Mississippi Valley Division
Rock Island District
Illinois Waterway Project

T.J. Obrien Lock
Dewatering 2014-15

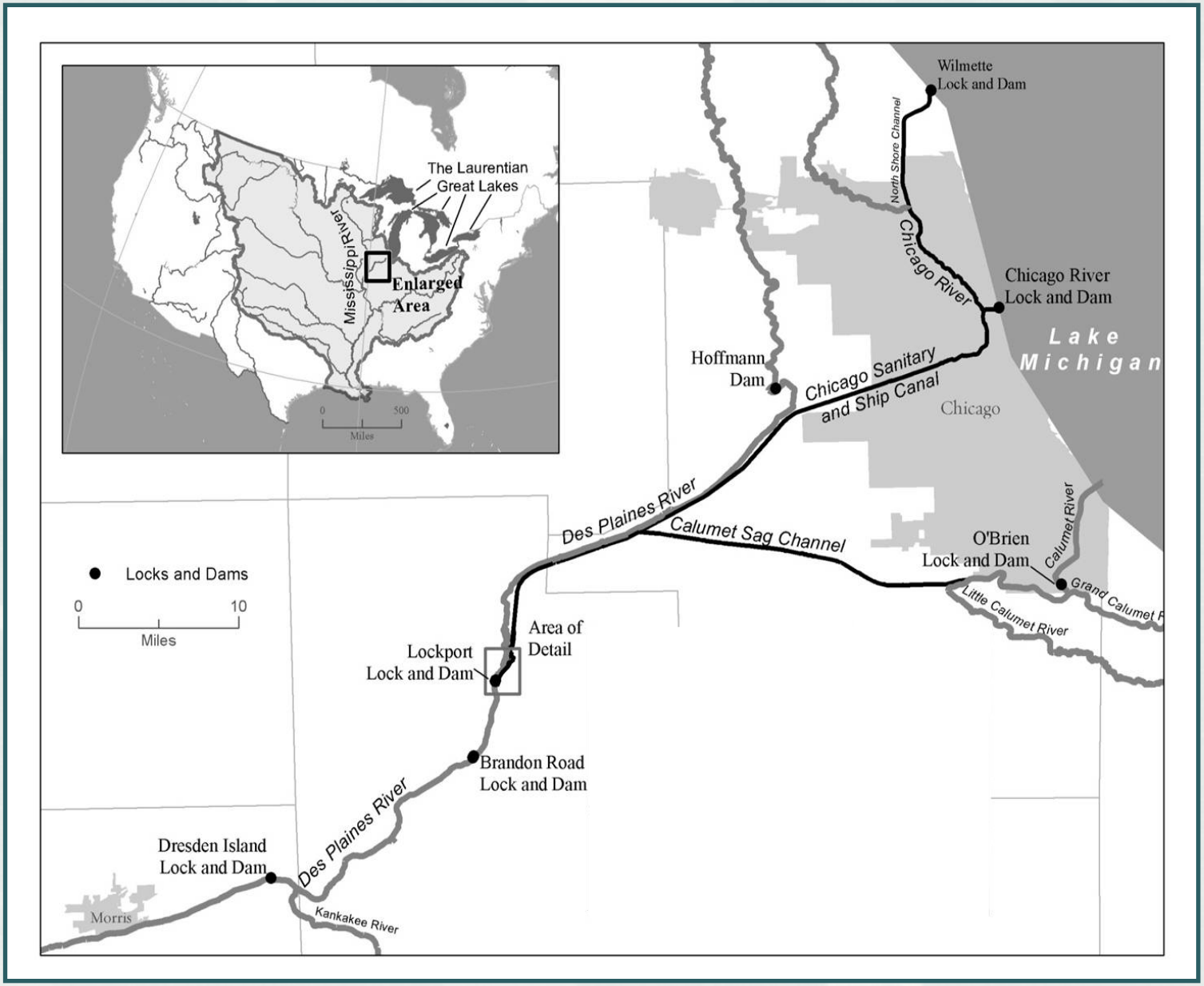
US Army Corps of Engineers
BUILDING STRONG®

Project Overview

- Description
- History
- Purpose
- Scope of Work
- Schedule
- Logistics
- Dewatering Operations
- Lessons Learned

Description

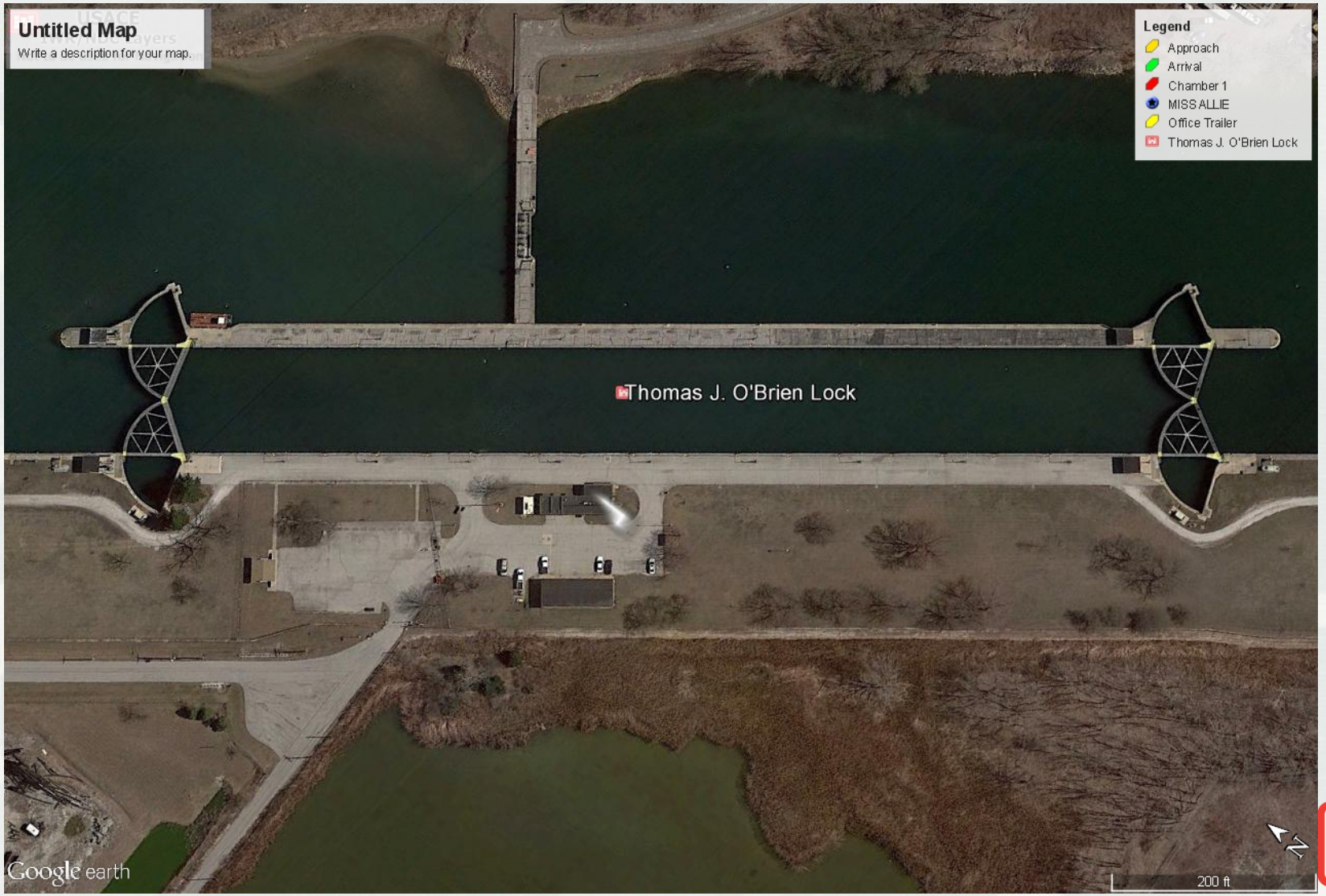
- Located on the south side of Chicago, T.J. Obrien Lock is an extremely vital link in the Upper Mississippi/Illinois Waterway Inland Transportation System connecting the Great Lakes via Lake Michigan through the Calumet River.
- The Chicago Harbor Lock is the only other navigable link between the Great Lakes and the Mississippi River.


The Laurentian
Great Lakes
Mississippi River
Enlarged
Area
0
500
Miles
Wilmette
Lock and Dam
North Shore Channel
Chicago River
Chicago River
Lock and Dam
Lake
Michigan
Hoffmann
Dam
Chicago Sanitary
and Ship Canal
Chicago
Des Plaines River
Calumet Sag Channel
O'Brien
Lock and Dam
Calumet River
Grand Calumet R
Little Calumet River
Locks and Dams
0
10
Miles
Area of
Detail
Lockport
Lock and Dam
Brandon Road
Lock and Dam
Des Plaines River
Dresden Island
Lock and Dam
Morris
Kankakee River

History

- Lock was placed into Operation in 1960
- It has seen full time operation for almost 55 years
- Last dewatered in 1979, the sector gates were jacked to inspect the pintle balls and bushings and the upper gates were blasted and painted. That closure lasted approximately 60 days
- The current dewaterings have been the first time there has been a full gate and gate bay inspection in 35 years.

TJ Obrien Lock- 110 ft X1000 ft



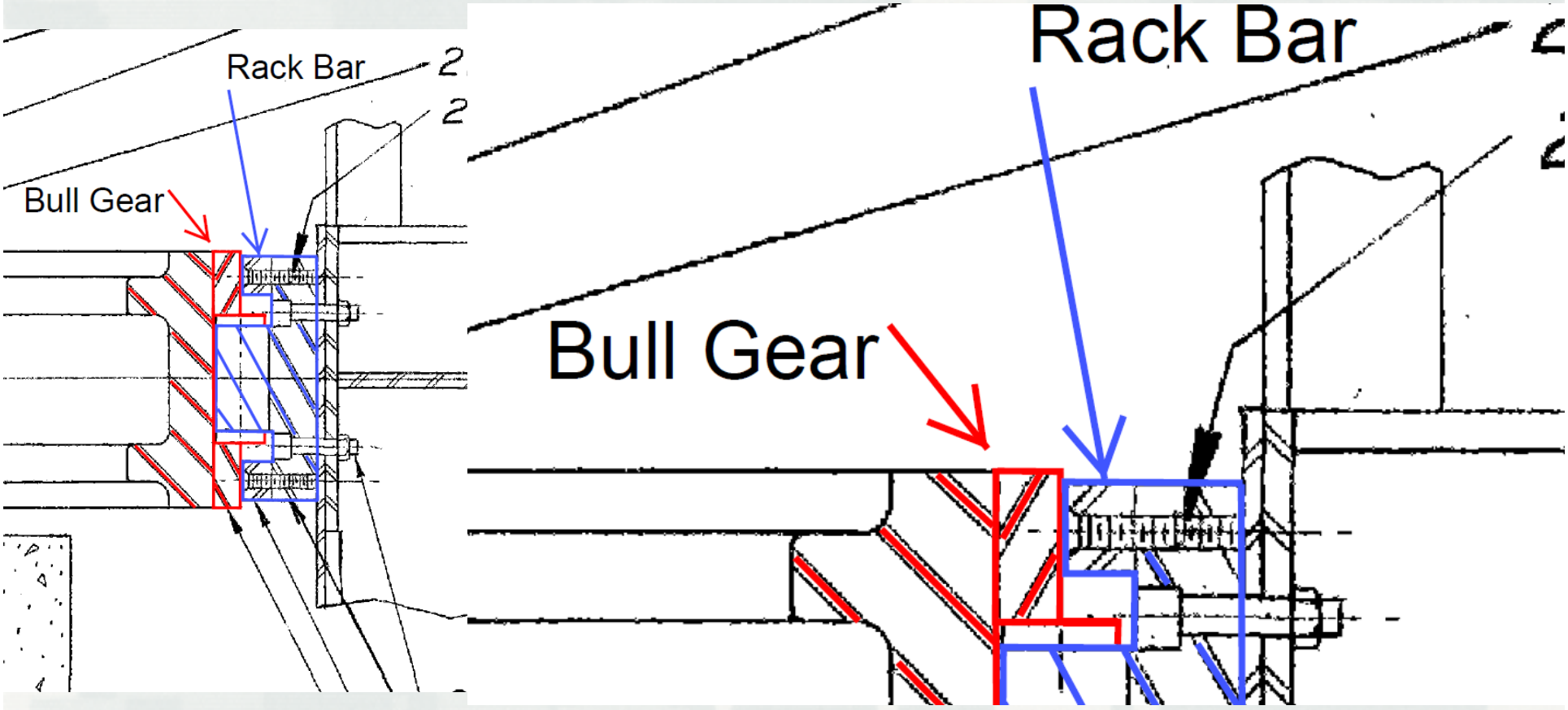
Project Purpose

- In 2011, Lock Staff identified an issue with interference between the sector gate bull gear which opens and closes the gates and the gear track it drives which is attached to the skin plate. The top surface of the bull gear was getting contacted by the top rack bar rail on the gate causing abnormal wear on the bull gear
- In early 2011, our Structures Maintenance Unit removed the top rail on both lower gates to alleviate the pressure being put on the bull gear and a plan was formulated to determine the root cause of the misalignment
- Because there is no way to assess the condition of the Pintle Ball and Bushing with the gate in place, the first step was to inspect the top Gate Elevation Pin and Bushing to determine if it was significantly worn causing the misalignment.
- In July 2011, our Structures Maintenance Unit along with the District Dive Team inspected the Lower Left Sector Gate Upper Gate Elevation Pin and Bushing
- Upon inspection, it was found that there was some slight pitting and corrosion on the pin, but that there was not enough material loss on the pin nor was there enough wear on the upper bushing to cause the amount of misalignment that was present
- The conclusion was made following that inspection that there had to be significant wear at the pintle ball and bushing to allow the skin plate end of the gate to drop enough causing the misalignment and that the gates would have to be removed to inspect and replace the worn parts.

Sector Gate Operation

Bull Gear to Rack Gear Interferance

Bull Gear to Rack Gear Misalignment



Pulling the Gate Elevation Pin to Check for wear in 2011

Project Purpose Cont'd

- Once the root cause of the problem was determined, a plan was formulated to start procuring the new balls and bushings and determine when and how replacing the balls and bushings would be accomplished.
- The gates weigh approximately 255,000 lbs each, and there are only two ways to remove the gate to replace the pintle balls and bushings, either lift the gates with a crane or dewater the gate bays and jack the gates utilizing hydraulic jacks.
- Researching the two different options, it was determined that it would be more economical to dewater the gate bays and jack the gates rather than lifting them using a crane or multiple cranes.
- Knowing that other critical inspection and maintenance items also needed to be addressed sooner rather than later, this project was widened in scope and soon proved to be more costly than our annual maintenance budget funds could support.
- Through the Prioritization of Maintenance (POM) process utilized by the Mississippi Valley Division to determine the best use of funds to maintain the waterways infastructure, this project was submitted and ranked based on a number of criteria such as tonnage/value of materials shipped through the lock, the age and condition of the lock and the risk involved if the project is not completed.

Project Purpose Cont'd

- Once ranked by the POM team, it was submitted to Congress for funding.
- In early 2014, Congress approved the funding of this project for FY2015 and subsequently the planning for execution of this project was significantly ramped up in the spring of last year.

Initial Spare Parts Purchased with Maintenance Funds in 2012 to have on hand in the event of a failure.
2 New Pintle Balls and 2 New Pintle Bushings.

Scope of Work

- Once the word came down that the project was officially funded, the Illinois Waterway Maintenance Section was tasked with preparing the final scope of work and detailing how and when we were going to execute the project.
- Through several preliminary meetings and working closely with the lock staff, IRCA (Illinois River Carriers Association), and the United States Coast Guard, it was determined that the most beneficial option to all parties would be to accomplish this project not in one long 90 day closure but instead divide it up into 2 separate closures each being 47 days in duration.
- Given the magnitude and complexity of this project, it was determined very early on in the planning process, that the Illinois Waterway Maintenance Section would need to bring in other district assets to assist us with successfully planning and executing this project.

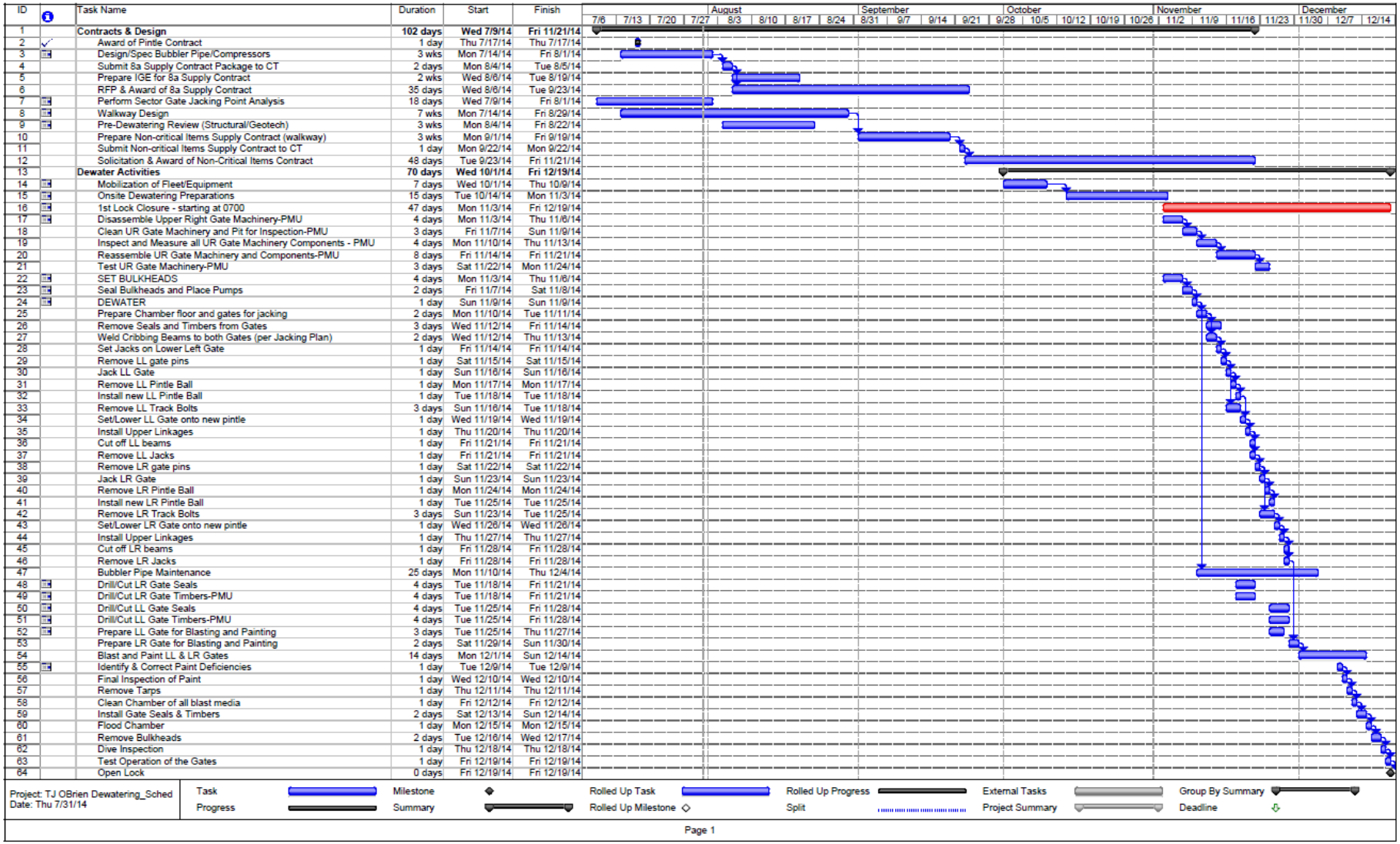
Scope of Work Cont'd

- Starting in June of 2014 the IWPO Maintenance Section began working closely with various District Offfices including, Safety, Engineering, Project Management, and the Contracting branches of the district. Developing a safety plan, narrowing down the scope of work, identifying what parts, supplies and equipment would need to be procured and or rented in order to complete the work, and issuing Press Releases to inform the public as to when and why the closures were scheduled to take place.
- We started out meeting monthly to identify early on what the roles and responsibilities of each branch were to be, and to establish milestones for completion of major key items such as letting contracts to procure longer lead time items such as the additional pintle balls and bushings and required equipment like the 80 jacking beams we borrowed from the New Orleans District to support the gates during the jacking process.

Scope of Work

- Set Bulkheads and Dewater each end of the lock separately.
- Jack each sector gate and replace all pins, balls, and bushings.
- Replace all gate seals, seal stops, and gate timbers.
- Blast and Paint the gates.
- Disassemble, Inspect, and measure the Upper Right Gate Machinery for condition assessment during the first closure.
- Replace bubbler piping as needed and install new diffusers.
- OCA team to conduct an inspection of all underwater components upon completion of blasting and painting operations.
- Rewater the chamber and pull the bulkheads.

Developing the Schedule



ID	Task Name	Duration	Start	Finish
1	**Contracts & Design**	**102 days**	**Wed 7/9/14**	**Fri 11/21/14**
2	Award of Pintle Contract	1 day	Thu 7/17/14	Thu 7/17/14
3	Design/Spec Bubbler Pipe/Compressors	3 wks	Mon 7/14/14	Fri 8/1/14
4	Submit 8a Supply Contract Package to CT	2 days	Mon 8/4/14	Tue 8/5/14
5	Prepare IGE for 8a Supply Contract	2 wks	Wed 8/6/14	Tue 8/19/14
6	RFP & Award of 8a Supply Contract	35 days	Wed 8/6/14	Tue 9/23/14
7	Perform Sector Gate Jacking Point Analysis	18 days	Wed 7/9/14	Fri 8/1/14
8	Walkway Design	7 wks	Mon 7/14/14	Fri 8/29/14
9	Pre-Dewatering Review (Structural/Geotech)	3 wks	Mon 8/4/14	Fri 8/22/14
10	Prepare Non-critical Items Supply Contract (walkway)	3 wks	Mon 9/1/14	Fri 9/19/14
11	Submit Non-critical Items Supply Contract to CT	1 day	Mon 9/22/14	Mon 9/22/14
12	Solicitation & Award of Non-Critical Items Contract	48 days	Tue 9/23/14	Fri 11/21/14
13	**Dewater Activities**	**70 days**	**Wed 10/1/14**	**Fri 12/19/14**
14	Mobilization of Fleet/Equipment	7 days	Wed 10/1/14	Thu 10/9/14
15	Onsite Dewatering Preparations	15 days	Tue 10/14/14	Mon 11/3/14
16	1st Lock Closure - starting at 0700	47 days	Mon 11/3/14	Fri 12/19/14
17	Disassemble Upper Right Gate Machinery-PMU	4 days	Mon 11/3/14	Thu 11/6/14
18	Clean UR Gate Machinery and Pit for Inspection-PMU	3 days	Fri 11/7/14	Sun 11/9/14
19	Inspect and Measure all UR Gate Machinery Components - PMU	4 days	Mon 11/10/14	Thu 11/13/14
20	Reassemble UR Gate Machinery and Components-PMU	8 days	Fri 11/14/14	Fri 11/21/14
21	Test UR Gate Machinery-PMU	3 days	Sat 11/22/14	Mon 11/24/14
22	SET BULKHEADS	4 days	Mon 11/3/14	Thu 11/6/14
23	Seal Bulkheads and Place Pumps	2 days	Fri 11/7/14	Sat 11/8/14
24	DEWATER	1 day	Sun 11/9/14	Sun 11/9/14
25	Prepare Chamber floor and gates for jacking	2 days	Mon 11/10/14	Tue 11/11/14
26	Remove Seals and Timbers from Gates	3 days	Wed 11/12/14	Fri 11/14/14
27	Weld Cribbing Beams to both Gates (per Jacking Plan)	2 days	Wed 11/12/14	Thu 11/13/14
28	Set Jacks on Lower Left Gate	1 day	Fri 11/14/14	Fri 11/14/14
29	Remove LL gate pins	1 day	Sat 11/15/14	Sat 11/15/14
30	Jack LL Gate	1 day	Sun 11/16/14	Sun 11/16/14
31	Remove LL Pintle Ball	1 day	Mon 11/17/14	Mon 11/17/14
32	Install new LL Pintle Ball	1 day	Tue 11/18/14	Tue 11/18/14
33	Remove LL Track Bolts	3 days	Sun 11/16/14	Tue 11/18/14
34	Set/Lower LL Gate onto new pintle	1 day	Wed 11/19/14	Wed 11/19/14
35	Install Upper Linkages	1 day	Thu 11/20/14	Thu 11/20/14
36	Cut off LL beams	1 day	Fri 11/21/14	Fri 11/21/14
37	Remove LL Jacks	1 day	Fri 11/21/14	Fri 11/21/14
38	Remove LR gate pins	1 day	Sat 11/22/14	Sat 11/22/14
39	Jack LR Gate	1 day	Sun 11/23/14	Sun 11/23/14
40	Remove LR Pintle Ball	1 day	Mon 11/24/14	Mon 11/24/14
41	Install new LR Pintle Ball	1 day	Tue 11/25/14	Tue 11/25/14
42	Remove LR Track Bolts	3 days	Sun 11/23/14	Tue 11/25/14
43	Set/Lower LR Gate onto new pintle	1 day	Wed 11/26/14	Wed 11/26/14
44	Install Upper Linkages	1 day	Thu 11/27/14	Thu 11/27/14
45	Cut off LR beams	1 day	Fri 11/28/14	Fri 11/28/14
46	Remove LR Jacks	1 day	Fri 11/28/14	Fri 11/28/14
47	Bubbler Pipe Maintenance	25 days	Mon 11/10/14	Thu 12/4/14
48	Drill/Cut LR Gate Seals	4 days	Tue 11/18/14	Fri 11/21/14
49	Drill/Cut LR Gate Timbers-PMU	4 days	Tue 11/18/14	Fri 11/21/14
50	Drill/Cut LL Gate Seals	4 days	Tue 11/25/14	Fri 11/28/14
51	Drill/Cut LL Gate Timbers-PMU	4 days	Tue 11/25/14	Fri 11/28/14
52	Prepare LL Gate for Blasting and Painting	3 days	Tue 11/25/14	Thu 11/27/14
53	Prepare LR Gate for Blasting and Painting	2 days	Sat 11/29/14	Sun 11/30/14
54	Blast and Paint LL & LR Gates	14 days	Mon 12/1/14	Sun 12/14/14
55	Identify & Correct Paint Deficiencies	1 day	Tue 12/9/14	Tue 12/9/14
56	Final Inspection of Paint	1 day	Wed 12/10/14	Wed 12/10/14
57	Remove Tarps	1 day	Thu 12/11/14	Thu 12/11/14
58	Clean Chamber of all blast media	1 day	Fri 12/12/14	Fri 12/12/14
59	Install Gate Seals & Timbers	2 days	Sat 12/13/14	Sun 12/14/14
60	Flood Chamber	1 day	Mon 12/15/14	Mon 12/15/14
61	Remove Bulkheads	2 days	Tue 12/16/14	Wed 12/17/14
62	Dive Inspection	1 day	Thu 12/18/14	Thu 12/18/14
63	Test Operation of the Gates	1 day	Fri 12/19/14	Fri 12/19/14
64	Open Lock	0 days	Fri 12/19/14	Fri 12/19/14

Logistics

- 8A Contractor for supplies and materials.
- Hotel Accommodations for a crew of 35
- Transportation Solutions for a crew of 35
- Work Hours-Taking into account the scope, complexity, and duration.
- Holidays
- Support Staff onsite to process time and travel and for purchase card support.

Monday November 3rd
0700 hours CST

Kick the tires and light the fires!

Operational Hurdles

- Seized pins
- Raised Sill
- New Pintle Bushing grease hole alignment
- Pintle Anchorage Plates
- Blizzard conditions

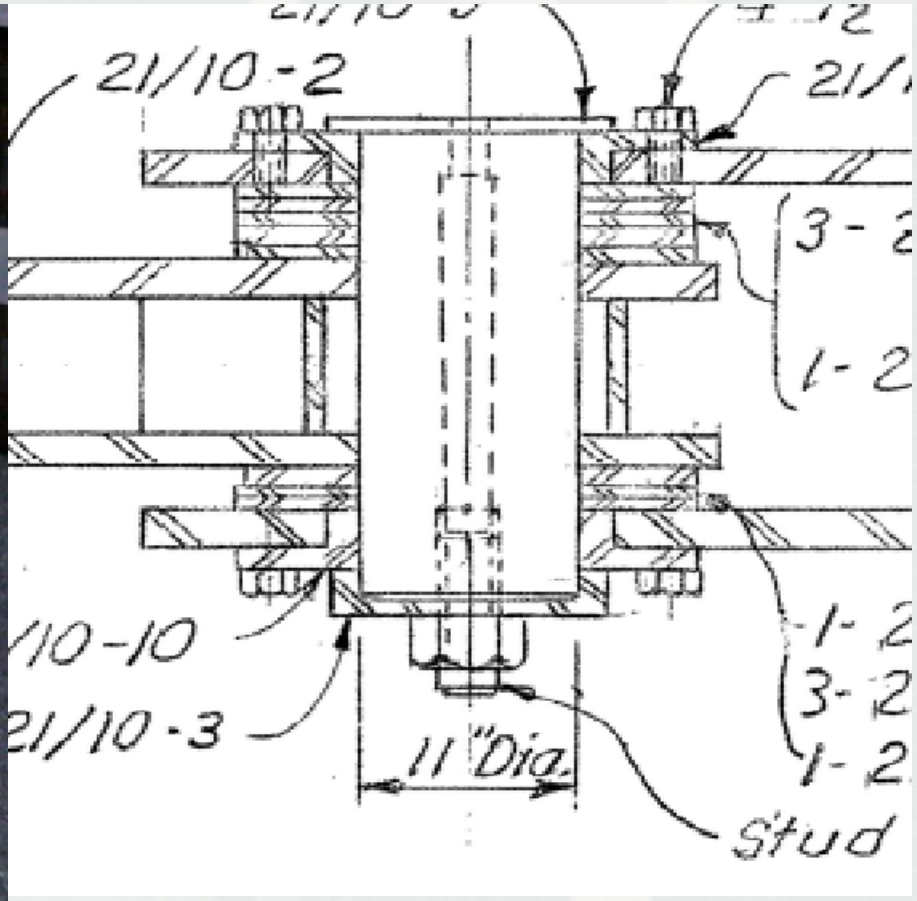
Elevation Gate Pins

Piece of Cake!

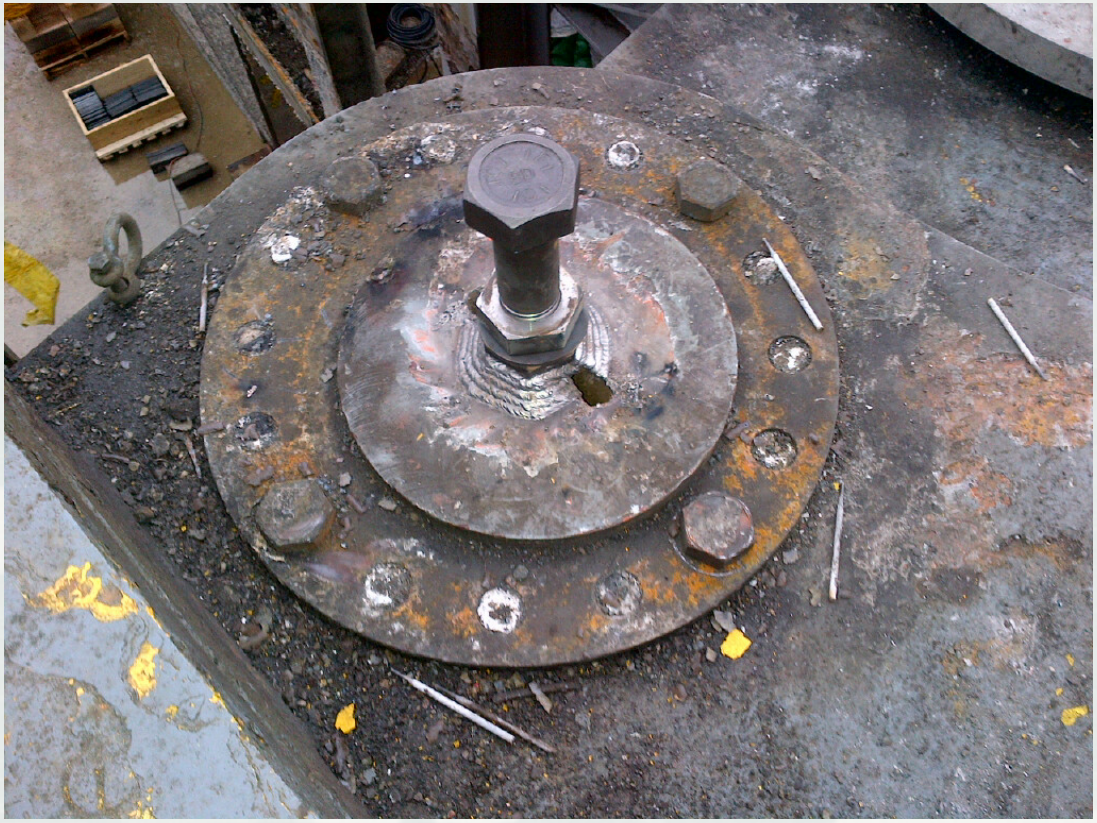
Elevation Anchorage Pins

Not so Easy!

- **Static Pins with no provisions for lubrication.**

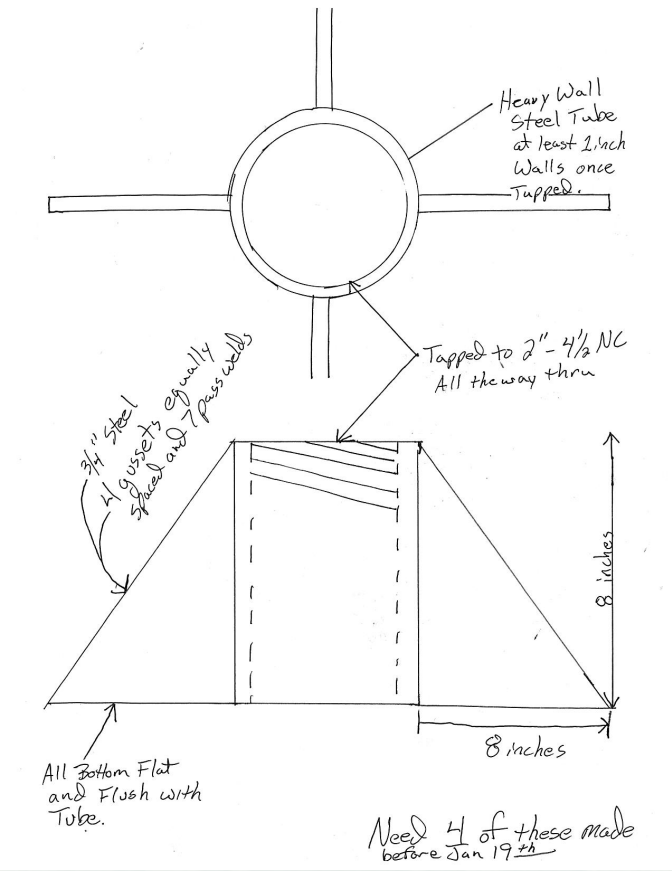


Original Method



Problem?

New Method!


Heavy Wall Steel Tube at least 1 inch Walls once Tapped.
Tapped to 2" - 4½ NC All the way thru
¾" Steel 4 gussets equally Spaced and 7 pass welds
8 inches
8 inches
All Bottom Flat and Flush with Tube.
Need 4 of these made before Jan 19th

Piece of Cake!

Gate Jacking Challenges!

Jack Cribbing?

Raised Sill?

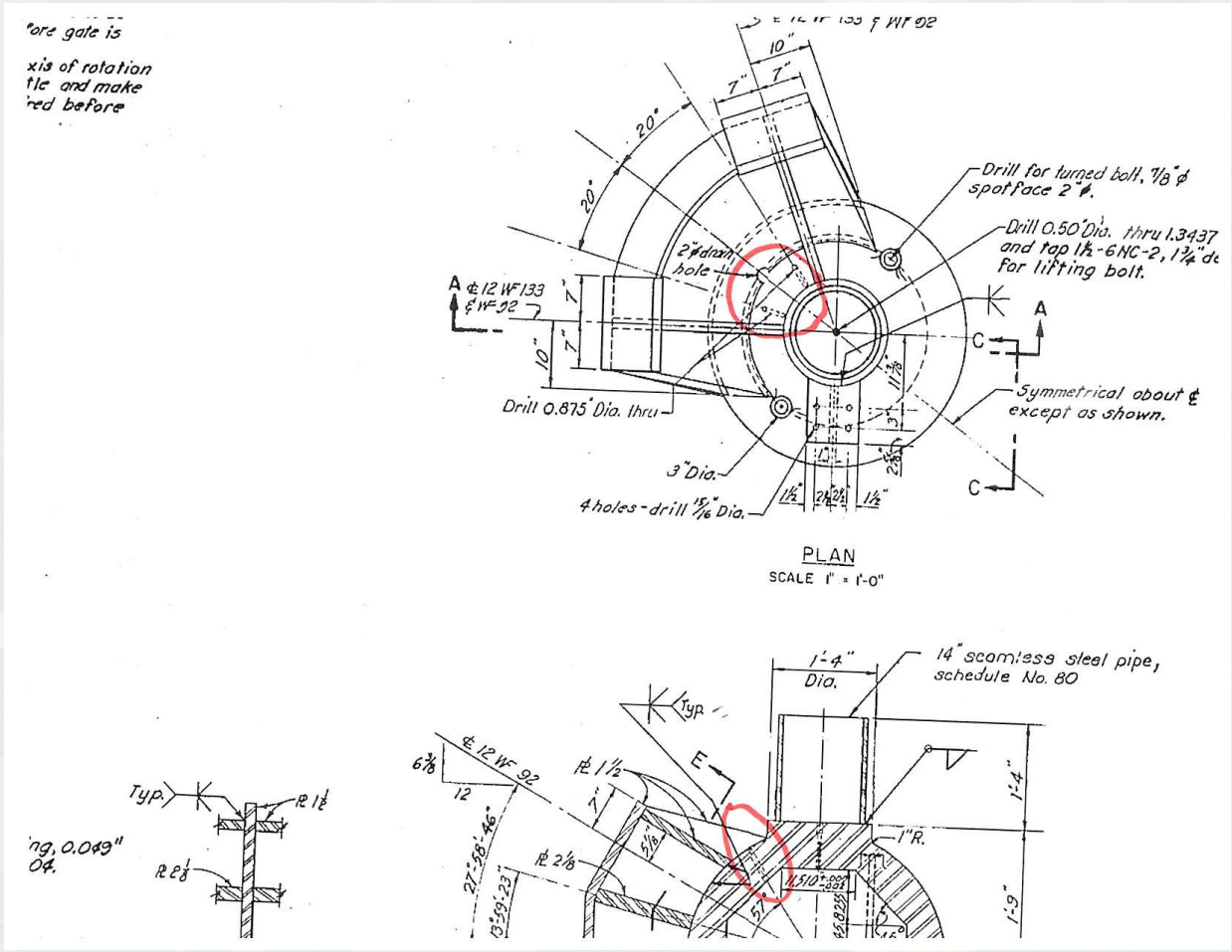
Raised Recess Floor

Fully Raised

Removing the Old Balls

Installing New Pintle Bushings

Bushing Grease Holes



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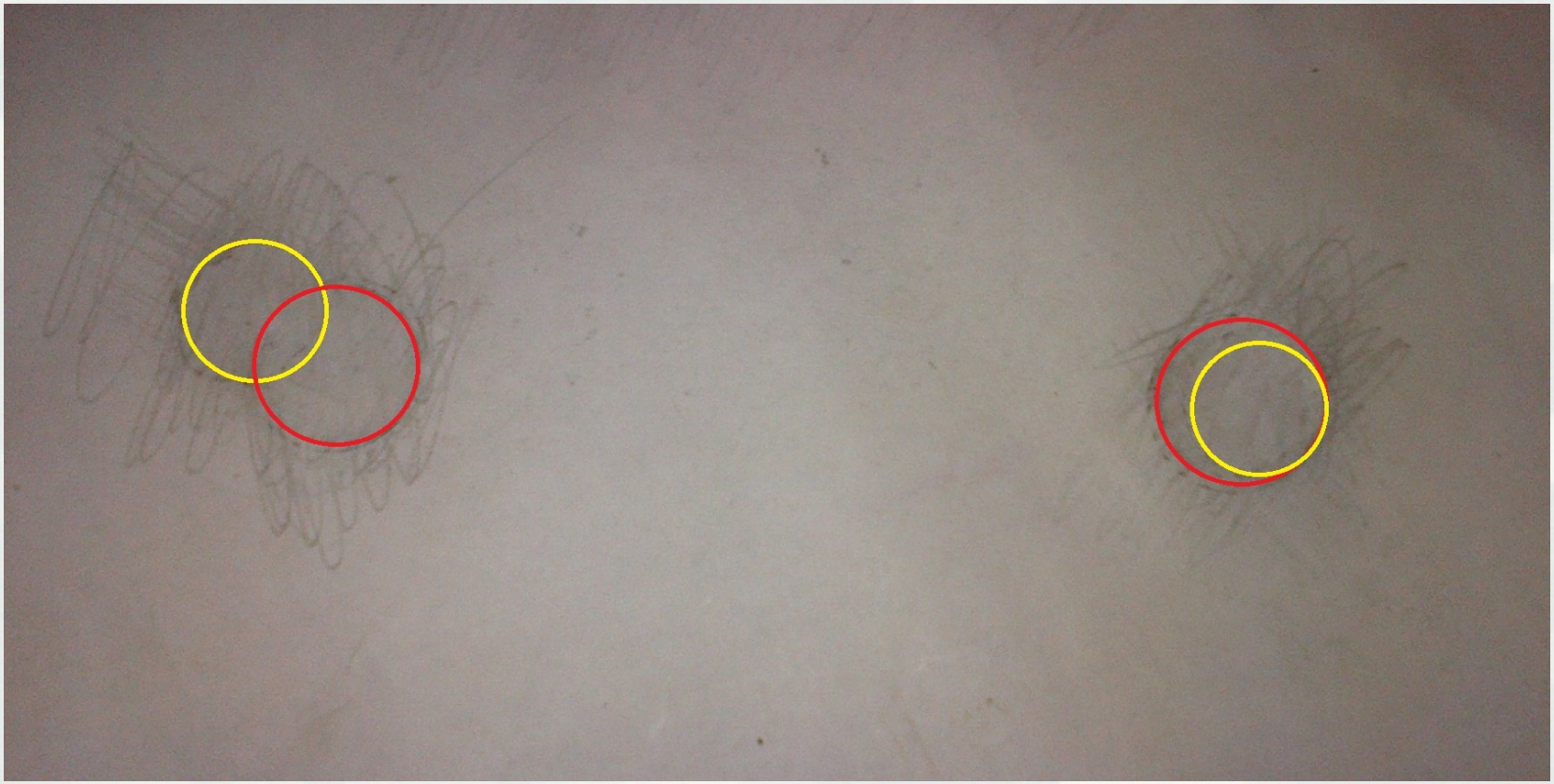
Uh Oh! They don't line up?

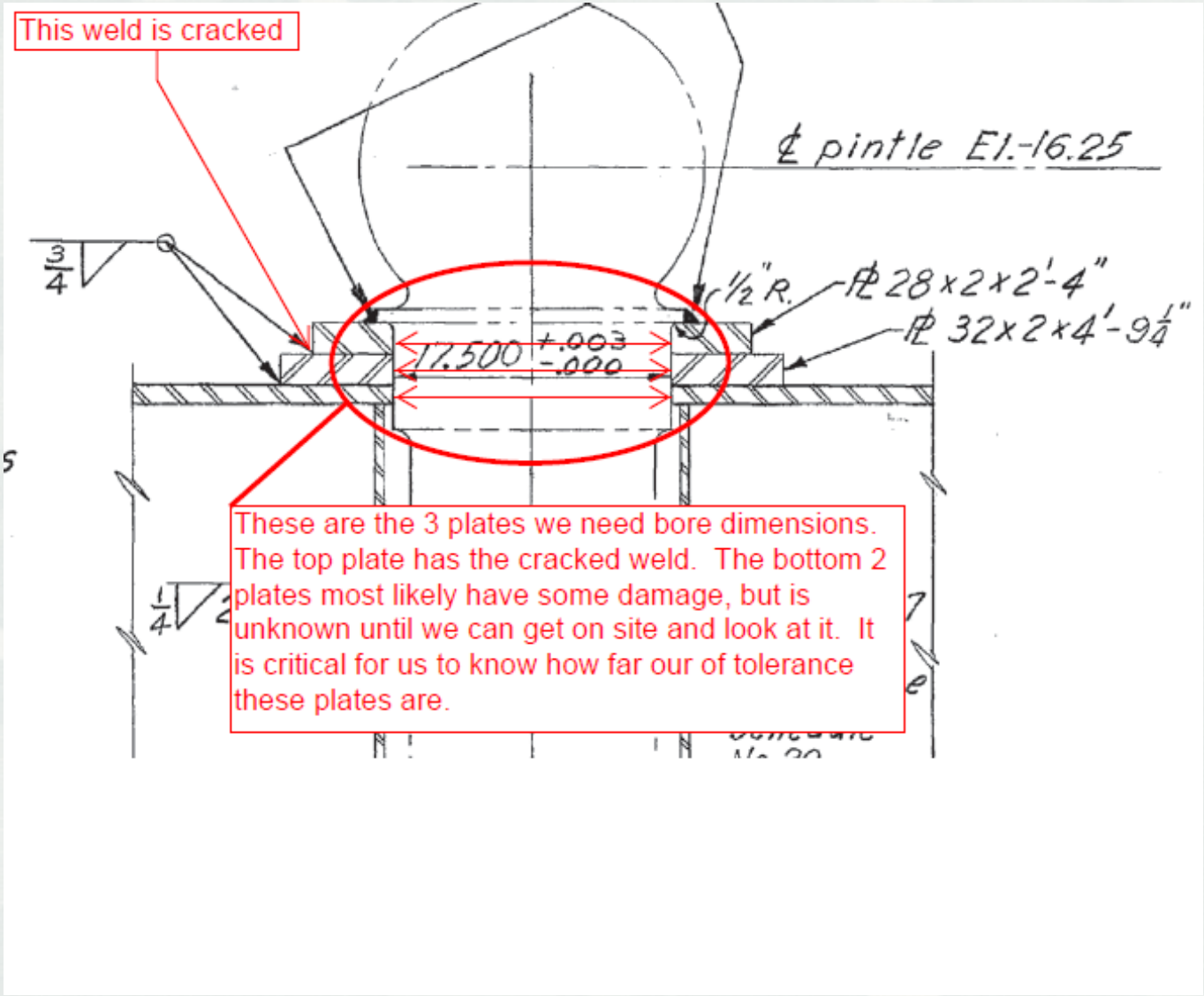


The Fix

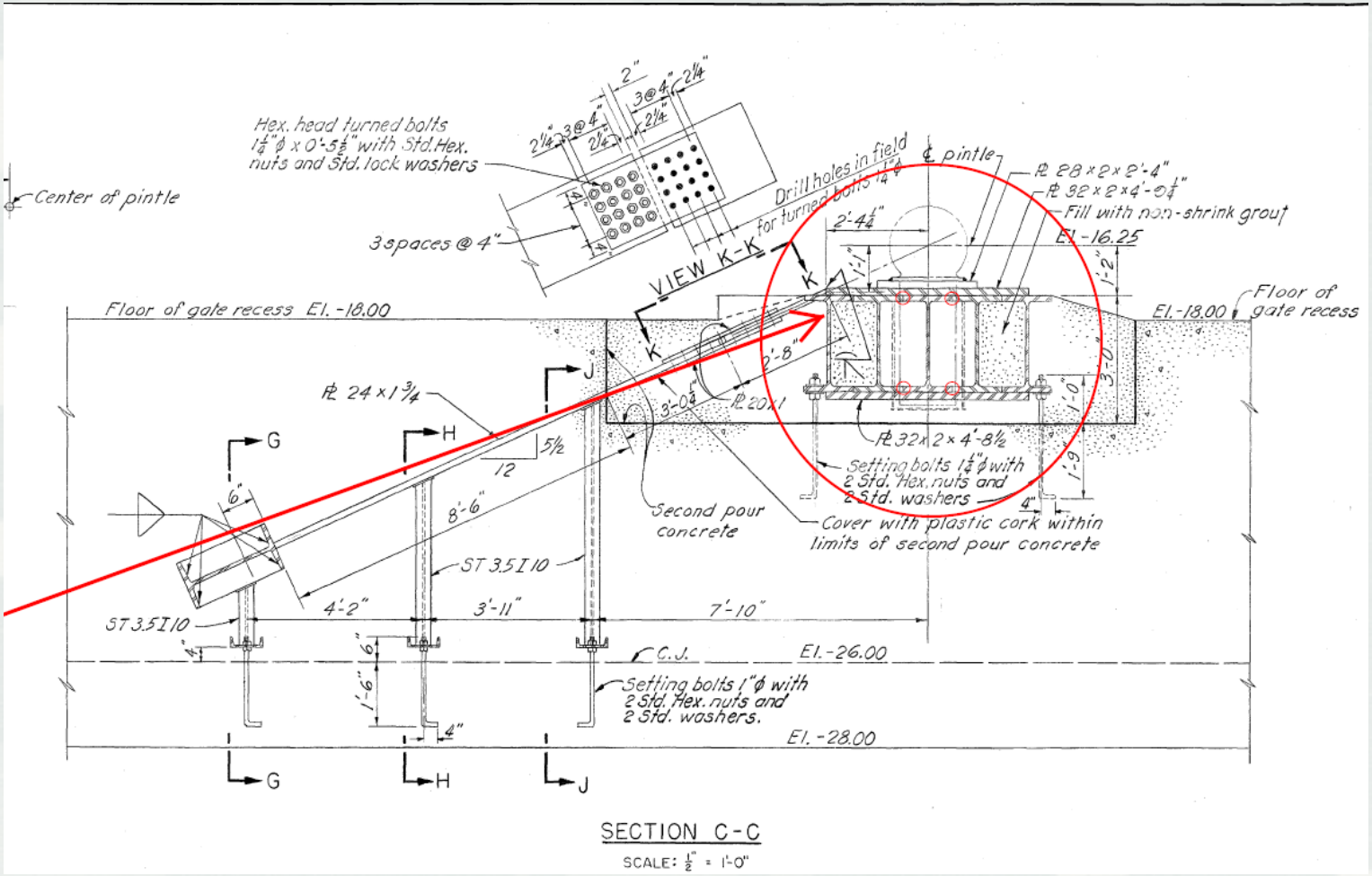
The Fix

Uh Oh!

The Problem


This weld is cracked
℄ pintle El.-16.25
3/4
1/2" R.
PL 28 x 2 x 2'-4"
PL 32 x 2 x 4'-9 1/4"
17.500 +.003 -.000
1/4
These are the 3 plates we need bore dimensions. The top plate has the cracked weld. The bottom 2 plates most likely have some damage, but is unknown until we can get on site and look at it. It is critical for us to know how far our of tolerance these plates are.

The importance!



More Uh Oh's

The fix

Gate Machinery Inspection

Inspection results

Good to go…..for now!

The Good Idea Factory!

Nice Tight Seal=Less Leaks to Stop

Applying ideas learned from other jobs!

Sealing Timbers-Oakum-Sandbags-Skimmer Pumps

Great Ingenuity!

Tarp Support Structure aka “The Lollipop”

More Good Ideas!

Roof it and Wrap it!

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Additional Good Ideas!

The Best Good Idea!

- Developing an Accident Prevention Plan aka APP! This was a first for us. District SO wants us to be more in line with contractors requirements on projects of this size, scope, and complexity?
- Final version over 100 pages with 12 sections, 37 compliance plans, and 20 appendices.
- 35 different AHA's were developed to provide in depth coverage of every single activity that was scheduled as well as anticipated activities that may or may not take place based on the allotted schedule.
- Started with a rough outline, but had to do some major tweaking to adapt it to this project. Took well over 70 hours to compile a draft and another 20 hours to make final additions following the safety office review and commenting.
- Assigned an SSHO from outside the Maintenance Section, and not part of the TJ Obrien Lock Staff. Third Party set of eyes and ears.

Lessons Learned

- Fortunate enough to have worked with MVN New Orleans and in 2012 was allowed to conduct a site visit to Bayou Dupre Dewatering and witnessed them jack the sector gates there.
- Holidays-Not accounted for in the original schedule formulation.
- Scissor lifts-Requested early on but the decision was made to use bakers scaffolding instead. Bakers scaffolding did not work. Scissor lifts were brought in.
- Additional Aerial Lift-Useful to have one aerial lift on each side of the gate sill. Especially to remove timbers and seals concurrently on each gate.
- Pre-Dewatering Inspection Dive-Clearly identify with the divers exactly what needs inspected. Chamber Recesses on the lower end had 18 inches of zebra mussel shells and mud built up that we did not know about.
- Jack cribbing-had a good idea of what to use, but turned out what we had was not going to be substantial enough to maintain stability through the entire lift. Stopped at 53 inches on the first gate. Ordered custom cribbing and went up the full 60 inches on each of the other gates.
- When using blast media containing Blastox, clean your hopper.
- FOD Walkdown-Missing Wedge!

Questions?