

# Pike Island Locks & Dam, Ohio River

2010 – Dewater Main  
110' x 1200' River Lock  
Chamber



®

US Army Corps of Engineers  
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# Scope of Work

## ➤ Primary

- Install four (4) new miter gate leafs (Remove, install, adjust/level, tension, pour contact blocks).
- Replace four (4) hydraulic gate cylinders w/ new.
- Replace four (4) strut spring assemblies.
- Replace one (1) hydraulic valve cylinder w/ new.
- Install ball valves on hydraulic, air and water lines in MW gallery.
- Gate recess modifications due to new walkway design.



# Schedule/Budget

**Original:** 13 Sept – 5 Nov 2010 (54/45)  
(due to spring flooding)

**Revised:** 12 Oct - 3 Dec 2010  
(due to gate fabrication delays)

**Revised:** 25 Oct – 17 Dec 2010 (54/45)

**\$3.25M**



# New Gates – Fabricated by G&G Steel in AL/MS for \$9.9M (NTP 2008)



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All old anchorages were burned to speed removal



PIIO - US gates (existing)  
prior to removal.



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# US Gates – Remove/Install/Level In-the-Wet (9 Days +/-)



# Contractor's Scrap Barge w/ US Gates



# US Gates arrived on site 10/25/10 (135 ton)





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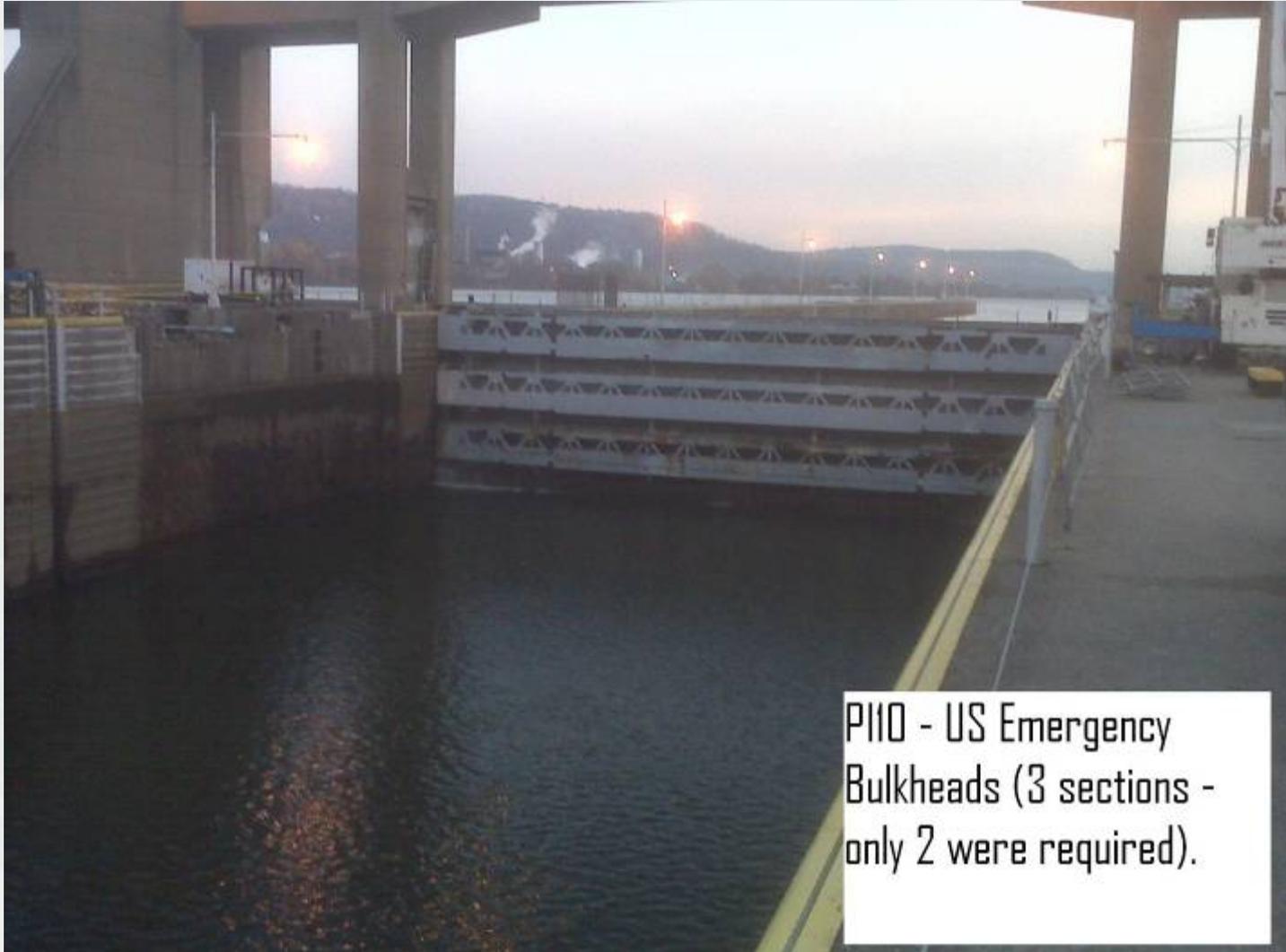
# Setting of US Bulkheads



PI10 - US emergency  
bulkhead (3 sections  
used, only 2 required).



# US Bulkheads Set - LP



PI10 - US Emergency  
Bulkheads (3 sections -  
only 2 were required).



# US Gates – New; removal (Typ)



PI10 - US gates  
(new). MONALLO III  
getting ready to  
remove USRW gate.



# US Gates Installed – Two Cranes



PIID - USRW gate  
(new); installation of.



# US Gates Installed – Two Cranes



P110 - USRW gate (new);  
installation of.



# US Gate(s) Installed



# New anchorage components, pins, bushings, ect fabricated by the contractor



# DS Gates arrived on site 10/31/10 (155 ton)



PI10 - DSRW gate  
(new) installation  
process.

11.12.2010



# DS Gates – Remove/Install/Level In-the-Wet (9 Days +/-)



PI10 - DSRW gate  
(new) installation  
process.

11.12.2010

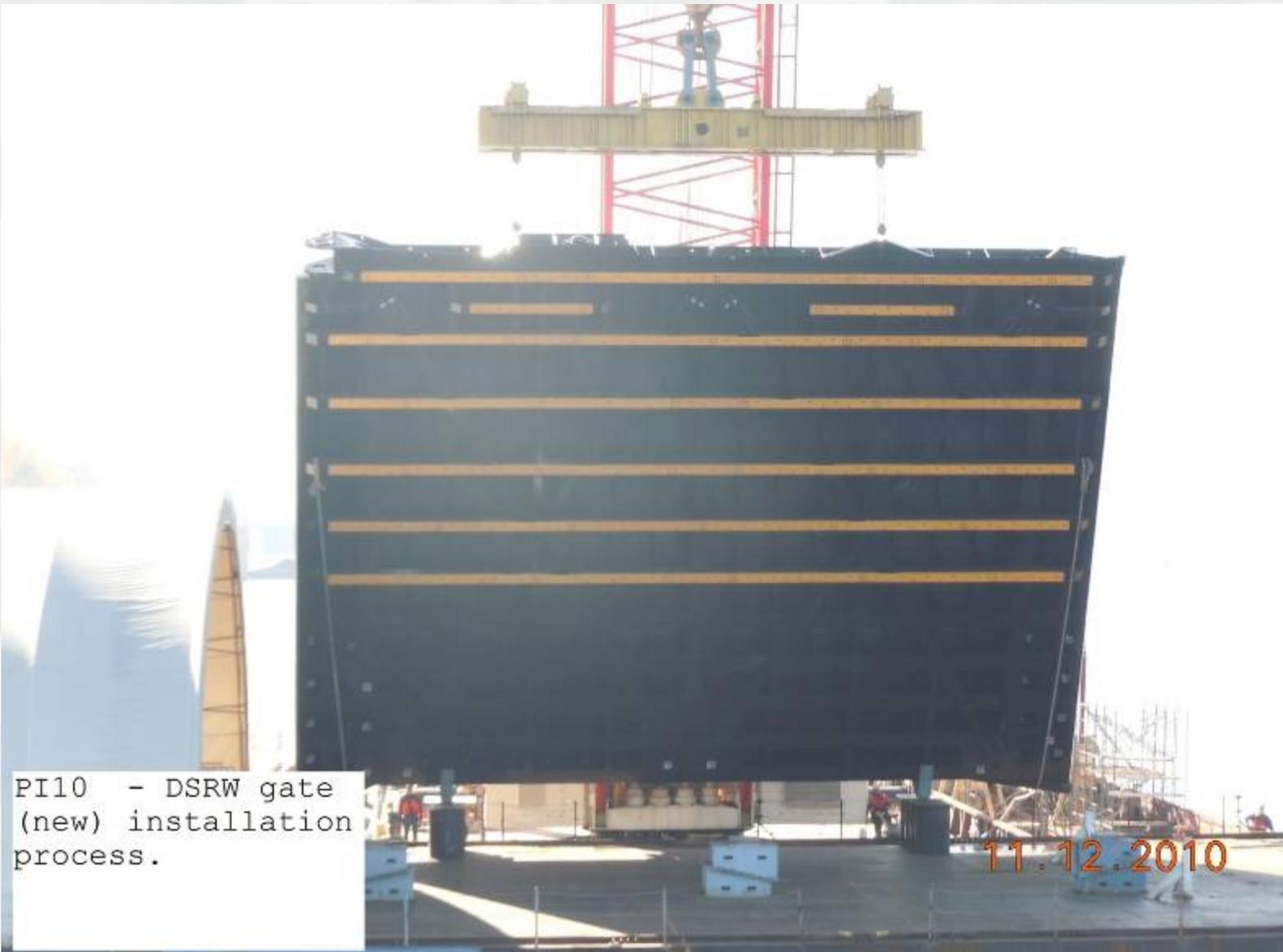




PI10 - DSRW gate  
(new) installation  
process.

11.12.2010





PI10 - DSRW gate  
(new) installation  
process.

11.12.2010



# DS Gates - Pivot point/Roller attachment





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# DSRW gate – Two cranes



PI10 - DSRW gate  
(new) installation  
process.



All gate recesses required modifications due to walkway design; saw cut by contractor.





PI10 - Gate Recess  
Retrofit; general.

12 20 2010



# Monolith M-10 overturning concerns

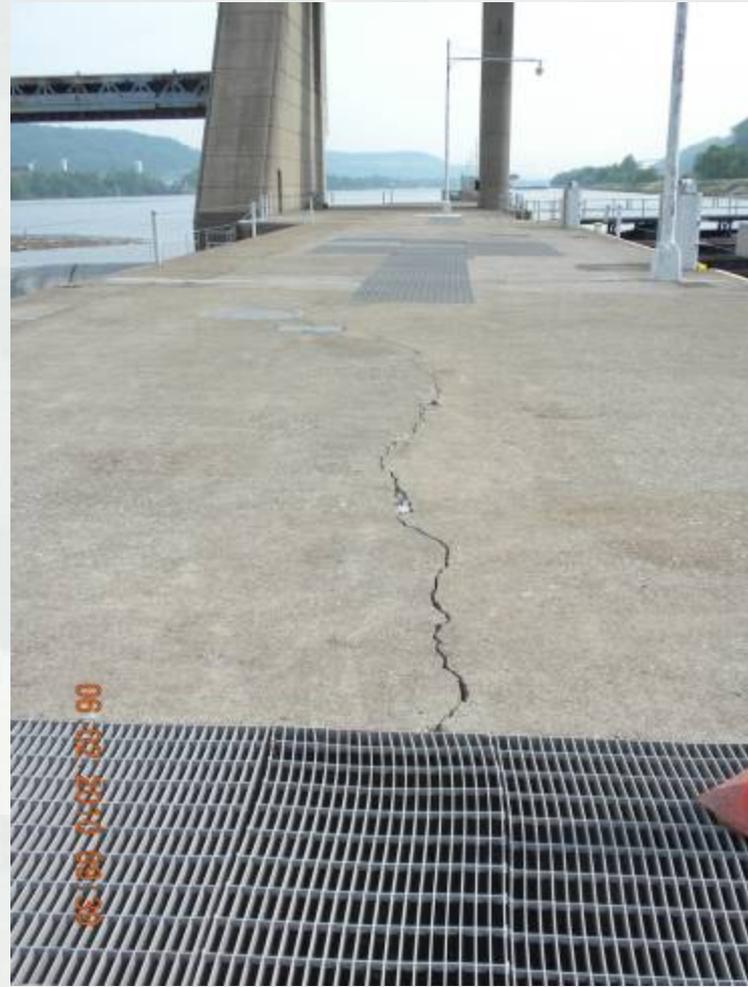


PI10 - M-10 w/  
gravity dam blocks  
(12x50t=600ton)

11.05.2010



# Monolith R-33/34 crack concerns



# Monolith R-33/34 crack concerns



# Monolith R-33/34 crack concerns



PI10 - R33/34 beam saddles prior to grout placement.



# DS poiree dam construction

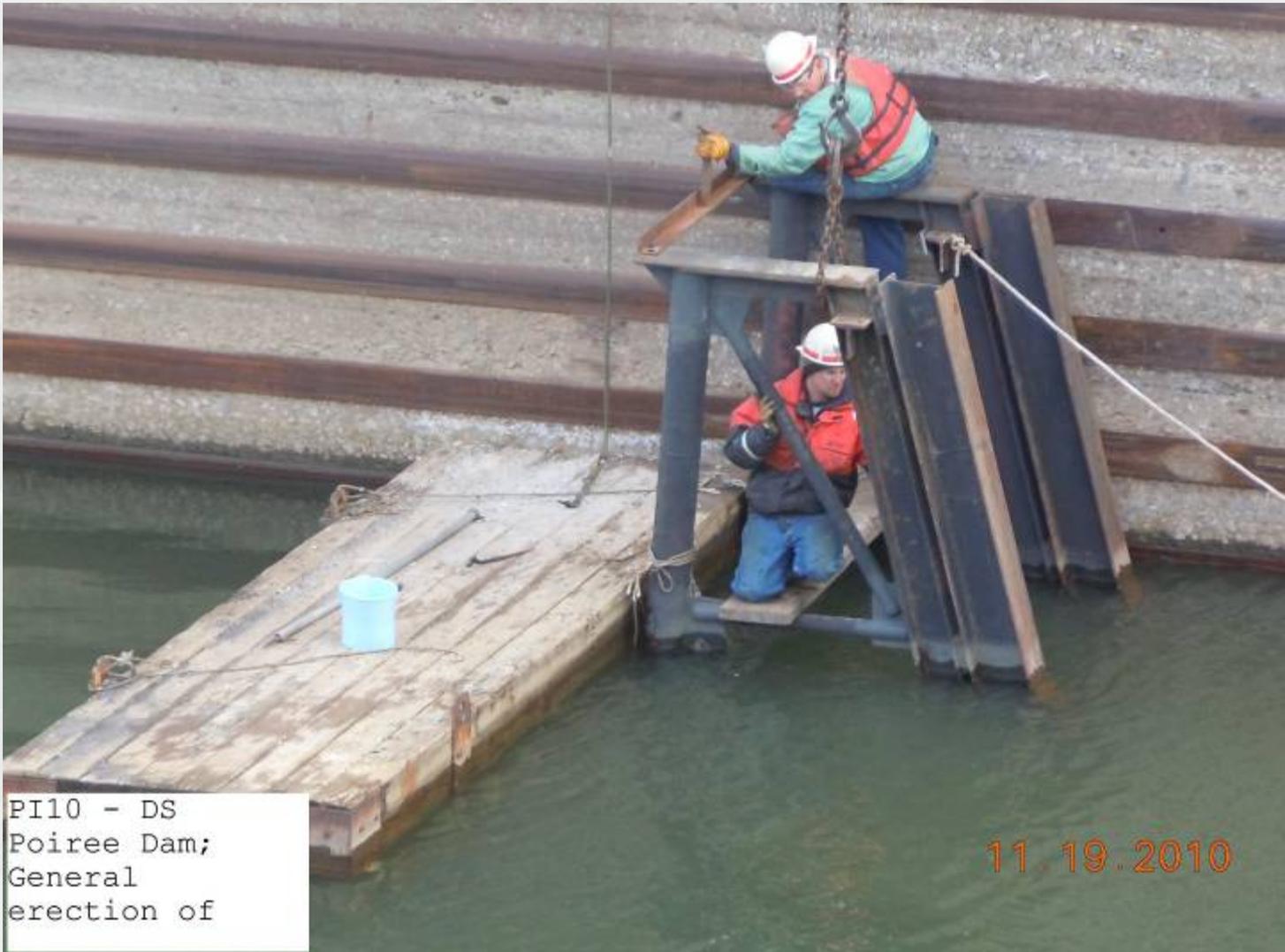
## All DS poiree boxes tested to 48 kips



PI10 - DS Poiree  
Dam; General  
erection of



# DS poiree dam construction



PI10 - DS  
Poiree Dam;  
General  
erection of

11.19.2010



# DS poiree dam – General construction



PI10 - DS  
Poiree Dam;  
General  
erection of



# DS poiree dam – General construction



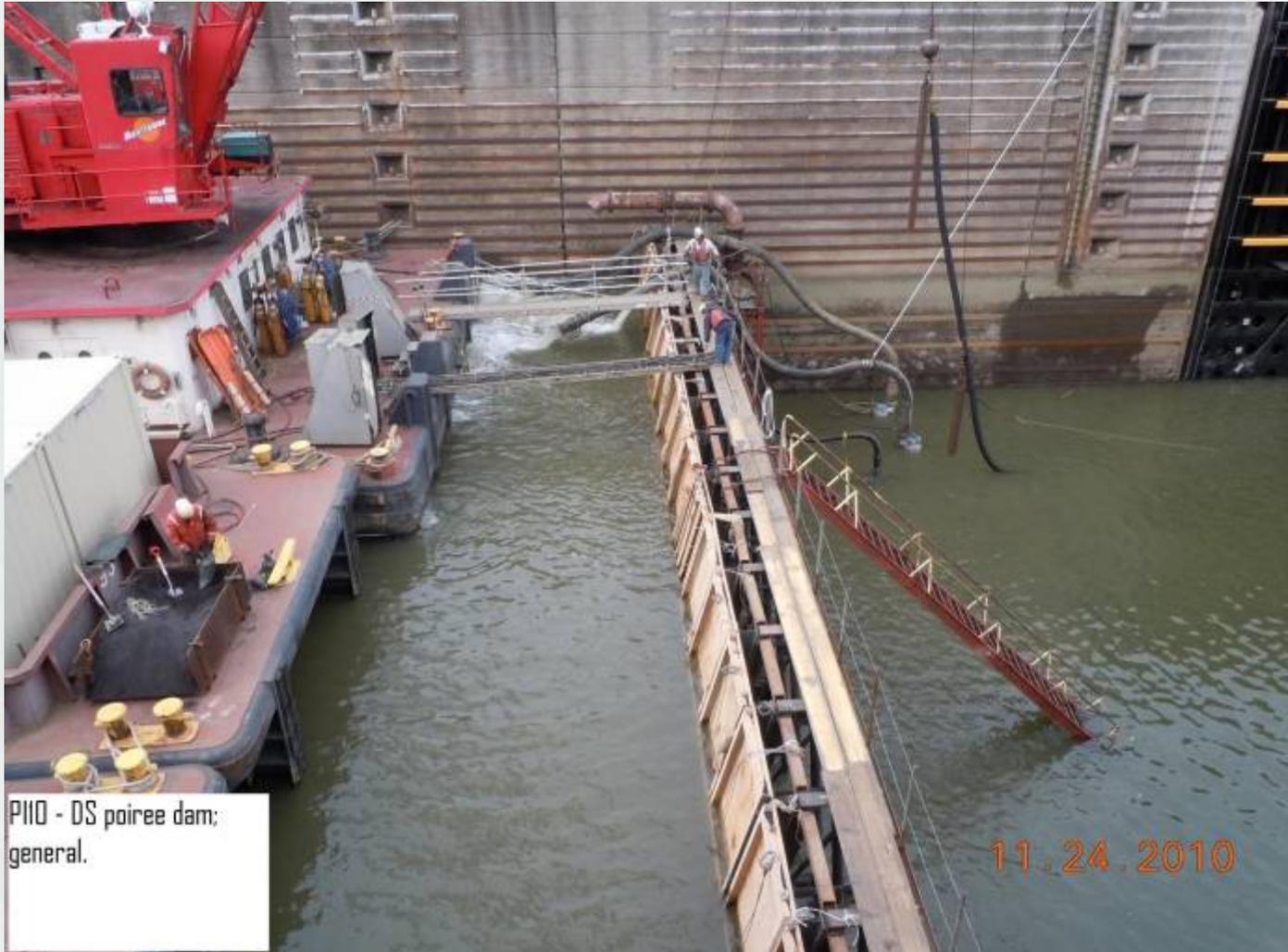
PI10 - DS  
Poiree Dam;  
General  
erection of

11.22.2010



# DS poiree dam construction

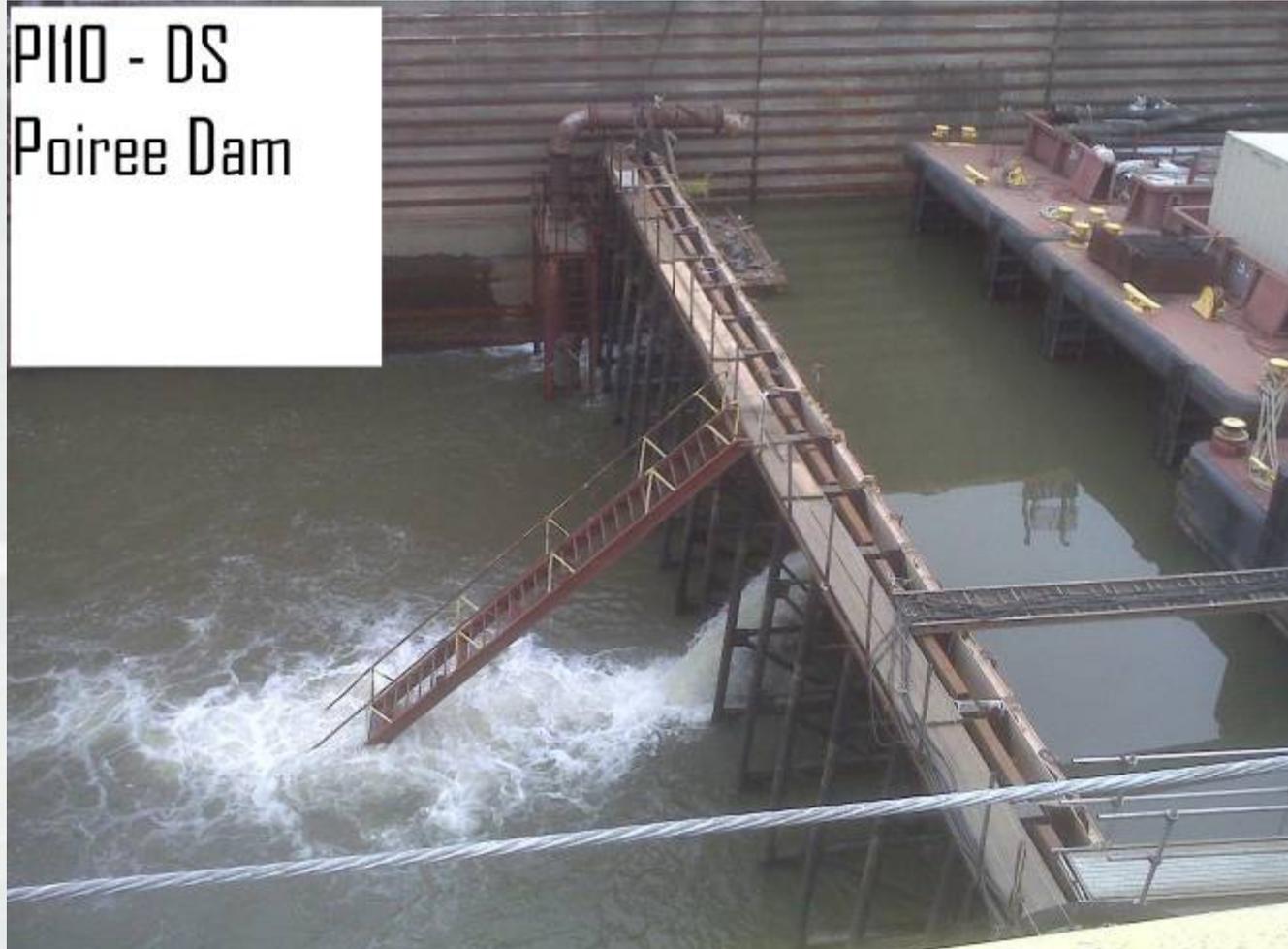
## Dewatering started 23 Nov 2010



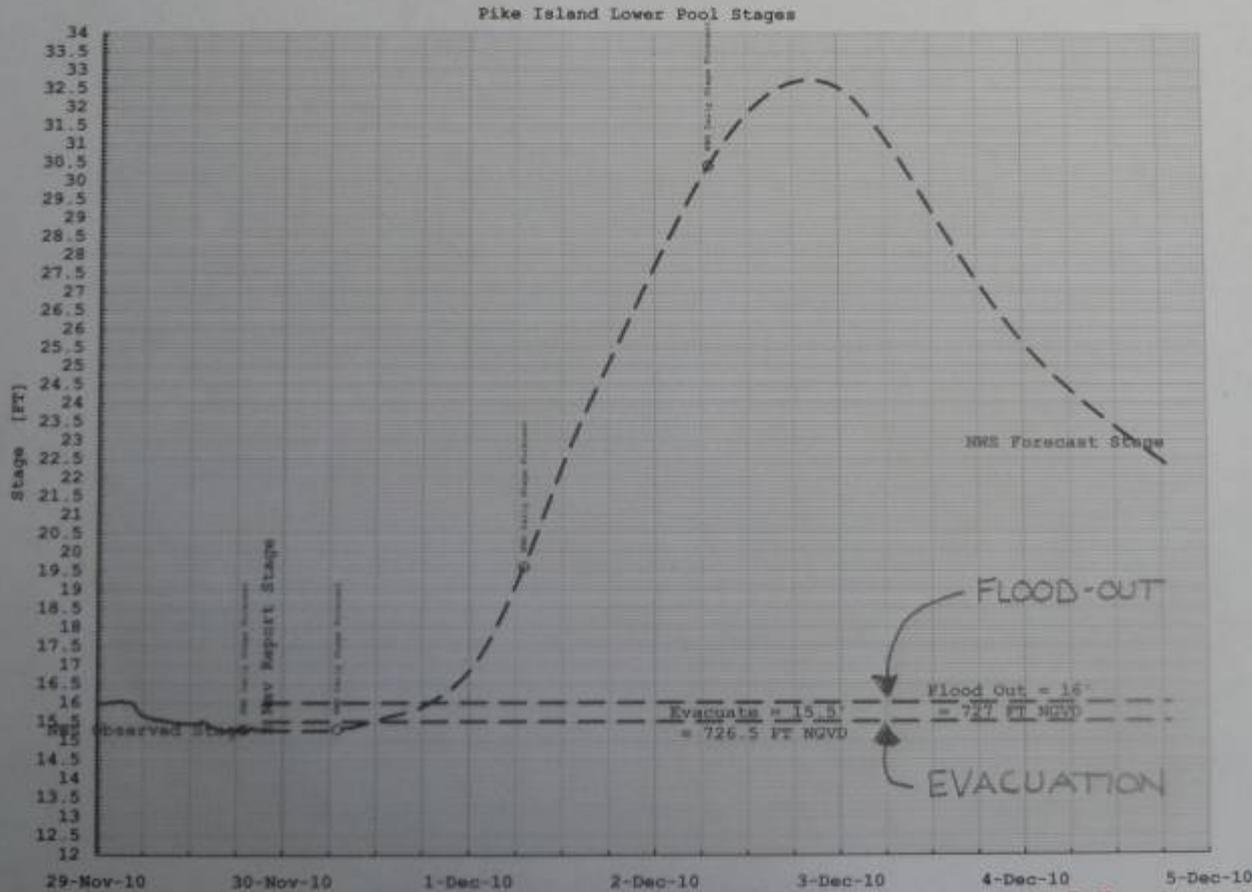
PIIO - DS poiree dam;  
general.



# Flooded Chamber 24 Nov 2010 after updated prediction



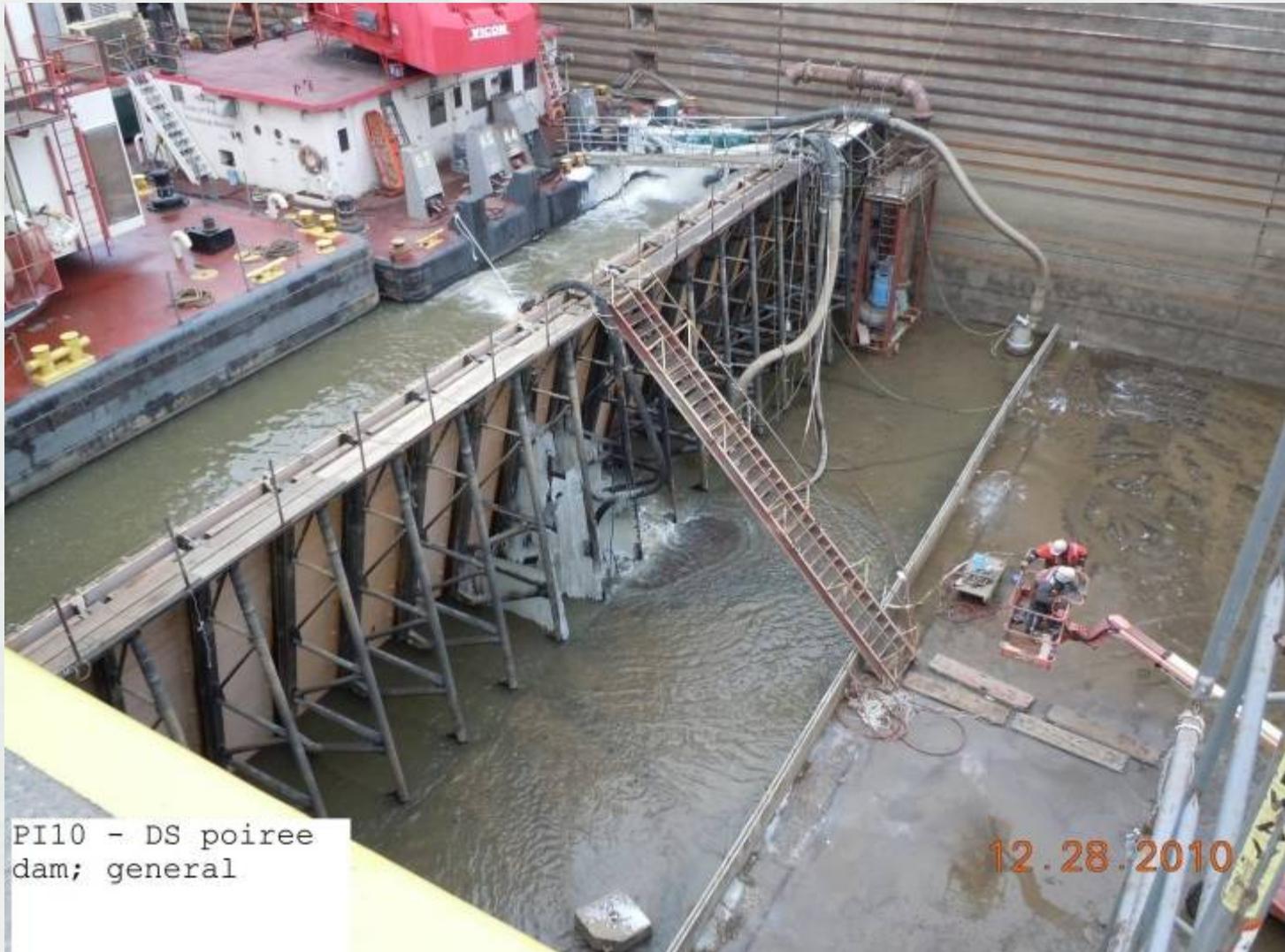
3" RAIN FALL  
12" SNOW MELT



02.01.2011



# DS poiree - General



PI10 - DS poiree  
dam; general

12.28.2010



# Flood-Outs

Flood-Out #1: 24 Nov – 19 Dec 2010  
(26 days lost / 21 work days)

Flood-Out #2: 2 Jan – 7 Jan 2010  
(6 days lost / 6 work days)



# Miter Gate Tensioning (Started 21 – 28 Dec 2010)

1. Start with level gate (leveling performed during installation of each gate).
2. Secure pintle ball – swung gates to insure pintle balls seated correctly; secure with hydraulic jack(s).
3. Follow tensioning procedure.
4. Final result will be a plumb gate.



# Testing of Strain Gages



PIID - Strain gage system  
setup/testing at PEWARS  
w/ EC-NS folks.



11.23.2010





PI10 - Strain gage system  
setup/testing at PEWARS  
w/ EC-NS folks.





PI10 - DSRW gate;  
general  
arrangement of  
strain gages

12.26.2010





PIID - USRW gate;  
stress procedure/setup.  
EC-NS team monitoring  
strain gage equipment.

12.23.2010



# Double Superbolt/tension bar



PI10 - US gates;  
protection of supebolts  
w/ plastic  
cap/cloth/grease (typ).

01.18.2011



# Fabricated box wrench



PI10 - 5" BOX  
WRENCH for  
SUPERBOLT MAIN  
NUT (snug)

11.19.2010



# Plumb Bob - Top



# Plumb Bob – Bottom



PI10 - Tensioning of  
gates; general.

12.26.2010

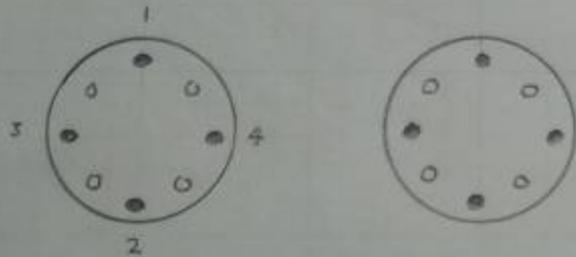


# Tensioning – General Process

1. Gates are “naturally” deflecting in US direction.
2. Tighten Primary TBs to move gate DS beyond the plumb position.
3. Tighten Secondary TBs to move gate back US to plumb position.
4. Tension now exists in all TBs.



STEP 1 - ONCE



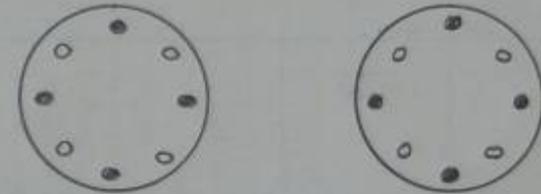
4 J.B. @ 1/2 LOAD, BOTH NUTS ON P1  
THEN P2.

STEP 3 - ONCE



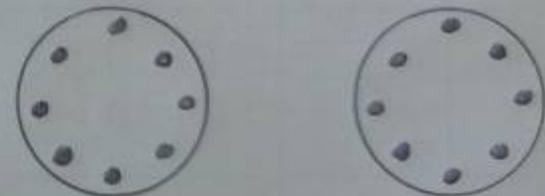
12 OTHER J, B @ FULL LOAD ↻ CW  
ON P1, THEN P2

STEP 2 - ONCE



RETORQUE 4 J, B @ FULL LOAD, ON BOTH  
NUTS ON P1, THEN P2.

STEP 4 - REPEAT (STABILIZE)

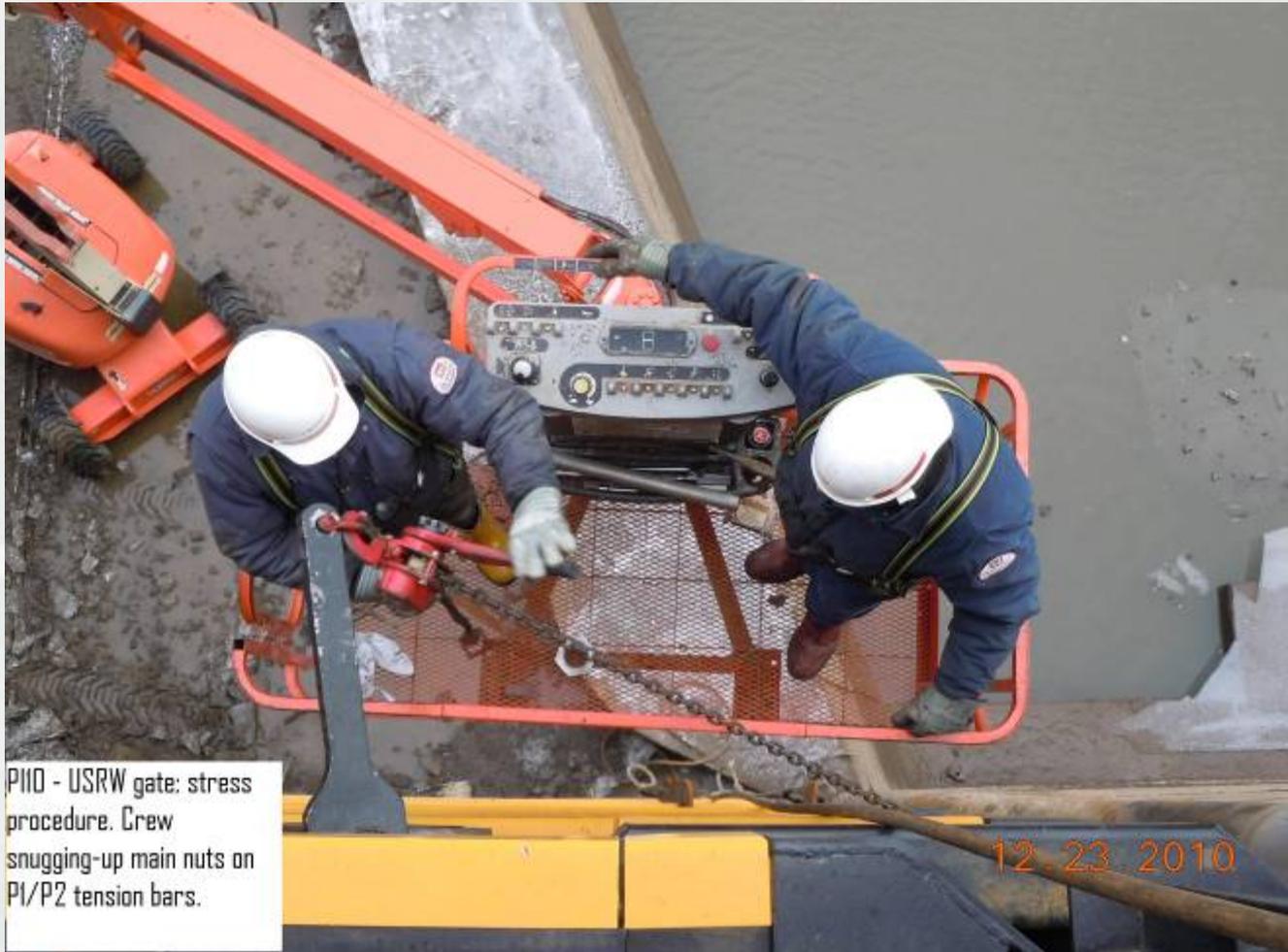


ALL 16 J, B @ FULL LOAD ↻ CW ON P1,  
THEN P2; 2-4 CYCLES TYPICAL

02.01.2011

# Tensioning – USMW Gate (Typ)

<u>Note</u>	<u>JB (ft-lbs)</u>	<u>Stress(ksi)</u>	<u>Stress(ksi)</u>	<u>Deflection</u>
All nuts loose	-	-	-	2-1/4" ( <b>0.75"t</b> )
Snug main nuts P1/P2	-	-	-	1-13/16"
	P37	P 0.5	P 0	1-13/16"
	P100	P 3.1	P 1.3	1-3/8
	P200	P 8.1	P 6.3	0"
Must go beyond plumb	P220 ( <b>75t</b> )	P 11.5	P 10.3	-15/16" ( <b>5.5"t</b> )
	S50	S 2.7	S 4.5	-5/8"
	S75 ( <b>50t</b> )	S 8.3	S 12.8	0"
Theoretical Stress ( <b>27 – 33 ksi; 45 ksi max</b> )	Gage Stress P1 = 13.7ksi, P2 = 13.3ksi <b>LOW</b>	Gage Stress S1 = 8.3ksi S2 = 12.8ksi <b>LOW</b>	JB Stress P = 90ksi S = 41ksi <b>HIGH</b>	



PHO - USRW gate: stress procedure. Crew snugging-up main nuts on PI/P2 tension bars.



# Contact Block Adjustments - QUOINS

## General Process

1. Miter gate(s) individually until quoin blocks aligned; 1/4" rubber seal preset .
2. Secure gate at miter and secure pintle ball.
3. Adjust quoin blocks out.
4. Seal/Heaters/insulation/Preheat/Pour/Post Heat.
5. Epoxy temperature restrictions.



# Contact Blocks (Q) – Typical Setup; establish ¼” preset condition and block alignment



# Contact Blocks (Q) – Typical Setup



# Typical pouring setup



PI10 - USMW quoin  
blocks; typical piping  
/ pouring setup.



# Epoxy Temperature Concerns



PI10 - Conex box setup  
for mixing epoxy; typ



# Contact Block Adjustments - MITER

## General Process

1. Miter the Gates
2. Achieve preset J-bulb seal  $\frac{1}{4}$ " requirement (theoretical); if achievable. Chain-pulls may be required; Secure pintle ball and secure gates w/ plates.
3. Adjust miter blocks out; Seal/Heaters/Insulation/Preheat/Pour/Post Heat.
4. Epoxy temperature restrictions.



# Contact Blocks (M) – Typical Preset 1/4”



PI10 - USRW gate; J-bulb shown  
w/ 1/4" preset. Trimming of  
steel on the gate NOT necessary.

01 08 2011



# Contact Blocks (M) – Secure gates prior to adjustment.



PIID - US gates; mitered position prior to epoxy pour and block adjustments. 5/8" gusset to prevent movement.



# Contact Blocks (M) – Secure gates prior to adjustment.



PHO - US gates; mitered position prior to epoxy pour and block adjustments. 5/8" gusset to prevent movement.

01.10.2011



# Contact Blocks (M) – Block adjustments underway.



PI10 - US gates mitered; contact blocks being adjusted. 2-7/8" gap prior to adjustments.



# Contact Blocks (M) – Typical Setup



# Contact Blocks (M) – Typical Setup



PIID - US gates; mitered position prior to epoxy pour and block adjustments. 6-ton chain pulls to secure gate and to achieve 1/4" preset.

01.10.2011



# Contact Blocks (M) – Typical Setup



PIID - US gates mitered:  
contact blocks being  
adjusted.

01.09.2011



# Contact Blocks (M) – Typical Setup



PIID - US Gates: Picture shows the HITI concrete adhesive that was used as a sealant. Worked great + seals were "tight" (1/32" clearance).

01.13.2011



# Contact Blocks (M) – Typical Setup



PIID - US gates; general setup prior to epoxy pour (miter). Heaters in-place.

01.11.2011



# New Gates

- General field modifications



# New Gates – Rubber J-Bulb Seal upon arrival; quoin



PI10 - US gates  
(new).



# New Gates – Trimming of Rubber J-Bulb Seal; quoin



PIID - DSRW gate; Trimming of rubber J-bulb seal in the quoin area.

01.10.2011





PHO - USRW Gate; Prior to final adjustment of rubber j-bulb seal in quoin area. Note bar stock added to help seal.

01.19.2011



# New Gates – Rubber J-Bulb Seal upon arrival; miter



PI10 - DS Gates; gates secured for final miter block adjustment. Prior to trimming bottom j-bulb and seal plates.



# New Style Miter Seal; J-Bulb



PIID - DSRW gate in mitered position prior to 1/4" preset. Can see steel below J-bulb rubber that needed trimmed (further down gate).



# New Gates – Rubber Seal Modifications (Typ); close to final trimming



PIID - US gates mitered; bottom seal. Plug plates will be installed to help create a better seal in this area.



# New Gates – Rubber Seal Modifications at miter (Typ)



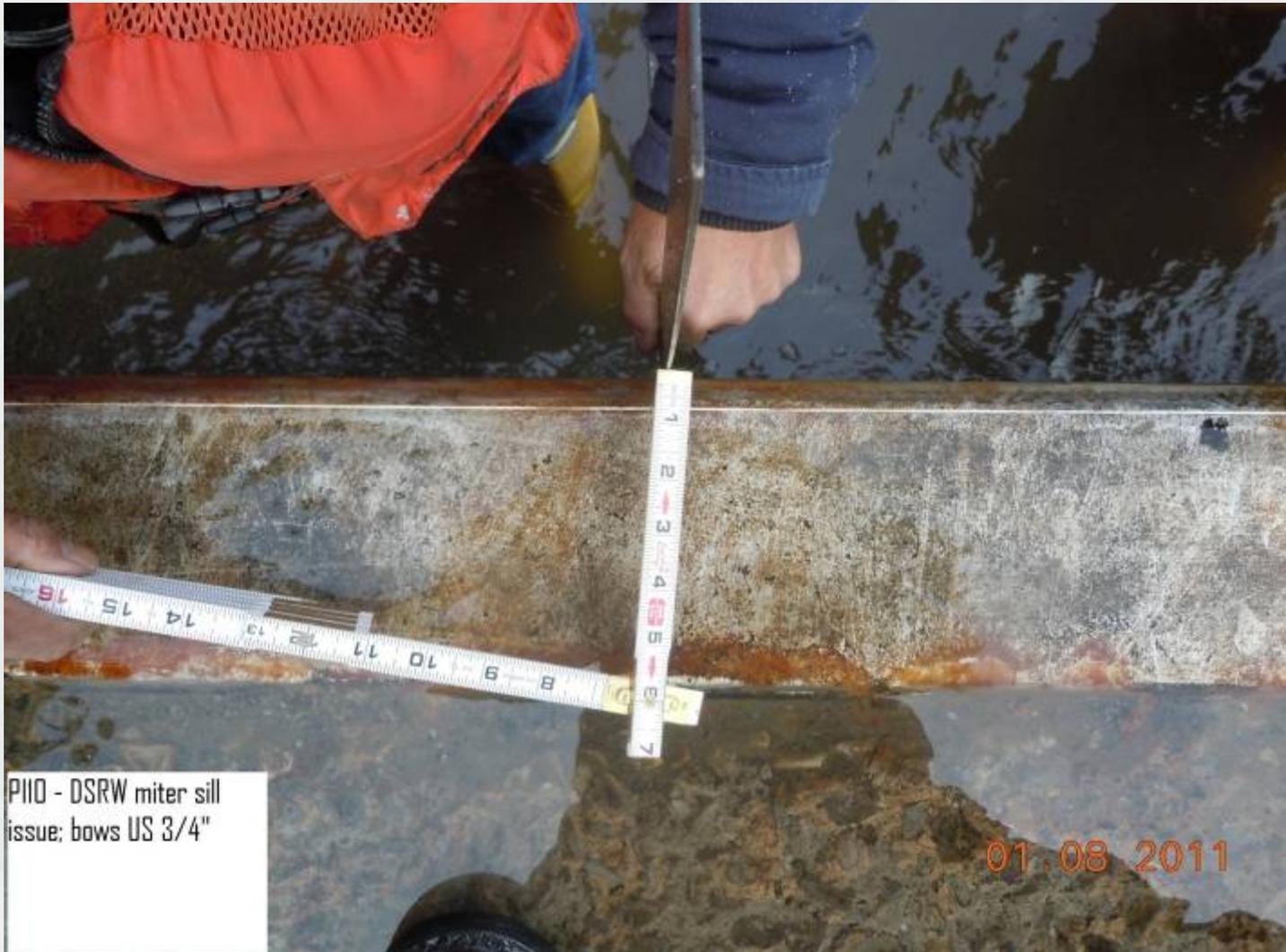
# Bottom J-Bulb protection plate



PI10 - DSRW gate;  
against miter sill;  
this side of sill US  
3/4" +/- in middle



# DSRW Miter Seal – Bowed US 3/4”





PI10 - DSMW gate; rubber j-bulb seal removed to trim gate steel; too close to miter sill in areas.

01.22.2011





PIID - DSRW miter sill issue; bowed US 3/4". Rubber removed in order to trim gate steel below J-bulb seal. Gate steel already trimmed in photo.

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PI10 - General

12.23.2010



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PI10 - General

12 23 2010



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P110 - General: view of both chambers.

01.09.2011





PIID - USRW general setup;  
Note saddles on RW; stability  
issues.



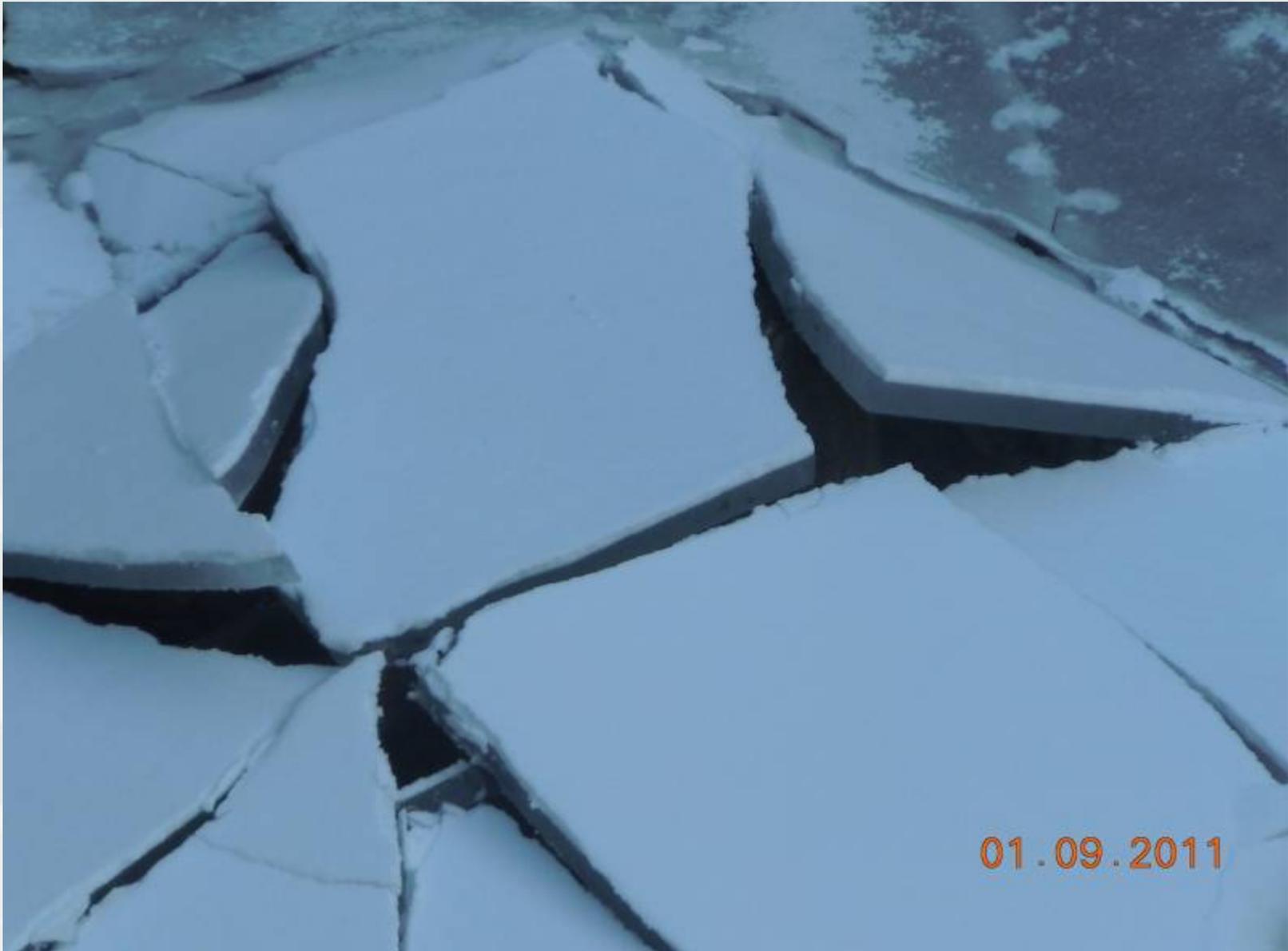


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PIID - US end of chamber; Note gravity blocks on MW and saddles on RW.



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