SCAPPOOSE DRAINAGE IMPROVEMENT COMPANY

Operation and Maintenance Manual

Flood Control Works

Revised: August 2023
Adopted Version 1-11-2024

IMPORTANT QUICK REFERENCE INFORMATION CONCERNING THE SCAPPOOSE DRAINAGE IMPROVEMENT COMPANY (SDIC)

PROJECT NAME: SCAPPOOSE DRAINAGE FLOOD DAMAGE REDUCTION SYSTEM

IDENTIFICATION NUMBER/CWIS NUMBER: 500430002 & 5005000005

RIVERS: MULTNOMAH CHANNEL

PROJECT LOCATION: COLUMBIA COUNTY, OREGON

PUBLIC SPONSOR: SCAPPOOSE DRAINAGE IMPROVEMENT COMPANY

ARMY CORPS OF ENGINEERS DISTRICT OFFICE LOCATION: PORTLAND DISTRICT

EMERGENCY POINT OF CONTACT FOR THE ARMY CORPS OF ENGINEERS:
Emergency Operation Center-503-808-4402

COLUMBIA COUNTY EMERGENCY OPERATIONS CENTER: 503-988-6700

STATE EMERGENCY OPERATIONS CENTER: 1-800-452-0311 or 503-378-6377

SDIC EMERGENCY CONTACTS: Chase Christensen (503) 396-6799

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COLUMBIA RIVER PUD CONTACTS: 503-397-1844

TABLE OF CONTENTS

Part I

Section I

INTRODUCTION

Section II

LEVEES

Section III

DRAINAGE STRUCTURES & WATER CONVEYANCE SYSTEM

Section IV

PUMPS

Section V

PROJECT PLANS LIST

Appendices:

A-SDIC Ditches and Infrastructure Maps
B-Vegetation Control Illustrations
C-Additional Manuals
D- Levee Inspection Approach
E- Supporting and Related Laws and Regulations

Part I
Section I

Introduction

Purpose of O & M Manual

The purpose of this manual is to provide the Scappoose Drainage Improvement Company (SDIC) with a single reference document that describes the proper operation of the SDIC flood control works and its interior water control systems. It is also designed to assist the SDIC in carrying out Federal regulations for operation and maintenance of flood control works (FCW) and provides information for the United States Army Corps of Engineers (USACE) Rehabilitation and Inspection Program and other USACE programs and assistance.
This manual incorporates data and information also found in USACE O&M Manuals from 1952, 1969, 1979, 1983 and 2011.

This manual will be updated as new information is available or as conditions change.

Notes:

Included in this manual are references to as-built engineered plans developed by USACE. These plans are identified with a "CLW" heading. A list of these plans is in Part I Section V of this manual. These plans are kept on file at the SDIC office.

Unless specifically identified, all elevations used in this manual are in National Geodetic Vertical Datum of 1929 (NGVD 29).

Locations along the levees are referenced by Station numbers, an example would be "Sta: 245+28" or"245+28". Stations are mark of distance along the levee crown in feet, Sta:245+28 would be 24,528 feet from beginning. The perimeter levee begins with 0+00 at the southern end and increases until reaching the northern end. The Sublevee begins with 0+00 at the northern end and increases moving south, the Sublevee is also denoted with an "L" as in "Sta: L25+00" or "L25+00".

Authorization

The improvements to the flood control works in the Scappoose Drainage Improvement Company, completed in 1978, and described herein were authorized by the Flood Control Act of May 1950 (Public Law 516, 81st Congress, 2nd Session). The improvements consisted of providing turnouts on levees and constructing a new Sublevee with an overflow spillway and a drainage control structure. Also, three pump stations and a tide box were removed and replaced with new ones.

Local Cooperation

The SDIC agreed to comply with the following local cooperation requirements in a document dated 14 March 1974.

- Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project.
- Provide without cost to the United States all necessary relocations and alterations of buildings, utilities, highways, high bridges, sewers, and related special facilities.
- Hold and save the United States free from damages due to the construction and subsequent maintenance of the project and if applicable, adjust all claims concerning water rights.

- Maintain and operate the project works after completion without cost to the United States, in accordance with regulations prescribed by the Secretary of the Army.
- Comply with Title IV of the Civil Rights Act of 1964.
- Assure that the district is a legally constituted body with full authority and capability to perform the terms of its agreement.
- Comply with Sections 210 and 305 of Public Law 91-646 entitled the Uniform Relocations Assistance and Land Acquisition Policies Act of 1970.

Location and Description of SDIC

SDIC is located east of the town of Scappoose, in Columbia County, Oregon, along the west bank of the Multnomah Channel between Columbia River miles 90.3 and 97.0. The district is about 6 miles long, averages 1-1/2 miles in width, and contains approximately 5,700 acres of improved land protected from flooding by about 10 miles of levee. High ground borders the district along the west side. In general, the protected area lies below elevation 28 feet (NGVD29).

History of Levee and Improvements

SDIC was organized as a political subdivision in 1922, under the laws of the State of Oregon. It is vested with power to own property, levy taxes, and administer the affairs of the district.

The original levee system was completed by the district in 1928. Approximately ten miles of levee and a combination pump station and tide box were constructed at that time.

In 1939 and 1940, under authority of Public Law 738 (22 June 1936), the Corps of Engineers raised and reinforced approximately 10 miles of levee: constructed floodwalls adjacent to the main pumping plant; placed 4,250 linear feet of bank protection revetment; and modified the existing discharge lines at the Sternberg, Round Lake, and Orchards pumping plants.

Revetment Locations:
Sta:23+50-27+00
Sta:109+00-117+00
Sta:264+50-270+50
Sta:292+50-300+50
Sta:438+00-450+50

In 1949 and 1950, under authority of Public Law 858 (30 June 1948), the Corps of Engineers constructed about 6,800 linear feet of sand drains along the landward levee toe; installed two relief wells in the vicinity of Sta:111+00; reinforced the levee at the main pumping plant; installed toe drains and reinforced the levee between Sta:495+50and 505+00: and removed the discharge line at the abandoned Sternberg pumping plant.

In 1956, under authority of Public Law 99 (28 June 1955), the Corps of Engineers placed pit-run gravel along the levee crown; installed a toe drain and pervious blanket and extended a relief well riser in the vicinity of Sta:110+00; and revetted the tide box outlet in the vicinity of Sta:5+50.

In 1969, under authority of Public Law 99 (28 June 1955), the bottom and riverward bank of the outlet channel at the main pump station were blanketed and the blanket protected by the quarry waste for temporary control of seepage.

Under authority of Public Law 516 (17 May 1950) revetments were constructed at the following locations as part of the Columbia Riverbank protection program:

1965 – Chapman Location (Sta: 77+00-98+00)
1967 – Evans Location (Sta: 282+00-308+00)
1972 – Hudson-Rowell Location (Sta: 334+00-373+84)
1973 – Santosh Location (Sta: 450+22-466+20)
1974 – Honeyman Location (Sta: 239+00-263+95 & 217+00-226+00)
1976 – Dikeside Location (Sta: 97+94-108+40)
1981 – Wodesky Location (Sta: 366+09-390+50)
1984 – Janice Location (Sta: 308+00-335+00)

In 1978, turnouts were constructed at 1,000-foot intervals along the crown of the perimeter levee, as detailed on drawing No. CLW-93-26/2 through No. CLW-93-26/10. The crown width of the levee is 12 feet and increases to 23 feet at the turnouts. A 6-inch-thick layer of gravel road surfacing was placed along the levee crown and turnouts to provide all weather access.
A 4,000-foot long Sublevee was constructed at the downstream end of the district to control seepage. The Sublevee details are shown on drawing No. CLW-993-23/3 through No. CLW-93-23/4. The Sublevee crown elevation is 15.0 feet (NGVD 29) including the 6-inch gravel surfacing.

In 2016, Loos Location Rip Rap 165+03.54 - 226 tons of pit run placed at Loos Dairy and SDIC.

Part I
Section II

Levees

Description & Additional Improvements

The levee is generally comprised of sandy silt fill and clay from adjacent borrow areas and underlain by stratified layers of silt, clay, sand and gravel river alluvium in the foundation. Nearly the entire length of the levee has some rock revetment. The perimeter levee crown ranges from elevation 30.5' (NGVD 29) at the downstream end to elevation 32.5' (NGVD 29) at the upstream end. The design crown elevation is based on a regulated standard project flood of 850,000cfs at The Dalles Dam, The Dalles, Oregon. The crown width is generally 12 feet. Much of the levee has side slopes of 2 horizontal to 1 vertical (2H: 1 V) on the riverward side, and 3H:1V on the landward side.

The SDIC performs annual maintenance and inspections of the levees and receives regular inspections from USACE.
USACE Site Visit inspections are usually performed every 1 to 2 years. USACE Periodic inspections are usually performed every 5 years.

Toe Drains/Relief Wells

Toe drains and relief wells are used to relieve hydrostatic pressures in the foundation of a levee which is caused by fluctuation in the water table or seepage under a levee or flood control structure during a flood.
SDIC contains five toe drains within three toe drain systems and two relief wells.
USACE Maps: CLW-93-5/8, CLW-93-5/4 and CLW-93-11 show toe drain and relief well locations and details. Toe drain and relief well locations and details can also be found on the SDIC Google Earth map.

Toe Drain Inspection and Maintenance

Maintenance of the toe drain systems begins with an annual inspection prior to flood season. All pipes should be easily accessible and the pipe terminus or drain wells clear of debris. Toe drain markers should be re-identified and painted if needed. For covered well, each should be opened, and the hatch inspected for proper operation. Toe drains should also be inspected during and directly after a high-water event. Open joint style pipes should not be cleaned by water jetting.

System A

CLW-93-5/8 and CLW-93-5/4
Sta:299+70 to 305+65
8" tile drain, 2' sections, non-reinforced concrete bell and spigot pipe with partially open joints.
Connected to following 10" tile drain at downstream end and a 6" transverse drain at upstream end.
Station-293+56 to 299+70
10"tile drain, 2' sections, non-reinforced concrete bell and spigot pipe with partially open joints.
This segment has four 6" traversed drains feeding into it and drains to a 12” steel culvert that daylights to an open ditch at Sta:299+40

System B

CLW-93-5/8 and CLW-93-5/4
Sta: 321+00 to 323+50
8" tile drain, 2' sections, non-reinforced concrete bell and spigot pipe with partially open joints.

Drains to Cherry Orchards Pumping Station.
Sta:234+30 to 325+50
8" tile drain, 2'sections, non-reinforced concrete bell and spigot pipe with partially open joints.
Drains to Cherry Orchards Pumping Station.

System C
CLW-93-11
Sta: 494+50 to 499+00
6" concrete bell and spigot pipe with open joints just below the levee crown paralleling the road.
Approximately 60' of 8" concrete B&S pipe with cemented joints running transverse down the embankment from end of the toe drain, under the road and day lighting at the levee toe at Sta: 494+50.

Relief Wells

CLW-93-13
Sta: 110+98
Two-12" Armco perforated vertical steel pipe with 12" Corrugated Metal lateral drainpipe.
Located on the Bernett property, in the parking area immediately in front of the barn on the west side of Dike Rd.
Wells are approximately 50’ apart.

CLW-93-23/12 & 93-23/14
Sta:279+00-Evans Pumping Station
Six-10” Vertical steel perforated pipes with 8” Steel lateral drains
Relief Wells are in a circular configuration around the pump station, the top of the vertical pipes is visible, except for #2 & #3 are under the gravel parking area.
Lateral drains daylight into the Evans Slough immediately west of pump station, except for RW-#3 daylights into Evans Pump #3 sump.

Tide Box Structures

Sta: 5+59 (South Tide Gates)
CLW (93-3/11) (93-26/17)
This structure consists of two parallel 48”X40” Concrete box culverts that traverse the levee with gravity Tide Gates on the riverward end.
Tide Gates are constructed of 4” thick timber material with steel top hinges. Gates should be regularly inspected for proper operation and cleared of debris. These culverts serve as the normal operating terminus of the Jackson Creek Diversion.

Sta: 498+85 (North Tide Gates)
CLW 93-26/11 thru 16
This structure consists of three parallel 8-gauge, 72-inch diameter, bituminous-coated corrugated metal pipes that traverse the levee and have a gate well located slightly off the midpoint. The pipe openings on the riverward side of the gate well are controlled with positive closure slide gates. Tides gates are located at the pipe openings on the landward side of the gate well.

The reinforced concrete gate well consists of three separate wells. Each well is equipped with a galvanized steel ladder, to allow access for inspection and maintenance.

Galvanized steel bar screen trash racks, which are placed on the landward ends of all three pipes and the riverward end of the center pipe prevents debris from entering the tide box structure. These trash racks should be cleaned as often as needed to ensure proper operation. Damaged trash racks should be promptly repaired or replaced to protect the flap gates.

The flap gates require lubrication of the hinge arms and periodic checks to assure that debris has not impeded their operation. All hinge arm lube fittings should be always charged with bearing-grade grease. The flap gate in the center well can be controlled manually by the winch on top of the gate well. The sluice gates are Rodney Hunt WCE82-4, details of which are given in the "Rodney Hunt Service Manual" located at the SDIC office.

The operating mechanism for the sluice gate consists of a manually operated floor stand hoist, stem, and stem guides. The rising stem shafts should be cleaned and greased at least once every six months, (more often, if grease becomes dirty). All grease fittings on floor stand hoist should be lubricated with heavy-duty grease. Mobil Grease Special™ or Mobilplex™ #45 are recommended by the manufacturer. The gates should be operated through a complete cycle at least twice per year to ensure proper operation.

Sublevee Drainage Structure and Spillway

The Sublevee System was built to control excessive seepage that occurs during high-water events. The area behind the Sublevee (westerly) is designed to fill to a pool elevation of 11.5' (NGVD29) and create a head pressure against the seepage to decrease the flow to a suitable amount that can be removed by the Evans Pumping Station. The system contains 4000' of earthen levee with a top elevation of 15' (NGVD29), a closable drainage structure and a stone riprap reinforced spill way.

Sublevee Drainage Structure
Sta: L37+03
CLW 93-23/4 thru 10
This structure consists of three parallel 72-inch diameter; bituminous-coated corrugated metal pipes that traverse the Sublevee and are connected at the midpoint in a gate well. The flow through the structure is controlled by three slide gates installed on the south side of the pipe openings inside the gate well. The reinforced concrete structure consists of three separate wells, each equipped with an aluminum access ladder.

The sluice gates are ARMCO Model 50-10, details of which are given in the "ARMCO Service Manual" located in the SDIC office.

Steel trash racks are provided at all six pipe openings. Debris collected at the trash racks should be removed regularly as needed. The trash racks require periodic repainting to prevent corrosion. A four-coat vinyl painting system (conforming to SSPC-PS 4.02) is recommended.

The operating mechanism for the sluice gate consists of an enclosed, gear-driven pedestal lift connected to the gate by a 3-inch-diameter stem. Periodic inspection, adjusting, cleaning, and repainting of gate components should be done according to the booklet, "Installation, Operation and Maintenance for the ARMCO Slide Gates" included in 1(b). Maintenance of threaded portion of gate stem is critical. If serious binding occurs, the stem should be removed from the lift nuts and the threads cleaned.

Sublevee Overflow Spillway
Sta: L38+20
CLW 93-23/4
This structure has a top elevation of 11.5 feet (NGVD 29) and provides an overflow relief, preventing excess accumulation of water behind the Sublevee. The overflow surface of the spillway consists of large riprap material.

Discharge Lines and Siphon Breakers
Evans Pump Station
The discharge pipes were fabricated using shop welded steel plates. The exterior surface of pipes placed underground or submerged underwater, are coated with coal tar enamel followed by a fibrous glass mat and glass mat and asbestos felt wrapped with a white-wash coating. The exterior of the discharge lines above ground are primed with one coat of red lead and coated with two coats of Aluminum paint. All interior surfaces are primed and spun lined with coal tar enamel. Harnessed flexible mechanical couplings are used to join individual lengths of discharge pipe to allow for expansion and contraction. Field joints are coated with coal-tar enamel.

A Harris-Automatic combination siphon breaker and air relief valve was installed at the high point of each new discharge line. When the pump is started, air in the discharge line escapes through the siphon breaker until the pipe is filled with water. The siphon breaker then closes and siphonic action begins. If the siphon breaker cap does not open to expel the air from the discharge line, some air may be trapped at the high point of the line which may prevent full siphonic action, reducing pump discharge. When the pump is stopped the siphon breaker opens, releasing the siphon and permitting water to flow out of the pipe. The Harris Siphon Breaker and Air Relief Valve is normally very dependable. However, in the event that the siphon breaker does not open to release the vacuum, the siphonic action may be interrupted by opening the hand operated 2-1/2-inch angle valve which is located adjacent to the siphon breaker. Although the pump may be operated with this valve open, there would be no siphonic action, consequently, pumping capacity would be reduced. If the siphon must be interrupted by using the hand-operated angle valve, the siphon breaker may need cleaning, oiling, and adjustment. Adjustment of all Siphon Breaker & Air Relief valves stated by the manufacturer is as follow:
"Leave the jam nut off of the valve stem and have small cover about ¼" off of gasket --- start the pump and when the line is fully primed, screw the valve stem down through the cover with your fingers until it bottoms --- then back out 5/8 to 1/4 of a turn, install jam nut and tighten TIGHT. As operating characteristics of pumps may vary it may be necessary to vary this adjustment slightly for best operation."

Maintenance of the siphon breaker will consist mainly of keeping the valve stem oiled and free from corrosion to prevent sluggish operation of the valve. Normally, the only part of the unit which will require replacement is the neoprene valve seat. If an air leak is noticed at the siphon breaker when the pump is operating, (the line is primed and the siphon breaker is closed), the seat should be replaced. Parts may be obtained from Durham Pump of Woodland; CA. Additional information may be found in the "Harris Siphon Breaker and Air Relief Valve" manual located at the SDIC office.

Sumps
Evans Pump Station
Pump sumps should be inspected frequently during operating periods. Any floating debris found should be removed. Periodic inspection of the sump slab should be made to detect accumulations of silt. Inspection may be accomplished by using a rod of sufficient length to reach the bottom of the sump (see

drawings for sump slab elevations). This can be accomplished by inserting a rod into the sump area and gently lowering the rod until it stops on top of the silt and recording the depth. Next, force the rod through the silt layer until the bottom of the sump is reached and record that depth. Check the apparent bottom depth against the drawing to be sure the rod has penetrated the accumulated material to the sump slab. If there are 3 inches or more silt accumulated on the sump slab, then a cleaning operation should be initiated. Two methods for cleaning enclosed sumps are described below:

Method I

This method does not require dewatering of the sump. Equipment needed for this method includes a 3-inch jet pump, a 6-inch trash pump, a hose of large enough diameter to allow necessary flow, and a tee nozzle. This operation is best accomplished with the services of a diver; however, a handle may be fabricated to allow operation of the nozzle from above the water surface.

The trash pump and necessary piping should be set up to pump into a desirable disposal area. The tee nozzle and necessary pipe and fittings required are connected to the jet pump. The inlet pipe of the trash pump is placed on the bottom surface of the sump area. The tee nozzle, which is connected to the jet pump, is then moved over the sump area and utilized to direct silt toward the inlet of the trash pump. After the silt has been removed in this manner, the trash pump may be removed, and the sump area inspected for any debris that could possibly damage the district's pumps.

Method II

This method requires dewatering of the sump. Necessary equipment includes sandbags, stop logs, and a tarpaulin 5 feet to 6 feet larger than the sump opening (in both dimensions).

The first requirement is to clean the stop log guides and along the bottom of the sump where the bottom stop log will rest, then install the stop logs. Tie sandbags to the bottom of the tarp and place them on the waterward side of the stop logs as close to the stop logs as possible. Center the tarp, so there is about 3 feet of excess tarp on either side of the sump opening. Start the main pump to begin the dewatering process. Prior to pump cavitation, shut off district pump and utilize the small sump pump to complete dewatering. After all the water has been removed, inspection and removal of silt may be accomplished.

If the use of stop logs is not desired, most of the sump can be dewatered as described above, by closing the sluice gates.

Levee Maintenance Plans

Vegetation Management Plan (VMP)
In accordance with its Articles of Incorporation, it is the obligation of the Scappoose Drainage Improvement Company (SDIC) to control (and eliminate in some cases) the growth and existence of unwanted vegetation along the entirety of the levees as well as within the water conveyance systems. The purpose of this VMP is to ensure compliance with USACE maintenance standards, ensure accessibility and visibility for routine operations and maintenance. The two basic methods that the SDIC will utilize is mechanical and chemical. Please also see Appendix B.

Mechanical, mowing, cutting, clipping, removing etc. Resources that we will utilize are contracted mowing, rental equipment, and landowner resources if available .

Chemical, Applications of all herbicides will be performed by a properly licensed applicator in both the spring and fall spray seasons. Herbicides such as Round up, Crossbow and Aquamaster may be used.

Seasonal:
In the spring (depending on weather) the Levee will be mowed both landward and riverward where accessible. The sub levee will also be mowed. Any broadleaf that obstructs the visibility for an inspection, woody weeds, shrubs or trees in the vegetation-free zone will be cut, clipped and sprayed or removed.. There are certain times of year that particular weeds should be sprayed. Weeds will be sprayed according to their life cycle. SDIC anticipates spring spraying to take place during March through June and fall spraying to take place September thru November. This may vary according to bloom. Any bare soil caused by the removal of woody weeds, shrubs, trees, or tree stumps will be seeded with the appropriate grass seed for the levee. Seeds will be hardy, drought tolerant, low growing grass variety that are native to the area / hydrology and soils such as perennial rye grass or red fescue blend.

Year Round:
All pesticide/herbicide spraying will be done as weather allows. Weather is critical to the correct application of herbicides. The SDIC or its contractors will apply herbicides when the environmental conditions are correct. All herbicide application will be done according to Oregon state and Federal laws, and regulations.
All Trees or voluntary growth saplings, shrubs within the vegetation free zone will be cut or clipped upon discovery. All stumps will be removed when the conditions of the levee permit. The levee prism will be restored to original design configuration using appropriate fill and compacted to guidelines in accordance with technical letter 1110-2-571. U.S. Army Corp. of Engineers Guidelines for Landscape, Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams and Appurtenant Structures. Any bare soil will be seeded in a manner as stated above.

Animal Abatement Control Plan
The levee is to be inspected for burrowing animals multiple times per year; inspections are most effective immediately after mowing has been completed, and in the fall, when the Multnomah Channel water levels are low, exposing the riverward levee toe. Thoroughly inspect areas which have had evidence of burrowing animals in the past. When an animal burrow is located, a licensed trapper or exterminator should be contracted to remove the animal from the site. After the animal has been removed the site should be excavated and backfilled with compacted soil that is similar to material of

the levee, and reseeded. This will avoid the possibility of water traveling through unfilled portions of the burrows during a flood. Bait stations and traps have proven to be the most effective method.

Part 1
Section III

Drainage Structures and Water Conveyance System

Description
SDIC's conveyance system consists of seventeen pumps located at nine different pumping stations, three gravity-controlled drainage structures and several miles of canals and ditches. Though all pumps and drainage structures are controlled and operated by the SDIC some ditches are maintained by SDIC while private property owners maintain others. Detailed maps can be found at the SDIC office as well as on our website.

Conveyance System Pumps
The SDIC utilizes three pumping stations that discharge to the Multnomah Channel: the Evans (Sta: 279+00), the Cherry Orchard (Sta: 320+00) and the North (Sta: 420+00).

- The Evans Pumping Station is the primary plant, with four 300HP pumps and four 34-inch discharge lines, with a combined rated capacity of 123,000 gallons per minute (gpm).
- The North Pump Station has two 50HPpumps with two 16-inch discharge lines with a rated capacity of 10,000 gpm.
- The Cherry Orchard Pump Station has two 100HP pumps with two 24-inch diameter discharge lines with a rated capacity of 20,000 gpm.

The SDIC also utilizes six auxiliary lift pump stations that drain a specific sub basin and discharge into the Santosh and Evans Sloughs. This water is then discharged to the Multnomah Chanel via gravity drainage or pumping.
These auxiliary pumping stations are the:

- Sternberg
- Hovan
- Smith
- Honeyman
- Johnson
- Kessi

More detailed information regarding the pumping stations can be found in Section IV. Current Maintenance and Visit logs and a copy of the stations Standard Operating Procedures are kept at each station or in the SDIC work truck. Older logs are kept at the SDIC office.

Conveyance System Gravity Drainage Structures
There are two tide boxes and one flow control structure that provide interior gravity drainage. One at the northwest end of the district at Sta: 498+85, known as the North Tide Gates, which outlets the Santosh/Evans Sloughs into the Multnomah Channel. Two are located at the southern end of the district that captures Jackson Creek, known as the Jackson Creek Diversion, and re-routes it to the south end of the levee and into the Multnomah Channel at Station 05+65 through the South Tide Gates.

Operations
Interior surface water elevations are maintained with the use of pumps and gravity drainage structures. Water surface elevations are managed and reported in (NGVD 29) datum.

At river stages averaging less than 4' (NGVD29), which prevail from mid-summer through fall, the existing tide boxes are effective in dewatering the district. The North Tide Gates at the downstream end of Santosh Slough will take care of normal drainage from most of the district including lift pumps. The sluice gates on the Sublevee Drainage Structure as well as the North Tide Gates should be kept open so that water from the upstream end of the district can exit through the tide box. Should water be desired for irrigation, the sluice gates at the North Tide Gates can be closed.

Except for very extreme rain events, hillside drainage from Jackson Creek will continue to be expelled via the Jackson Creek Diversion and South Tide Gates so long as the Multnomah Channel remains below 18' (NGVD29). During very extreme runoff events, the Jackson Creek Diversion Structure will act as an overflow spillway, allowing enough water to be diverted into the Santosh Slough so as to not overwhelm the South Tide Gates. Should the Multnomah Channel raise to 18' NGVD 29, the boards in the Jackson Creek Diversion Structure should be removed to divert Jackson Creek into the Santosh Slough.

During higher Multnomah Channell stages, interior water surface elevations are controlled by the SDIC pumping stations. Specific pump controlled sub-basins water surface elevations are covered in Table 1 and in Section IV under Pumps (all heights are in NGVD 29). Although it is the intent of the SDIC to maintain the following water surface elevations; certain situations can affect these, very extreme rain events can overwhelm the pumps, equipment failure, fluctuations for maintenance, and other natural phenomena. It is also common for the SDIC to work with the sub-basin's adjacent landowners to temporarily adjust the water level for mutual benefit.

Table 1	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Evans	3.7-4.4	3.7-4.4	3.7-4.4	3.7-4.4	3.7-4.4	<4.5	<4.5	<4.5	<4.5	<4.5	3.7-4.4	3.7-4.4
Cherry	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
North	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Hovan	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Sternberg	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Smith	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Honeyman	<4.5	<4.5	<4.5	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	<4.5	<4.5
Johnson	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0
Kessi	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	1.5-2.0	<2.5	<2.5	<2.5	<2.5	1.5-2.0	1.5-2.0	1.5-2.0

The Jackson Creek Diversion structure should be checked frequently for proper operation during the winter months, especially during and after heavy rain events.

Maintenance

Ditches and pump inlets are cleaned as needed in accordance with our ditch maintenance plan.

The SDIC managed interior ditch system should be inspected regularly.
Items to pay special attention to include the following:

1. Areas of bank erosion or sluffing
2. Areas of silt accreditation near culverts
3. Pump fore bay areas.

4. Trees or heavy brush blocking flow
5. Damage from nutria, beavers, livestock, etc.

The Santosh and Evans sloughs should be surveyed bi-annually by boat to check the depth of water and soft silt to determine the need to clean.

Access roads to pump stations and along SDIC ditches need to be mowed or sprayed annually and graded periodically. Some of these roads include:

1. East Honeyman Rd. to the Hovan pump station.
2. E. Columbia Ave to the Johnson pump station.
3. E. Honeyman Rd. to the Smith Pump station, continuing from there along the south side of the east/west Smith Pump feeder ditch then turning southerly to the Honeyman Pump station.
4. From the Smith Pump westerly along the south side of the Santosh/Smith Auxiliary ditch to the Santosh Slough then southerly along the east bank of the Santosh Slough to the north side of the Santosh/Honeyman Auxiliary ditch.
5. From the Smith Pump westerly along the north side of the Smith/Santosh Auxiliary ditch to the Santosh Slough then northerly along the east side of Santosh Slough until it reaches the south side of the Evans Slough, then easterly along the south side of the Evans Slough for approximately 500'.
6. From the Honeyman Pump westerly along the south side of the Honeyman/Santosh Auxiliary ditch to the east side of the Santosh Slough then southerly along the east side of the Santosh Slough for 1500'.
7. From Johns Landing Rd. on the east side of the diverted Jackson Creek to the Jackson Creek Diversion structure. This access road needs to be maintained to the level for the ingress and egress of a loaded solo dump truck.

The Jackson Creek Diversion canal from where it crosses under the railroad tracks, continuing to where it crosses under Johns Landing Rd creates a buildup of sediment that typically requires cleaning every other year.

The Jackson Creek diversion structure including the boards should be inspected annually.

Interior Drainage Area

The area draining to the SDIC assessment area covers approximately 13.5 square miles. Ground surface elevations in the drainage area range from -1 to 1,490 feet (NGVD 29). The highest elevations are in the Jackson Creek watershed, which is the main tributary to the SDIC assessment area. The Jackson Creek watershed has a drainage area of 2.9 square miles and enters the assessment area along the southwestern boundary. The lowest elevations in the drainage area are in the lands near the northern end of the assessment area. Several water courses exist within the SDIC assessment area. Many of the watercourses are interconnected and have an extremely low gradient, resulting in a complex drainage system.

Pump House Structures

Evans, North and Cherry Orchard Pumping Stations

The pump house structures are wood frame buildings with reinforced concrete floor slabs. The exterior of pump house superstructures is aluminum v-beam siding with aluminum louvers. The roofs have removable hatches over each pump, so that pumps can be removed with mobile cranes.

The Evans Pump house is supported on the walls of the reinforced concrete sump substructure which is set on timber piles. The Cherry and North pump house concrete decks are directly supported on timber piles and have timber panel sump walls. Sump bottoms are precast concrete slabs. All timber piling has been treated with creosote. The access bridge to the North pump house has been designed for a H-20-44 loading or a 25-ton crane lifting one pump.
The trash screens surrounding the pump sumps provide adequate inflow to the pumps. However, the screens will collect leaves and other floating debris which, if allowed to accumulate can reduce the inflow to the pumps and cause cavitation. Cavitation will greatly reduce pump efficiency and pump life. To prevent this situation from arising, the screens should be cleaned regularly.

Maintenance and Inspections of Pumps
A list of all pump stations Standard Operating Procedures, Calendar of Operations, Startup Procedures and Maintenance can be found in the Pump O&M Manual in section IV.

Part I
Section IV

Pumps

Operation and Maintenance Manual by Pump Station:

Evans Pump

The Evans is the main pumping station for the SDIC. The four Evans Pumps discharge into the Multnomah Channel. The pump station controls the dewatering of the Santosh and Evans Sloughs.
The site should be visited daily when the pumps are operating.
A floatation device should be worn when cleaning the trash racks.

Equipment:
Pumps - Aurora / Type 30P / GPM 32,600 (all four)
#1 V75-70799D / #2 V75-70799C / #3 V75-70799B / #4 V75-70799A
Motors-(4) GE 300HP / 480V / 700RPM / 27 Head Ft. #5K6336XC325A (all four pump motors have same model number)
Meter #8873765
53680 E Honeyman Rd (Main/Evans) #314085

Pump numbers are clearly marked; however, the northernmost pump is #1 increasing in numerical order moving south.

Standard Operating Procedure:
Run pumps depending on desired ditch level, rainfall amounts, rainfall predictions, and season.
Normal conditions – Run pump #1, 2, 3, or 4 individually.
Heavy inflows – Run pumps # 1 & 3 or 2 & 4 together.
Typically, the Evans pumps are on AUTO setting and turned on and off utilizing a mercury switch float system. In the AUTO position the electrical starter unit for each pump is equipped with a time delay so no more than one pump should start at the same time.
The delays are as follows (in minutes and seconds):
#1-0:10
#2-1:30
#3-3:00
#4-10:00

Calendar of Operations:
The ditch elevation is pumped between 3.7’-4.4’ Nov-May
The ditch elevation is kept below 4.5' June-Sept

Operational Procedure Manual:
1. Turn selector switch from OFF to MAN
2. Press START button
3. Check Amps. (normal readings-#1=280 amps, #3 & #4=330 amps, #2=310 amps)
4. Press OFF button to shut down

5. Turn selector switch from MAN to OFF

Operational Procedure Automated:
1. Turn float toggle selector switch to 1, 2, 3, or 4
2. Turn selector switch to Auto (No need to push "Start")
3. Turn selector switch from AUTO to OFF to shut down while running

Daily Maintenance:
- Trash rack – Check and clean as needed.
- Check bearing oil levels through sight glasses. Two per motor, upper and lower bearings. *
- Keep Electro-Luber filled with grease (Unoba EP Grease 2 or equivalent).

Daily Checks and Records:
- Time and Date
- Initials of person checking
- Number of pumps running
- Water Level
- Hour Meter
- State: On/Off/Auto
- Amperage
- Note any abnormal sounds or sights that may be caused by a problem.
- No stuffing boxes reservoirs to check.

Adjusting Mercury Switch:
All pumps are operated from the same Selectrol mercury float switch.
See manual for switch adjustments.
Each starter has a toggle switch that can be rotated to select which mercury switch elevation to pump to.
Toggle position #1 = not set / position #2 = not set / position #3 = 3.7'-4.4'/ position #4 = not set

Annual Maintenance:
- *Motor Bearings are sealed and should not require regular filling. Bearing should have oil changed annually with Turbine Oil 68.
- MEC testing and a Vibration Analysis should be conducted every 2 years.
- Sumps should be dewatered and inspected annually, visually inspecting the pumps lower units as well.

North Pump Station

Pump House with two pumps.
The pumps discharge into the Multnomah Channel.
Site should be visited as needed.

A safety harness and/or a floatation device must be worn when cleaning trash racks.

Equipment:
Primary-Pump #1 Northernmost Pump
Aurora Pumps No. V75-70800A Type 14LM / GPM 4600 / 29' head
GE Motor 50HP / 480V / 1175RPM #5K6267X4729A
Secondary-Pump#2 Southernmost Pump
Aurora Pumps No. V75-70800B Type: 14LM / / GPM 4600 / 29' head
US Motors 50 HP 480V 1170 RPM #808-N993A-M B1
Meter #8873749
37037 Ellis Farm Rd (North Pump) #314074

Standard Operating Procedure:
Keep pump #1 in AUTO mode. Turn pump #2 to AUTO if pump #1 cannot maintain desired water level.
Both pumps operate on the same Selectrol mercury float switch.
In the AUTO position the electrical starter units for each pump are equipped with a delay so no more than one pump should start at the same time. The delays are as follows:
#1-0:00
#2-0:10

Calendar of Operations:

Month	Level * Coordinated between landowner and SDIC manager.
Nov. – Jan.	1.5-2.0
Feb. – Oct.	1.5-2.0

Elevation can be changed by adjusting the mercury switch floats.

Start-up Procedure:
1. Turn selector switch from OFF to AUTO.
2. Check amps (normal #1 56, #2 38).
3. Pumps can also be operated manually

Daily Maintenance:
- Trash rack – Check and clean as needed.
- Check bearing oil levels through sight glasses. One per motor, upper bearings. *
- Keep Electro-Luber filled with grease (Unoba EP Grease 2 or equivalent).

Daily Checks and Records:
- Time and Date
- Personal checking
- Number of pumps running
- Water Level
- Hour Meter

- State: On/Off
- Amperage (normal readings-#1 56 amps / #2 = 38 amps)
- Note any abnormal sounds or sights that may be caused by a problem.
- No stuffing boxes reservoirs to check.

Adjusting Mercury Switch:
See Selectrol class 3500 Autocon manual kept with other manuals on file in the SDIC office.

Annual Maintenance:

- Grease lower motor bearings annually or every 2200 hrs., whichever comes first. Use only Poly-Urea based grease (do not use Lithium or heavy EP grease).

*Bearings are sealed and should not require regular filling. Bearing should have oil changed annually with Turbine Oil 68.

Cherry Orchard Pump Station

Pump House with two pumps.
Pumps discharge into the Multnomah Channel.
A safety harness and/or a floatation device must always be worn when cleaning trash racks.
Visit site as needed.

Equipment:
Primary-Pump #1 Northernmost Pump
Economy Pumps Inc. (same as #2)
GE 100HP / 460V / 1180RPM #5K6285XJ76A
Secondary-Pump #2 Southernmost Pump
Economy Pumps Inc. 18X20SAFV G20-2296 / 10000GPM / 35'TDH
US Motors 100 HP / 460V / 1185RPM / #K03 20042295-100R-01
Meter #11204387
37037 Ellis Farm Rd (Cherry Orchard) #314075

Standard Operating Procedure:
Keep pump #1 in AUTO mode. Start pump #2 if pump #1 cannot maintain water level.
Pump #1 operates on a float switch. Pump #2 is manually operated.

Calendar of Operations:

Month	Level * Coordinated between landowner and SDIC manager.
Nov. – May	1.5 - 2.0
Jun. – Oct.	1.5 - 2.0

Elevation can be changed by adjusting stops on float guide shaft.

Start-up Procedure:
Pump #1
1. Turn selector switch from OFF to AUTO. (Pump can also be operated manually).
Pump #2
1. Push lever back into the START position.
2. Once pump has wound up (about 3 seconds), pull lever into the RUN position.

Daily Maintenance:
- Trash rack – Check and clean as needed.
- Check bearing oil levels through sight glasses. One per motor, upper bearings. *
- Each motor has two drain lines for water-cooled upper pump shaft bearings. Check to ensure hose lines are not plugged.
- Check for water on the floor inside the pump building. If there is water inside, make sure rubber hoses draining from the water lubrication is clear of debris.

Daily Checks and Records:
- Time and Date
- Personal checking
- Water Level
- Hour Meter
- State: On/Off

- Note any abnormal sounds or sights that may be caused by a problem.
- No Stuffing Box Reservoirs to check.

Annual Maintenance:

- Grease lower motor bearings annually or every 2200 hrs., whichever comes first. Use only Poly-Urea based grease (do not use Lithium or heavy EP grease).
- *Bearings are sealed and should not require regular filling. Bearing should have oil changed annually with Turbine Oil 68.

Sternberg Pump

No building. One pump and motor.
Pump discharges into the Santosh Slough.
Visit site as needed.

Equipment:

Pump-Peerless Pump Serial # F22117
Motor-General Electric / 20HP 230/460V / 1165RPM / #5K6235XM518B Ser. No. CRJ328286
Meter #16256975
35892 E Honeyman Rd (Sternberg Pump) #314069

Standard Operating Procedure:

Keep the pump in AUTO mode. Pump operates on a float switch.
Water level at 1.5 - 2.0.

Start-up Procedure:

1. Turn selector switch from OFF to AUTO (pump can be operated manually)
2. Check stuffing box oil reservoir sight glass for proper oil lubrication (6 drops per minute average).

Maintenance:

Trash rack – Check and clean as needed.
Check stuffing box oil reservoir - Fill with Turbine Oil 68.

Daily Checks and Records:

- Time and Date
- Personal checking
- State: On/Off
- Hour Meter
- Note any abnormal sounds or sights that may be caused by a problem.

Annual Maintenance:

- Grease upper and lower motor bearings annually or every 2200 hrs., whichever comes first. Use only Poly-Urea based grease (do not use Lithium or heavy EP grease).

Hovan Pump

Pump building with one pump and motor.

Pump discharges into the Evans Slough

Visit as needed.

Equipment:
Pro Shops (Goulds Pumps Co.) SO# 3608
US Motors 20 HP 230/460V 1170 RPM #BF89
Meter #8873376
53951 E Honeyman Rd (Hovan Pump) #314080

Standard Operating Procedure:
Keep the pump in AUTO mode. Pump operates on a float switch.
Water level at 1.5'-2.0'.
Elevation can be changed by adjusted stops on float guide shaft in front of trash rack.

Start-up Procedure:
1. Turn selector switch from OFF to AUTO (pump can also be operated manually).
2. Check sight glass for proper oil lubrication. (6 -10 drops per minute)

Maintenance:
Trash rack – Check and clean as needed.
Check stuffing box oil reservoir - Fill as needed with Turbine Oil 68

Daily Checks and Records:

- Time and Date
- Personal checking
- State: On/Off
- Water level
- Hour Meter
- Note any abnormal sounds or sights that may be caused by a problem.

Annual Maintenance:

- Grease upper and lower motor bearings annually or every 2200 hrs., whichever comes first. Use only Poly-Urea based grease (do not use Lithium or heavy EP grease).

Smith Pump

No Pump building. Two pumps and motors.
Pumps discharge into the Santosh Slough
Visit site as needed.

Equipment:

(Primary) Pump #2 Northernmost Pump-Prime Pump Ser. No.: 0605080 Model No.: 16P12-17
GE 15 HP 230/460V 1175 RPM #5K2840TT7005
(secondary) Pump #1 Southernmost Pump-Cascade Pump Company Serial No.: 13878 Size: 12AF
Impeller: 14.5
RPM: 1760
US Motors 30 HP 230/460V 1760 RPM #BF41
Meter #14147825
53341 E Honeyman Rd (Smith Pump) #314086

Standard Operating Procedure:

Keep pumps in AUTO mode. Pumps operate on separate float switches.
Pump #2 set 1.5'-2.0'.
Pump #1 set at 1.8 to 2.2 and will come on if Pump #2 cannot maintain water level.
Elevation can be changed by adjusted stops on float guide shaft. One float for each pump is located inside of sump.

Start-up Procedure:

1. Turn selector switch from OFF to AUTO (pumps can be operated manually).
2. Check sight glasses for proper oil lubrication. (6 -10 drops per minute)

Maintenance:

Trash rack – Check and clean as needed.
Check stuffing box oil reservoirs - Fill as needed with Turbine Oil 68

Daily Checks and Records:

- Time and Date
- Personal checking
- State: On/Off
- Water Level
- Hour Meters
- Note any abnormal sounds or sights that may be caused by a problem.

Annual Maintenance:

- Grease upper and lower motor bearings annually or every 2200 hrs., whichever comes first. Use only Poly-Urea based grease (do not use Lithium or heavy EP grease).

Honeyman Pump

Pump building. One pump and motor.
Pump discharges into the Santosh Slough
Visit site as needed.

Equipment:
Pacific Pumping Co. Cat# 16B-M0 Ser#: 3BG11156 GPM: 4750 TDH: .5
US Motors 15HP 230/460V 1165RPM #W 10 7631440-0052
Meter # 15688790
52201 E Honeyman (Honeyman) #314087

Standard Operating Procedure:
Keep the pump in AUTO mode. Pump operates on a float switch.
Water level at 1.5 to 2.0 spring and summer
Water level at 3.0-4.5 winter, SDIC to work with landowner.

Start-up Procedure:
1. Turn selector switch from OFF to AUTO (pump can be operated manually if needed.
2. Check sight glass for proper oil lubrication. (6 -10 drops per minute)

Maintenance:
Trash rack – Check and clean as needed.
Check stuffing box oil reservoir - Fill as needed with Turbine Oil 68.

Daily Checks and Records:

- Time and Date
- Personal checking
- State: On/Off
- Water level
- Hour Meter
- Note any abnormal sounds or sights that may be caused by a problem.

Annual Maintenance:

- Grease upper and lower motor bearings annually or every 2200 hrs., whichever comes first. Use only Poly-Urea based grease (do not use Lithium or heavy EP grease).

Johnson Pumps

No building. Two pumps and two motors.
Pumps discharge into the Santosh Slough
Visit site as needed.

Equipment:

(primary) Pump #1 Westernmost Pump-Prime Pump Corp. Ser. No.: 00103596 Model No.: 16P12-15
US Motors 15 HP 230/460V 1165 RPM Model #BF66 ID# W 10 7631400-0052
(secondary) Pump #2 Easternmost Pump-Prime Pump Corp. Ser. No.: 1506939 Model No. 16M12-17
US Motors 25 HP 230/460 V 1175 RPM #BF9 0A
Meter #11204376
35601 E Columbia Ave (Johnson Pump) #314100

Standard Operating Procedure:

Keep pumps in AUTO mode. Pumps operate on separate float switches.
Water level at 1.5 - 2.0.
Pump #2 set at 1.8 to 2.2 and will come on if Pump #1 cannot maintain water level.

Calendar of Operations:

Month	Level * Coordinated between landowner and SDIC manager.
Jan-Dec	1.5 to 2.0

Start-up Procedure:

1. Turn selector switch from OFF to AUTO (both pumps can be operated manually).
2. Check stuffing box sight glasses for proper oil lubrication. (6 -10 drops per minute).

Maintenance:

Trash rack – Check and clean as needed.
Check stuffing box oil reservoirs - Fill as needed with Turbine Oil 68
Check Pump#2 upper bearing oil level in sight glass*.

Daily Checks and Records:

- Time and Date
- Personal checking
- State: On/Off
- Water level
- Hour Meter
- Note any abnormal sounds or sights that may be caused by a problem.

Annual Maintenance:

- Grease #1 upper and lower and #2 lower motor bearings annually or every 2200 hrs., whichever comes first. Use only a Poly-Urea based grease (do not use Lithium or heavy EP grease).
- *Bearings are sealed and should not require regular filling. Bearing should have oil changed annually with Turbine Oil 68.

Kessi Pumps

Pump building. Two pumps and motors.

Pumps discharge into a sub-basin then passively drain into the Santosh Slough.

Gate valve on gravity line to Kessi Ditch can be utilized to backflow water for irrigation.

Visit site as needed.

Equipment:

(Primary)Pump #1 Northernmost Pump US Motors 20 HP 230/460V 875RPM #H07029/B01A3360189R-1
(Secondary)Pump #2 Southernmost Pump-GE / 25HP / 230-460 volts / 880 RPM / SK3326DA8021
Prime Pump Corp. Model No.: 20P16A-12OL
Meter # 11204381
34616 E Columbia Ave (Kessi Pump) #314108

Standard Operating Procedure:

Water level at 1.5 - 2.0.
Pump #2 set at 1.8 to 2.2 and will come on if Pump #1 cannot maintain water level.
Pumps operate on separate float switches.
Elevation can be changed by adjusted stops on float guide shaft inside of building.

Calendar of Operations: 2014/2015

Month	Level * Coordinated between landowners and SDIC manager.
Oct– May.	1.5 to 2.0
Jun. - Sept	2.0 to 2.5

Start-up Procedure:

1. Turn pumps to auto at the safety switches (pumps can be operated manually if needed.
2. Check stuffing box sight glasses for proper oil lubrication. (6 -10 drops per minute)

Maintenance:

Trash rack – Check and clean as needed.
Check stuffing box oil reservoirs - Fill as needed with Turbine Oil 68
Check bearing oil reservoir – sight glass, upper motor bearings*.

Daily Checks and Records:

- Time and Date
- Personal checking
- State: On/Off
- Water Level
- Hour Meter
- Note any abnormal sounds or sights that may be caused by a problem.

Annual Maintenance:

- Grease lower motor bearings annually or every 2200 hrs., whichever comes first. Use only a Poly-Urea based grease (do not use Lithium or heavy EP grease).
- *Bearings are sealed and should not require regular filling. Bearing should have oil changed annually with Turbine Oil 68.

Part1
Section V
Project Plans
(Plans left out of document for size, all plans are available at the SDIC office)

USACE CLW-Project Plans

CLW-93-23/1 Flood Protection Improvements – General Plan and Index
CLW-93-23/2 Evans Slough Drainage Canal – Plan
CLW-93-23/3 Santosh Slough Sublevee – Plan and Details
CLW-93-23/4 Canal and Sublevee Profiles and Sections
CLW-93-23/7 Sublevee Drainage Structure – Excavation
CLW-93-23/8 Sublevee Drainage Structure & Gate Well Structure
CLW-93-23/9 Sublevee Drainage Structure Trash Rack Details
CLW-93-23/10 Sublevee Drainage Structure – Backfill and Riprap
CLW-93-23/12 Evans Slough Pumping Station – Site Plan
CLW-93-23/13 Evans Slough Pumping Station – General Arrangement
CLW-93-23/14 Evans Slough Pumping Station – Excavation and Embankment
CLW-93-23/15 Evans Slough Pumping Station – Discharge Line and Details
CLW-93-23/16 Evans Slough Pumping Station – Building – Plans and Elevations
CLW-93-23/17 Evans Slough Pumping Station – Building – Sections and Details
CLW-93-23/18 Evans Slough Pumping Station – Bracing and Details
CLW-93-23/19 Evans Slough Pumping Station – Substructure – Conc. Outline
CLW-93-23/20 Evans Slough Pumping Station - Substructure – Reinforcing
CLW-93-23/21 Evans Slough Pumping Station – Appurtenances
CLW-93-23/22 Evans Slough Pumping Station - Substructure – Misc. Metal
CLW-93-23/23 Evans Slough Pumping Station – Outlet Structure
CLW-93-23/26 North Pumping Station – General Plan and Section
CLW-93-23/27 North Pumping Station – Plan, Profile and Sections
CLW-93-23/28 North Pumping Station Building – Plan and Elevations
CLW-93-23/29 North Pumping Station Building – Elevations and Details
CLW-93-23/30 North Pumping Station Access Bridge
CLW-93-23/31 North Pumping Station – Substructure & Appurtenances
CLW-93-23/32 North Pumping Station Pump Supports & Discharge Line
CLW-93-23/33 North Pumping Station Trash Racks
CLW-93-23/36 Pumping Stations – General Details
CLW-93-23/40 Evans Slough Pumping Station Electrical Sheet 1
CLW-93-23/41 Evans Slough Pumping Station Electrical Sheet 2
CLW-93-23/43 North Pumping Station Electrical
CLW-93-22/1 Evans Slough Pumping Plant Pump Arrangements
CLW-93-22/2 North Pumping Plant Pump Arrangements
CLW-93-22/3 Evans Slough Pumping Plant Electrical 1
CLW-93-22/4 Evans Slough Pumping Plant Electrical 2
CLW-93-23/5 North Pumping Plant Electrical
CLW-93-26/1 Tide box Construction, Levee Improvements and Pumping Plant Removals – General Plan
CLW-93-26/2 Plan and Typical Details – SDIC 0+00 to SDIC 62+00

CLW-93-26/3 Plan – SDIC 62+00 to SDIC 124+00
CLW-93-26/4 Plan – SDIC 124+00 to SDIC 186+00
CLW-93-26/5 Plan – SDIC 186+00 to SDIC 248+00
CLW-93-26/6 Plan – SDIC 248+00 to SDIC 310+00
CLW-93-26/7 Plan – SDIC 310+00 to SDIC 372+00
CLW-93-26/8 Plan – SDIC 372+00 to SDIC 434+00
CLW-93-26/9 Plan – SDIC434+00 to SDIC 496+00
CLW-93-26/10 Plan and Details – SDIC 496+00 to SDIC 547+69
CLW-93-26/11 Tide Box Sta. SDIC 498+85.35 – Excavation Plan & Details
CLW-93-26/12 Tide Box Sta. SDIC 498+85.35 – Plan & Details
CLW-93-26/13 Tide Box Sta. SDIC 498+85.35 – Gate well Reinforcement
CLW-93-26/14 Tide Box Sta. SDIC 498+85.35 – Gate well Miscellaneous Metals I
CLW-93-26/15 Tide Box Sta. SDIC 498+85.35 – Gate well Miscellaneous Metals II
CLW-93-26/16 Tide Box Sta. SDIC 498+85.35 – Trash rack Slab and Details
CLW-93-26/17 Pumping Station Removal Details and Jackson Creek Outlet Protection
CLW-93-26/18 Subsurface Date
CLW-93-28/1 Orchards Pumping Station – Plan, Profile and Details
CLW-93-28/2 Orchards Pumping Station – Plans and Details I
CLW-93-28/3 Orchards Pumping Station – Plans and Details II

Other Plans and Details:

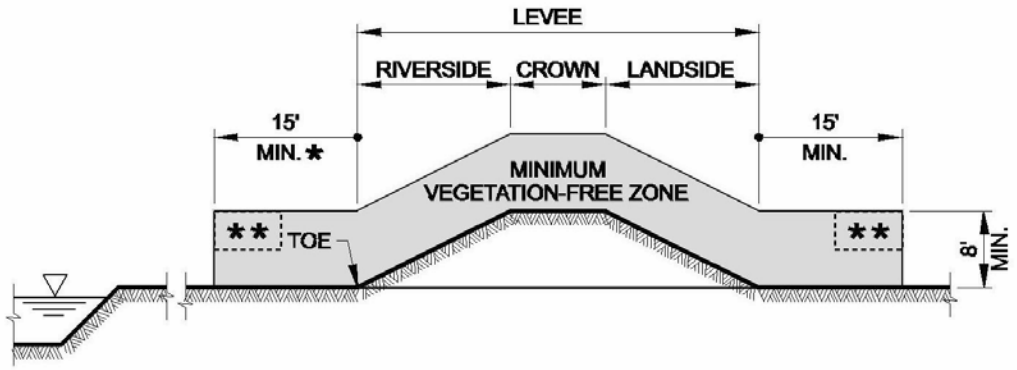
2022 Smith Pumping Station Foundation Plan

Appendix A: Maps of SDIC Ditches and Infrastructure

(add map of 2013 LON)

Appendix B: Vegetation Control Illustrations

The figures presented here are cross-sections and are organized as follows. Figure 1 illustrates the minimum vegetation-free zone required for a basic levee section.

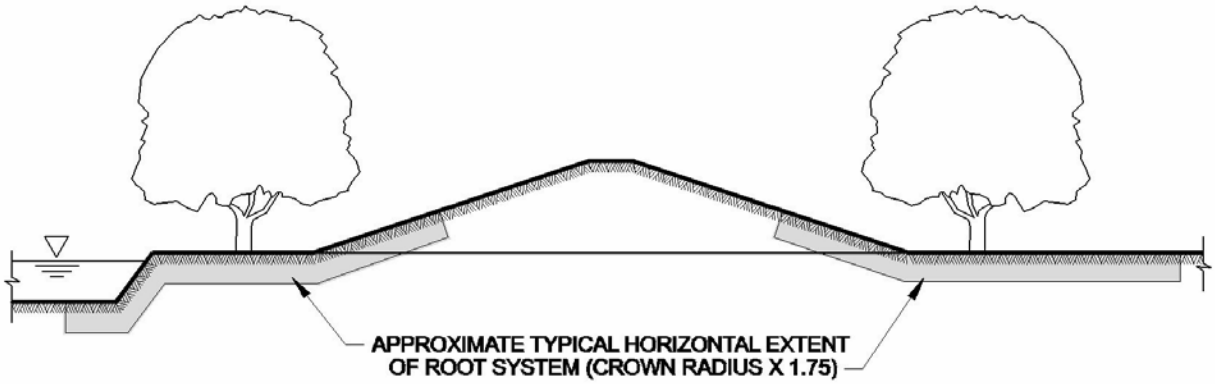


* 15' OR DISTANCE TO EDGE OF NORMAL WATER SURFACE, IF LESS

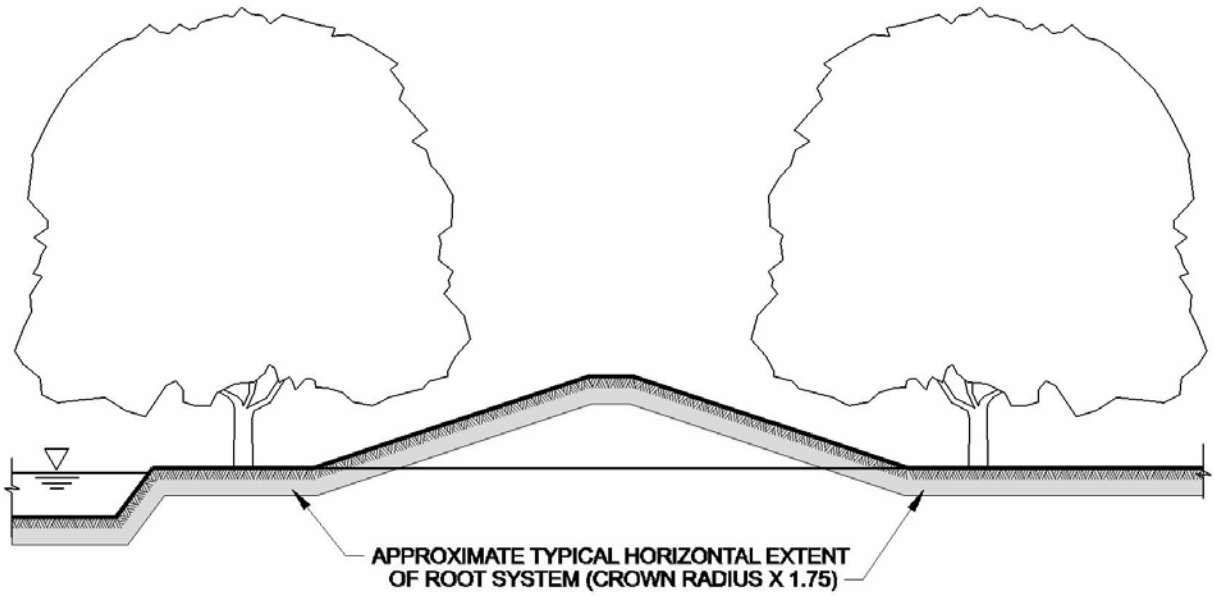
** IN THIS 4' X 7' TRANSITION ZONE, TEMPORARY OBSTRUCTION BY LIMBS AND CROWN IS ALLOWED DURING DEVELOPMENT OF NEW PLANTINGS, FOR UP TO 10 YEARS

▽ NORMAL WATER SURFACE

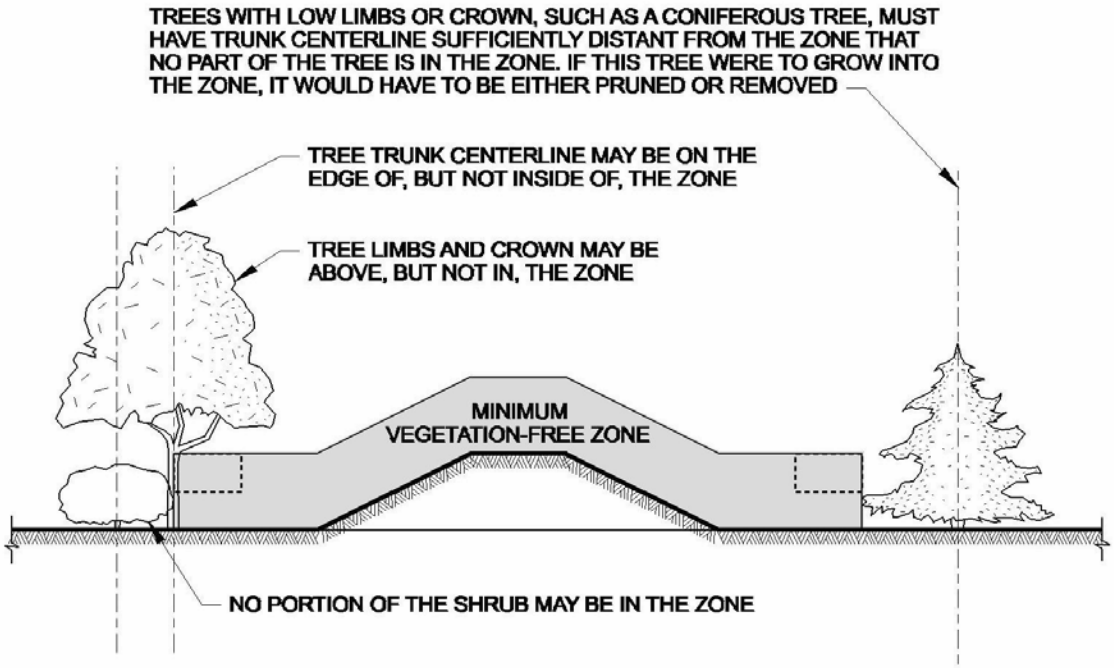
THIS PROPORTIONALLY CORRECT FIGURE USES TREES IN THE MEDIUM TO LARGE SIZE RANGE TO ILLUSTRATE REALISTIC SPATIAL RELATIONSHIPS BETWEEN TREES (AND THEIR ROOT SYSTEMS) AND LEVEES.



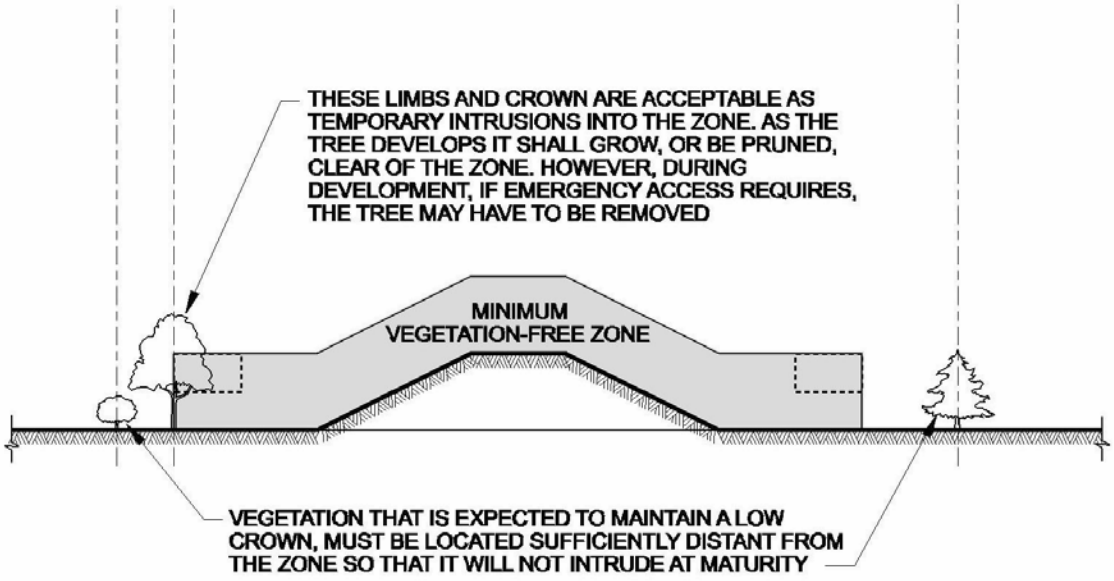
a. TREES (50' TALL, 50' SPREAD) LOCATED AT EDGES OF VEGETATION FREE ZONE (TRUNK CENTER AT 15' FROM LEVEE TOE)



b. TREES (100' TALL, 100' SPREAD) LOCATED AT EDGES OF VEGETATION FREE ZONE (TRUNK CENTER AT 15' FROM LEVEE TOE)



a. MATURE TREES AND SHRUB



b. NEWLY PLANTED TREES AND SHRUB

NOTE: THE MIRROR IMAGE OF THIS FIGURE WOULD BE EQUALLY CORRECT, REGARDLESS OF WHICH SIDE IS THE RIVERSIDE

Appendix C: Additional Manuals (On File at SDIC Office)

-USACE Design Memorandum Scappoose Drainage District June 1971

-USACE Levee Owner's Manual for Non-Federal Sponsors

-USACE Design and Construction of Levees

-USACE Technical Design Manual for Levees and Dams (Plants)

-USACE Technical Design Manual for Levees and Dams (Animals)

-USACE Operation and Maintenance Manual: Evans and North Pumping Plant

-ARMCO Service Manual

-Rodney Hunt Service Manual

-Harris Siphon Breaker and Air Relief Valve

-Hardesty Denver Water Gates

-Selectrol Class 3500 Autocon

Appendix D: Levee Inspection Approach

Encroachments

Encroachments are described as fences, gates, structures, tank and any other object that may impede inspection or flood fighting. All encroachments are prohibited within 15' of the landward toe of the levee.

Excavations, structures, or other obstructions present within the project easement area are generally prohibited. Fencing that prohibits access along the crown of the levee is prohibited. Where access control is needed, SDIC may approve the installation of gates that will allow continued access along the crown of the levee. The Corps may make certain exceptions to the rule, provided the encroachment does not impact the operation, maintenance, or structural integrity of the levee.

All encroachments must have an approved USACE Section 408 application prior to installation.

It is the property owner's responsibility to maintain all gates in working order.

It is the property owner's responsibility to keep all fences and gates clear of vegetation.

It is the property owner's responsibility to ensure that the SDIC is able to open all gates on the levee or within the right of way. The SDIC will provide a paddle lock for each gate. The property owner may also attach their own paddle lock to the SDIC paddle lock.

It is the property owner's responsibility to inform SDIC of any alterations to approved encroachments.

Slope Stability

Some earthen materials tend to become saturated with water very easily. When this happens, they lose stability and can't support their own weight. If a stream or river embankment is composed of these materials, the embankment will slump off and move down the slope into the river, causing a bulge at the base of the slope. When riverbanks break down like this, they are said to have slope stability problems and need to be repaired. Slope failures can lead to serious problems, especially if the failure occurs near a levee.

Levees, like riverbanks, are subject to the same soil saturation effects during a flood or period of heavy rainfall. Levees are generally less susceptible to slope stability problems because of the materials they are made of and because of their shallow slopes. However, slope failures have occurred during prolonged periods of high water or heavy rainfall. While slope failures will generally occur on the riverward slope of a levee, be aware that slope failures on landward slopes are also possible. A levee should be carefully inspected for slope stability problems after these events.

A related slope failure/ stability problem involves trees growing on or near the channel or levee slopes. It's very important to prevent tree growth near levees or channel embankments, because when the roots of these trees decay they leave voids in the soil, which allow water to quickly saturate the slope and cause a slope failure. Trees can also be uprooted and deflect flood flows into the embankment, accelerating the erosion of the bank.

The classic signs of slope stability problems are listed below, and you should watch for these signs during routine inspections.

- Wide deep cracks that parallel the riverbank or levee crest. In the case of levees, these cracks may also extend down the slope of the levee.
- Vertical movement of the material along the crack.
- If the slope has slumped or is starting to slump, examine the area along the toe of the embankment. In many cases there will be a noticeable bulge in the slope or riverbank.

Deep seated sliding often requires the removal and replacement of that section of the levee or river slope, and the stabilization of the area with a soil or rock berm. If you identify signs of a developing

slope stability problem, it is very important that you contact your local Corps district office for an investigation and to get technical assistance as to the best way to repair the problem.
See Corrective Action Plan for locations of past concerns and locations to monitor.

Erosion

Types of Erosion

There are several types of erosion that effect FCWs. For example, the slopes of any embankment can become eroded from rain runoff, or by embankment overtopping. Depending on the extent of the erosion, the level of protection provided by the FCW can be significantly reduced. In cases of embankment overtopping during a flood, there may be a total failure of the structure.

A second type of erosion often seen on embankments is wave wash. Under high water conditions, wave action can form long terraces along the length of the embankment slopes. If additional material or bank protection is not provided, the embankment will continue to cave as the waves work their way farther into the slope.

A third type of embankment erosion is caused by the flow of water within a river or channel. These flows can erode a channel bank or levee or undermine other flood control structures and cause them to cave into the water. Bank caving or stream bank erosion can be a very serious threat to the stability of an FCW. It's critical that the riverward bank be inspected for bank caving or erosion. If the river or stream bank erosion or caving is observed to be moving in the direction of the levee, immediate action should be taken to stabilize the banks.

Repair of Areas Damaged by Erosion

All erosion gullies need to be repaired to prevent further erosion and more significant damage during high water. The ground should be scarified and backfilled with the same type of material that the levee is made of. The backfill material should generally be placed in 6-inch layers and compacted mechanically or by hand, in order to restore the original shape of the levee. Additionally, since this erosion is typically a reoccurring problem, something should be done to improve the drainage and prevent further erosion in the area. Consideration should be given to installing drainage channels or appropriately sized rock, and areas of the levee that remain exposed should be reseeded and mulched.
See Corrective Action Plan for locations of past concerns and locations to monitor.

Removal of Debris/Beaver Dams

Any accumulations of drift, grass clippings, and other objectionable materials deposited on the riverward side of any FCW or along the crown and side slopes of a levee must be removed and disposed of at suitable locations outside of the floodway. When debris collects in a flowing channel, it can deflect the water towards the channel bank, causing significant damage to the FCW.

Beaver dams must be removed as soon as discovered. Beaver dams can raise the elevation of the drainage ditch behind the dam as well as cause severe bank erosion. All efforts should be made to trap and remove the animal before the dam is removed. Large dams may need to be removed with an excavator while smaller dams may be removed with a rake or chain saw.

Riprap Revetments

Riprap can be a very effective method for protecting a riverbank or flood control feature from erosion. However, if the riprap protection is not placed correctly, it can cause eddy currents to erode unprotected areas of the bank upstream or downstream of the project.
For riprap protection to be effective, it's important to ensure that it is properly maintained. During project inspections, look for settled areas that may indicate the riprap is being undermined by the river

or debris. When undermining or rock displacement occurs, additional rock will need to be added to restore the even slope. When the rock protection is uneven the flow turbulence will increase, resulting in additional erosion of the project or of areas upstream or downstream of the project.
The protected area needs to be kept free of unwanted brush, saplings, and trees. Unwanted vegetation should be sprayed with an appropriate herbicide to kill the plant, and the root system should be removed. Failure to control the sapling and tree growth can result in the trees being uprooted during a flood, displacing the riprap and increasing the rate of erosion.
Any areas of stone riprap that have settled, moved, or been damaged by erosion should be filled in with hard, durable rock of suitable size or with a six-inch filter-blanket layer or a layer of geotextile fabric under the stone riprap, between the soil and the rock. These sub-layers allow the water to pass from the soil yet prevent the fine soil from washing out.
from under the stone riprap. It's very important to contact the Corps for technical assistance when installing geotextile fabrics, as the Corps has significant experience in installing riprap over geotextile fabric and can help you to avoid complications with the process.
When selecting stone for riprap, choose durable rock that's insoluble in water. Stratified or easily crumbled rocks such as shale, or rocks such as clay stones that are likely to decompose in water are not good for riprap. Stone for riprap should be block shaped with a specific gravity of at least 2.5. Smooth rounded stone or flat, thin, elongated and slab stones are not recommended. As a general rule, no more than 25% of the stones distributed throughout the gradation should have a length more than 2.5 times longer than the other dimensions, and none of the stones should be 3 times longer than their width or thickness.
Grouted riprap should be avoided unless it is absolutely necessary. The surface of grouted riprap can look perfectly fine until the bond between the grout and the rock fails. Grouted riprap can fail suddenly if it is undermined, and this can lead to unexpected and catastrophic failure of the slope. Other objections to using grout include the cost of installation, the lasting environmental impact, and the undesirable aesthetics of having a cement-lined stream bank as opposed to a plain rock bank.
It should be noted that work within a river channel which involves placing or adding material (soil or rock) may require a Section 404 permit from the Corps. Please contact your Corps district before placing any material along the banks of a river or stream to determine whether you will need a permit for the work. If the FCW is damaged by a flood or by high-water and is eligible for rehabilitation assistance under PL 84-99 as discussed in later chapters of this manual, the Corps will help you to obtain the necessary permits.
The Corps can provide recommendations or materials on the proper sizing, gradation, thickness, use of geotextile fabrics, and other details related to the placement of riprap.

Cracking

It's important to closely monitor and evaluate all visible areas of cracking on a levee or riverbank, to ensure they don't develop slope stability problems. Cracks in a levee develop when the levee material is saturated with water and when it is overly dry. Clay, like most impervious materials, will shrink as it dries and re-expands when wet. Clay levee surfaces tend to shrink and expand slightly, and some cracks in the surface of the FCW are to be expected. Shrinkage cracks are generally narrow and shallow, not extending more than a few inches into the levee, but during long periods of drought they may extend as much as two feet into the levee. These cracks can run longitudinally or transverse to the levee. If the cracking becomes excessive, it needs to be corrected even if the levee appears to be stable. It's important to contact the Corps district office for guidance on how to repair cracks observed in your levee.

Depressions / Rutting / Animal Grazing

Ruts and other depressions often develop along levees or patrol roads as a result of livestock, pedestrian or vehicular traffic, settlement, or because of an inadequate crown slope. Sometimes the levee material over a culvert can settle, leaving a trench across the crown of a levee. Ruts and depressions are a problem because they allow water to pond on the levee crest or access road. If left uncorrected, the ponded water will seep into the levee's interior or into roadway embankment, saturating the foundation material, and making the levee more susceptible to failure during a flood. The levee or access road should be inspected for ruts, potholes, and areas of standing water after it rains.
To correct these problems, the topsoil and sod should be removed, and the existing levee surface should be roughened. Loose fill material should be added evenly, in approximately 6-inch layers. Add water or dry backfill materials as necessary to attain optimal moisture content during compaction. Compact in place by hand or mechanical methods in order to bring the levee back to its original shape. The topsoil should be replaced, and the area should be reseeded and mulched for erosion control.
Any rutting deeper than 6 inches is considered an Unacceptable violation.
All damage to the levee caused by farm animals shall be the property owners' responsibility to repair. All damage shall be repaired annually, during the summer months. Repair work shall consist of grading and filling ruts back to the as built design conditions, and reseeding with approved vegetation.

Utilities
It's also recommended that you coordinate the construction of any utilities that cross over, under, or through levees or other flood control structures with the drainage improvement company and Corps prior to the start of construction. Any utility going through the levee will require a Section 408 review. During the installation of the utility, care needs to be taken to ensure that pipes do not leak, and that there is adequate compaction around the utility. Failure to provide good compaction will allow for seepage along the pipe during a flood. Once installed, the utility trench will need to be monitored for cracks, depressions, settlement, sink holes, or saturated soils that may indicate a leak or possible seepage along the utility line. These types of problems should be brought to the utility company's attention as soon as they are discovered and repaired expeditiously.

Seepage / Sand boils
Sand boils and seepage problems are not usually identified during routine inspections because these problems typically only appear under high water conditions. However, if sand boils or continuously saturated soils (not caused by ponded water or poor drainage) are observed on the landward side of the levee or floodwall under low water conditions, regardless of their size, they will likely become serious problems under high water conditions. Sand boils and under seepage is a serious problem that should not be taken lightly. If sand boils are observed during a flood or low water conditions, or if there's evidence that foundation material is being (or has been) removed from the levee foundation, then the Corps should be contacted to evaluate the situation and provide technical advice regarding repairs. Appendix D of this manual provides additional information regarding seepage and sand boils.

Excavating
The removal of levee blanket materials may endanger the levee by increasing the potential for seepage or stability problems. Any excavation that is proposed within the boundaries of the levee easement or right-of-way should be reviewed by SDIC and USACE. This review may result in a recommendation to not allow the excavation, or to recommend restrictions on the excavation in order to maintain SDIC's eligibility for rehabilitation assistance. The areas that SDIC should monitor for excavation activities include the levee itself, and those areas within 100 feet, both landward and riverward, of the levee. Also, any deep excavations, even if they are future then 100' from the levee

Appendix E: Supporting and Related Laws and Regulations

a. Public Law (PL) 84-99

This is the federal law which gives the Corps the legal authority to supplement local efforts in the repair of flood control projects that are damaged by floods. It can be found on the web at http://uscode.house.gov. Click on the link to "Search the US Code." Search for title "33" and chapter "15". Look through the search results, and the current form of PL 84-99 will be listed as 33 USC 701n.

b. Title 33, Code of Federal Regulations, Part 203 (33 CFR 203)

This federal regulation establishes the Rehabilitation and Inspection Program (RIP), describes the types of assistance the Corps can provide, and describes the general operation, maintenance, and disaster preparedness that is expected of nonfederal flood control works. The current version of the CFR can be accessed through the CFR main page, http://www.gpoaccess.gov/cfr/index.html Select "Browse and/or search the CFR," then scroll down to the current version of Title 33, (Navigation and Navigable Waters). Browse parts 200-399; then open part 203.

c. Title 33, Code of Federal Regulations, Part 208 (33 CFR Part 208):

This federal regulation provides more specific details on the operation and maintenance required of Federally constructed FCWs. This regulation provides a guideline for O&M, but doesn't provide the level of detail regarding specific requirements that the Levee Owner's manual does. The current version of the CFR can be accessed through the CFR main page, http://www.gpoaccess.gov/cfr/index.html Select "Browse and/or search the CFR," then scroll down to the current version of Title 33, (Navigation and Navigable Waters). Browse parts 200-399; then open part 208.

d. Engineer Regulation (ER) 500-1-1

This Corps regulation expands on the previously mentioned laws and regulations, provides basic information on the Corps' implementation of Public Law 84-99. Chapter 5 of ER 500-1-1 details the RIP program. Any discrepancies or conflicts that occur between the Levee Owner's Manual and ER 500-1-1 will be resolved based on the content of ER 500-1-1. This document can be found on the web at http://www.usace.army.mil/inet/usace-docs/eng-regs/er500-1-1/toc.htm

e. Engineer Pamphlet (EP) 500-1-1

This Corps pamphlet provides further detail on how the ER will be applied practically. It establishes the Inspection Guide and other applicable forms that are listed in the appendices to this manual. Any discrepancies or conflicts that occur between the Levee Owner's Manual and any EP or ER will be resolved based on the content of the ER or EP, and any discrepancies or conflicts that occur between the EP and the ER will be resolved based on the content of the ER. EP 500-1-1 can be found on the web at http://www.usace.army.mil/inet/usace-docs/engpamphlets/ep500-1-1/toc.htm

f. Engineer Manual (EM) 1110-2-1913

This manual provides the Corps of Engineer's guidelines for engineering design and construction of levees. The document can be found at http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-1913/toc.htm

g. Engineer Manual (EM) 1110-2-301
This manual provides guidelines for landscape planting at Floodwalls, Levees, and Embankment Dams. This document provides additional clarification as to which types of vegetation are acceptable on and around flood control works. This can be found at http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-301/toc.htm

h. Engineer Manual (EM) 1110-2-2705
This manual provides guidance on the design of closure structures for local flood control projects. It can be found on the web at http://www.usace.army.mil/inet/usace-docs/eng-manuals/em1110-2-2705/toc.htm

i. Engineer Manual (EM) 1110-2-1205
This manual provides information regarding environmental engineering for flood control channels. This EM can be found at http://www.usace.army.mil/publications/eng-manuals/em1110-2-1205/toc.htm