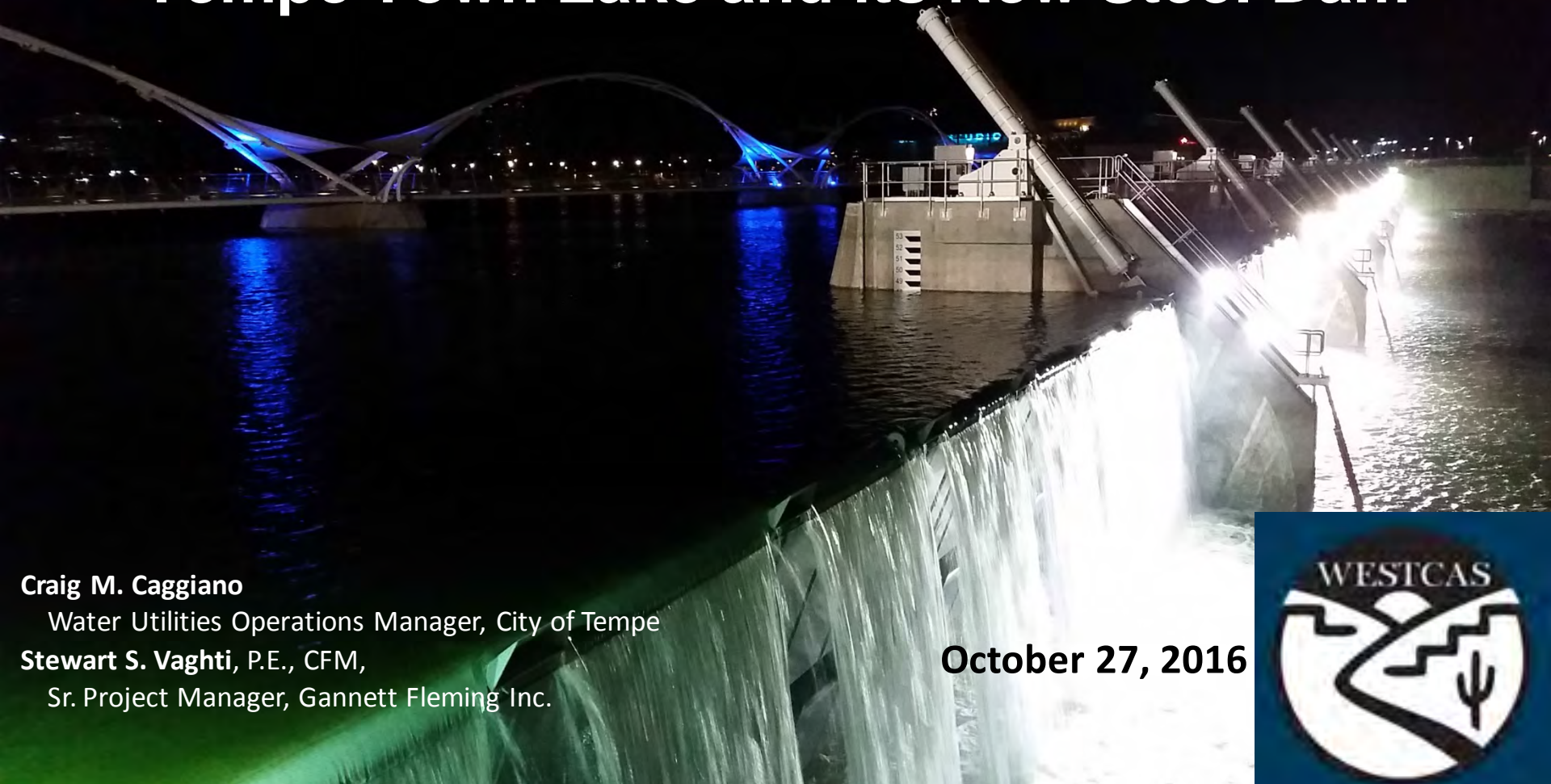




Gannett Fleming



Design, Operating and Maintaining Tempe Town Lake and its New Steel Dam



Craig M. Caggiano

Water Utilities Operations Manager, City of Tempe

Stewart S. Vaghti, P.E., CFM,

Sr. Project Manager, Gannett Fleming Inc.

October 27, 2016





FOX 10 **TRAPPED BEAVER RELEASED**
9-13 7P TAKEN TO A RANCH NEAR CONGRESS

Outline

- Bits of history
- Alternative Evaluation
- Design & Construction
- Operations and Maintenance
- Challenges

Tempe Town Lake: Part of a River System

- 13,000 sqmi watershed





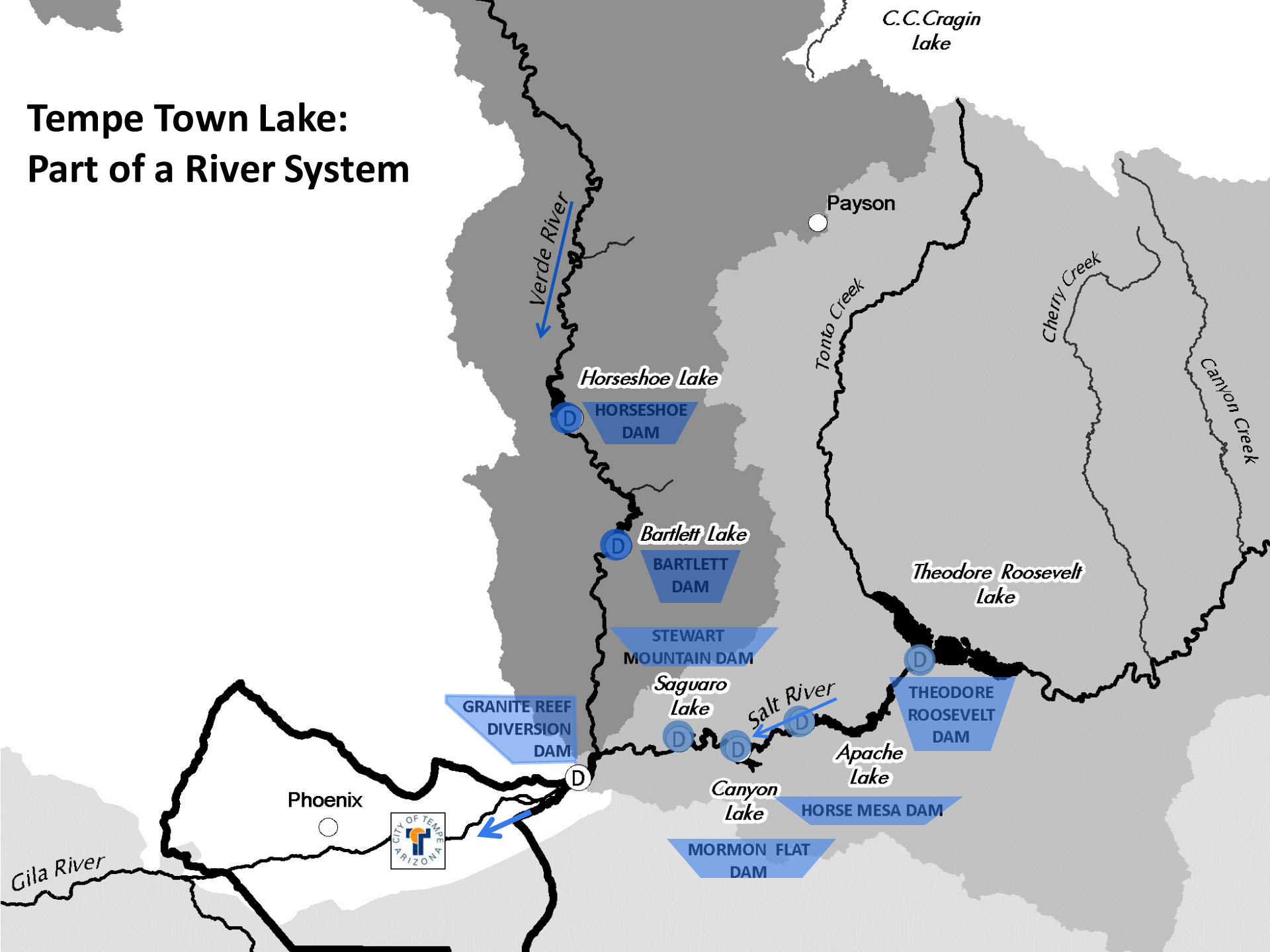
HAER No. AZ-29-2







Tempe Town Lake: Part of a River System





Original Dam

Construction Time: 1997 - 1999



Original Dam

Construction Time: 1997 - 1999



TEMPE TOWN LAKE



Now





26,400 cfs (2/13/05)



Intra Carcass Pressurization (ICP)



■ 9:44 p.m., July 20, 2010

■ 2,600 acre-feet of water

2010/07/21

Fortuitous



Coffer Dam

- Rebuilt in 93 Days (completed Nov 22nd 2010)
- **5 Year Lease** on Rubber Bladders

Dam's Timeline: Most Important Five Years



✓ Rubber Bladder Dam Replaced - Nov 22nd 2010

✓ Alternatives Evaluation – June thru November 2011

✓ Phase 1 Validate Concept & Select Dam Technology – Nov. '11

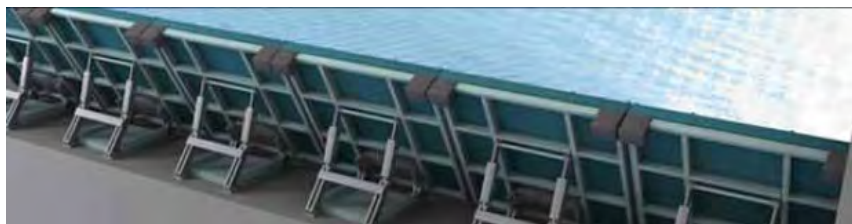
✓ Phase 2 Design/Acquire Permits – mid '14

✓ Procure Construction Contract by end of 2013 early '14

✓ Start Construction by mid 2014

✓ Finish Construction mid 2016

Alternatives Evaluation



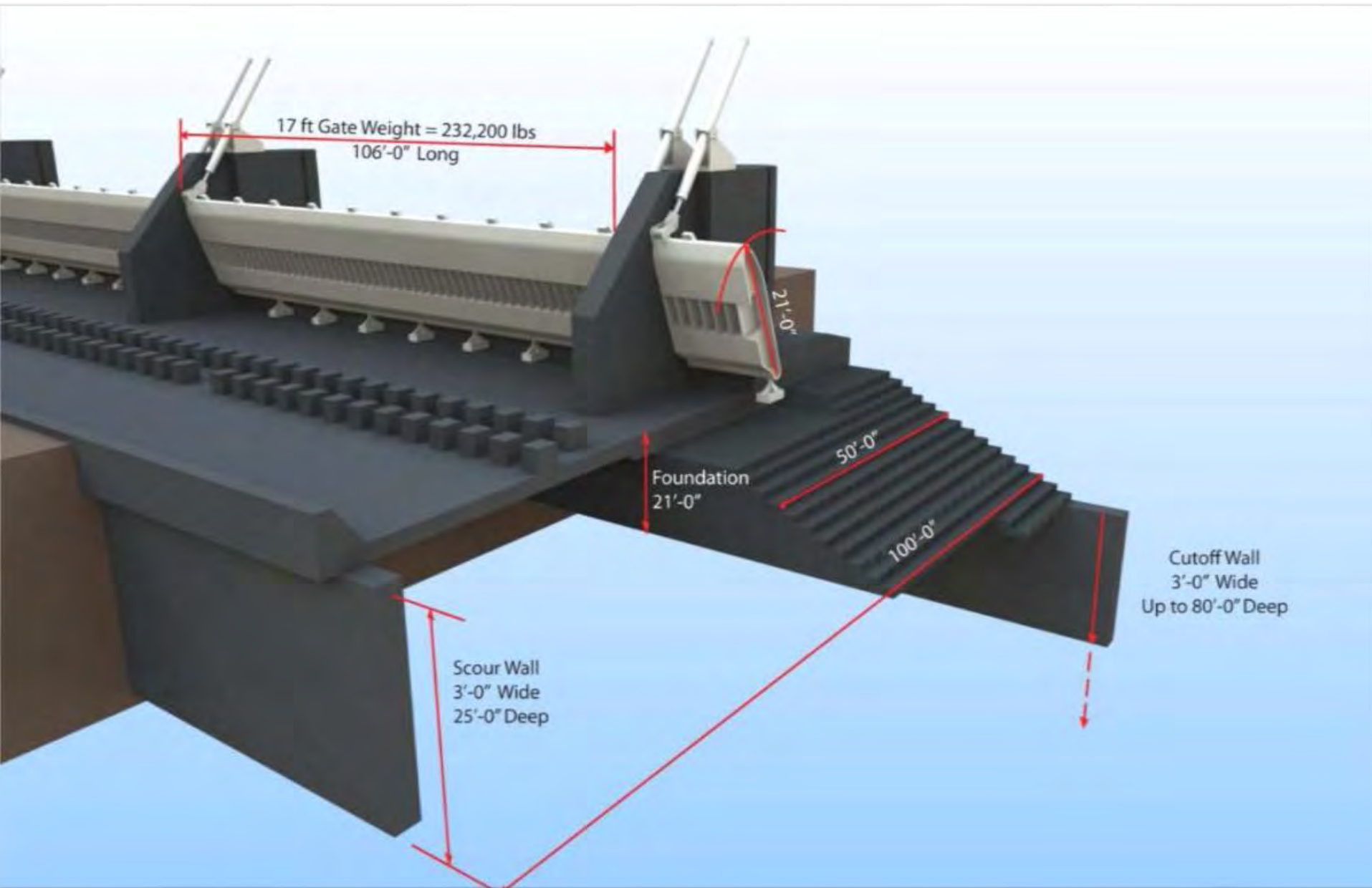
About 20 Dam Options Studied:

- Radial (Tainter) Gates
- Bascule or Bottom-Hinged Leaf Gates
- Inflatable Rubber Dams(water and air-filled)
- Ogee Crest Weirs
- Labyrinth Weirs
- Many Styles of Fuse Plugs
- Several Styles of Pneumatically-Operated Hinged Crest Gates (Obermeyer)
- **Hydraulic Hinged Crest Gates**
- Dyrhoff Rubber Dams (Sumitomo)
- Vertical Lift Gates
- Swing Gates
- Fusegates (Hydroplus)
- Earth Embankment/Fuseplug
- Several Styles of Mixed-type Spans
- Cable-Operated Hinged Crest Gate
- Others

File Name: C:\pwworking\gfpw01\kneone\d0214755\055656-S-TTL-C-07.dwg Scale: 1:1 Plotted By: tkone on Sep 10, 2014 at 11:37am



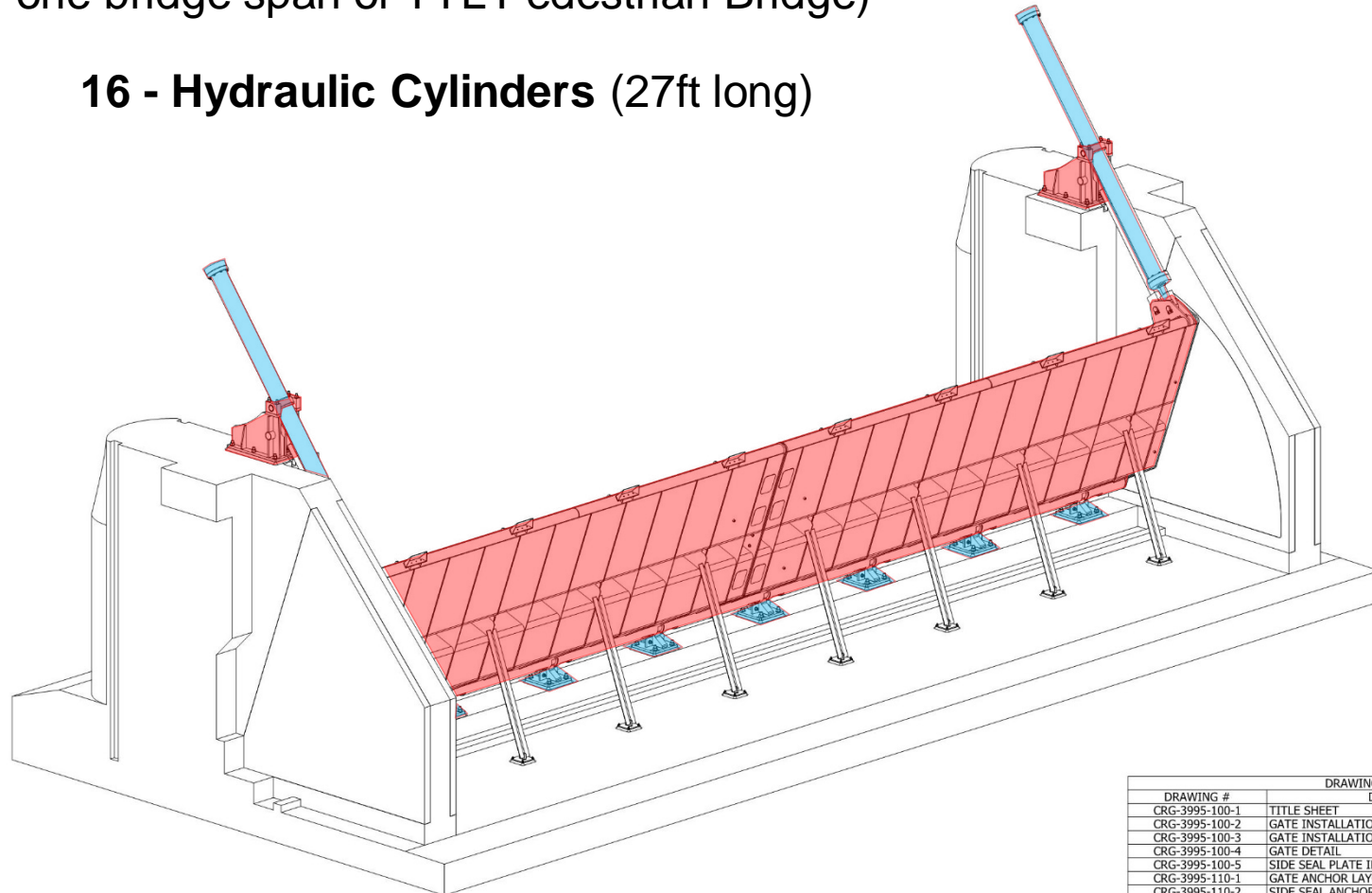
- **Designed to withstand failed scour wall (no passive resistance)**
- **Designed to withstand failed/ineffective cutoff wall along with an ineffective drainage layer (full uplift pressure)**



Gate

8 - 106 ft long Steel Gates
(260,000 lb. each equivalent to the weight of
one bridge span of TTL Pedestrian Bridge)

16 - Hydraulic Cylinders (27ft long)



PART #	QTY
170	4
229	16
409	8
413	4
606	16
607	8
609	8
669	8
674	88
675	88
676	44
677	44
678	88
679	8
684	16
685	24
686	40
687	32
688	32
689	16
690	16
695	16
906	2
998	2
999	2
CRG-3995-200	1
CRG-3995-201	1
CRG-3995-210	1
CRG-3995-211	1
CRG-3995-213	8
CRG-3995-220	4
CRG-3995-305	2
CRG-3995-306	8
CRG-3995-310	1
CRG-3995-311	1

PAINT:

- ALL EXPOSED SURFACES TO BE PAINTED WITH THE REQUIRED ANTI-RUST PAINT

UPSTREAM PANEL:

- PRIME COAT
- SECOND COAT
- FINISH COAT
- FINISH COAT

DOWNSTREAM PANEL:

- PRIME COAT
- SECOND COAT
- FINISH COAT

DRAWING INDEX		
DRAWING #	DESCRIPTION	REVISION
CRG-3995-100-1	TITLE SHEET	0
CRG-3995-100-2	GATE INSTALLATION	0
CRG-3995-100-3	GATE INSTALLATION	0
CRG-3995-100-4	GATE DETAIL	0
CRG-3995-100-5	SIDE SEAL PLATE INSTALLATION	0
CRG-3995-110-1	GATE ANCHOR LAYOUT	0
CRG-3995-110-2	SIDE SEAL ANCHOR LAYOUT	0

DESIGN PARAMETERS:

- CLEAR WATER WAY WIDTH: 106.0'
- GATE HEIGHT: 17'





**Construction
Start May 2014**



SOUTHWEST WATER CRISIS

A wet winter may be on the way,
and it could provide a big boost
to Arizona's parched water supply

El Niño to the rescue?



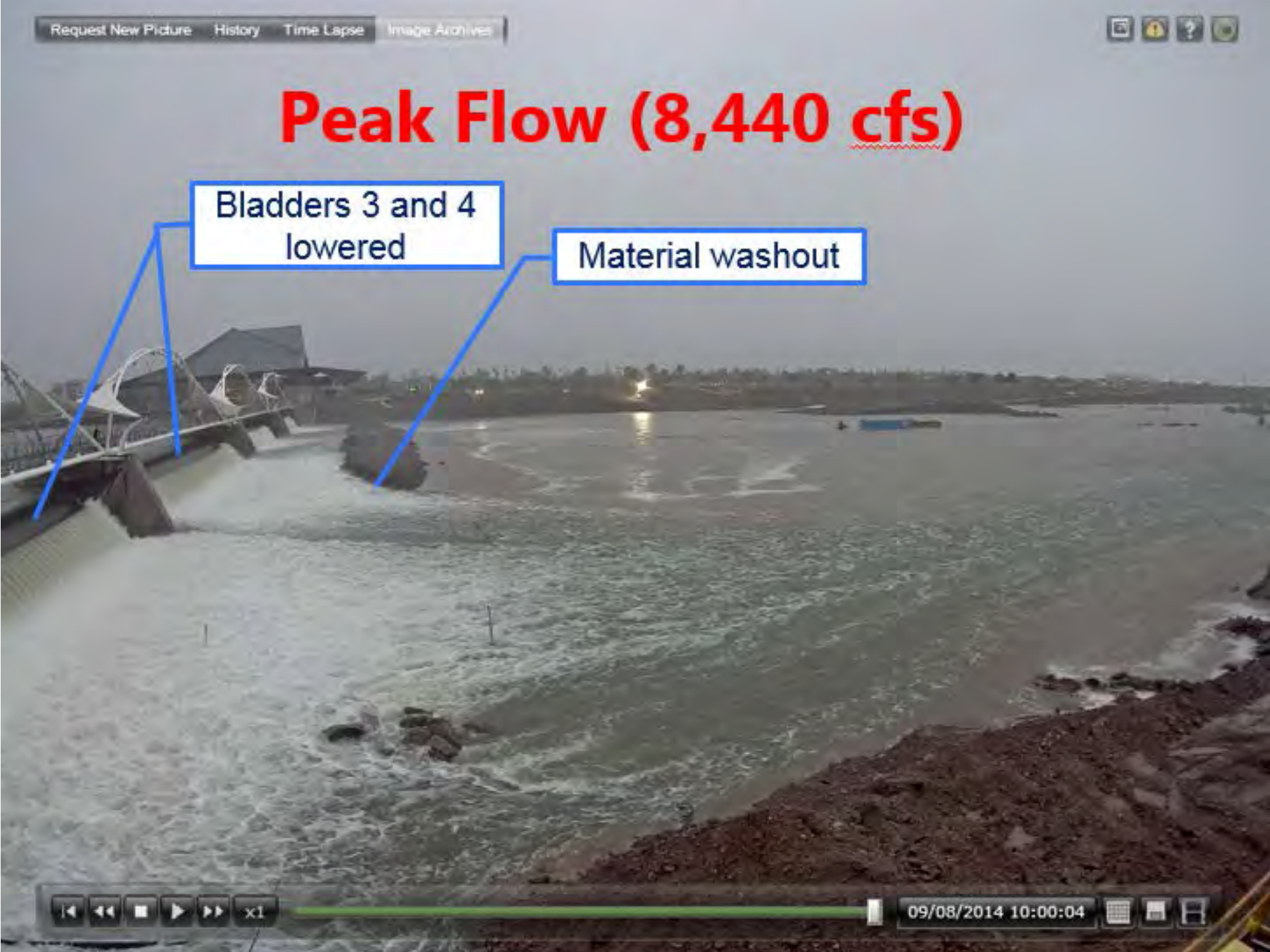


Rebar cages

Peak Flow (8,440 cfs)

Bladders 3 and 4
lowered

Material washout













STEEL WORKS

80004
200000
1000000
1000000
1000000

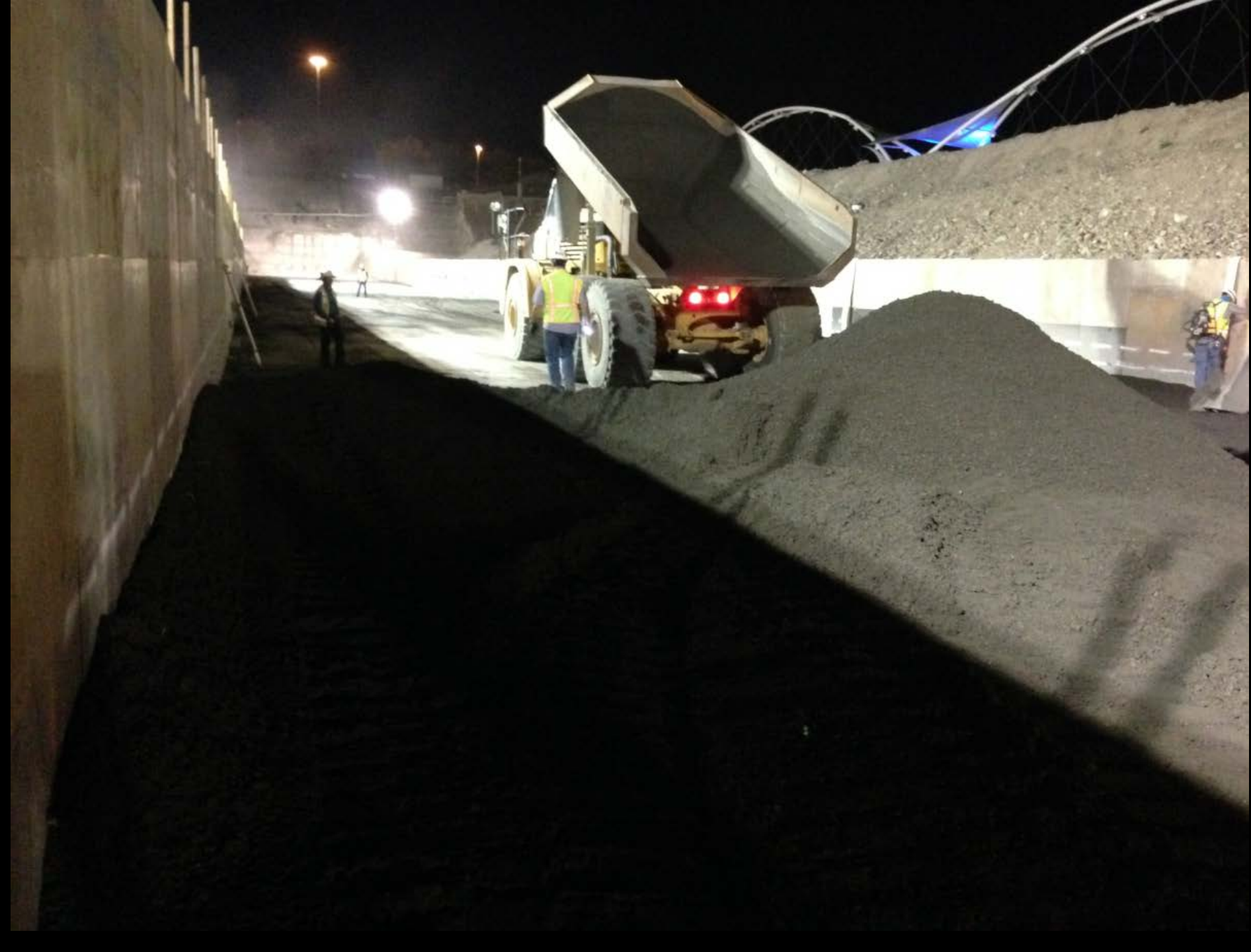
26P

7/1/00















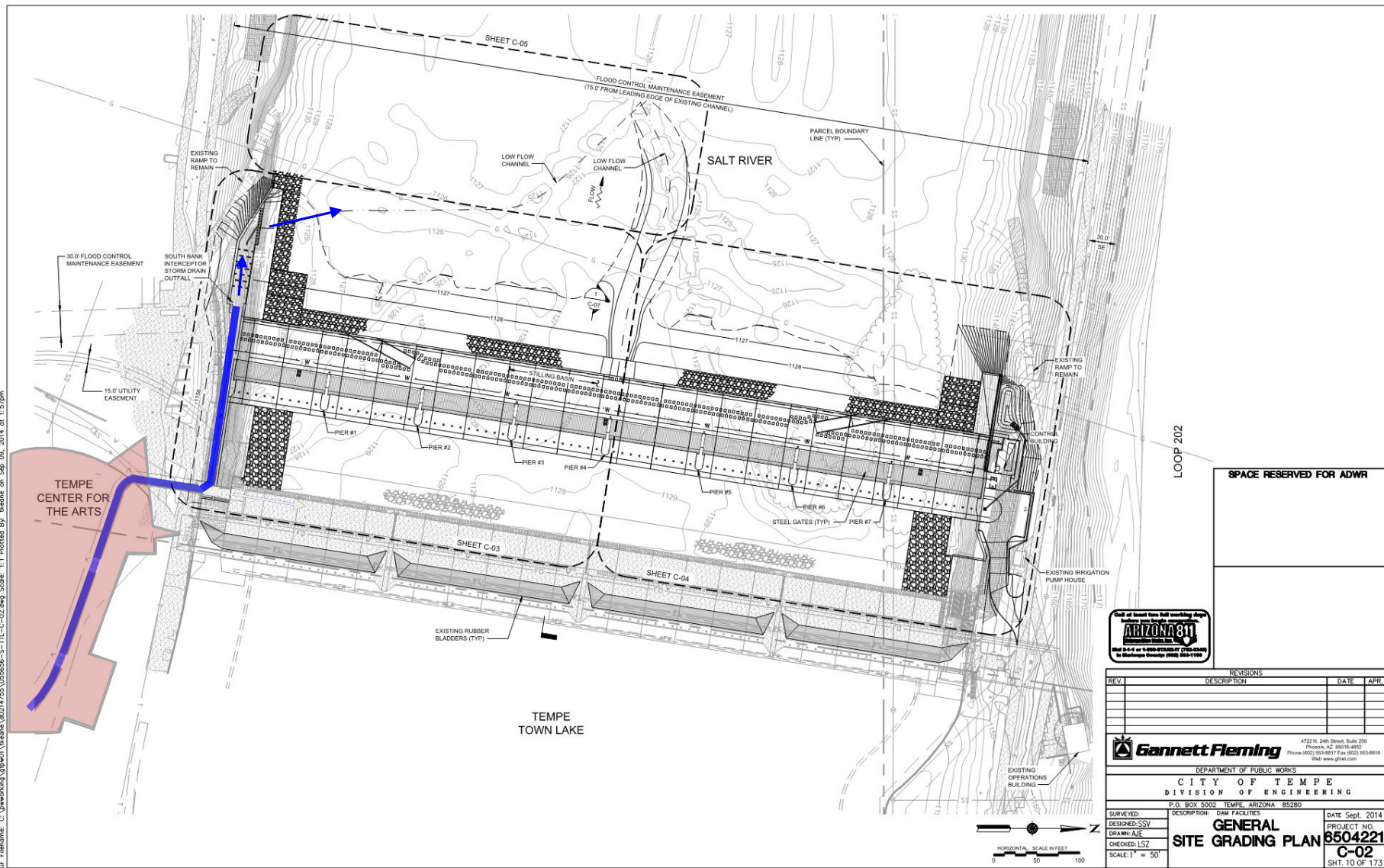








South Bank Interceptor



FINAL - FOR PERMIT APPROVAL









WARNING

EAR PROTECTION
REQUIRED WHILE
EQUIPMENT
IS OPERATING

DANGER

THIS EQUIPMENT
STARTS AUTOMATICALLY

PELIGRO

ESTE EQUIPO ARRANCA
AUTOMATICAMENTE

DANGER

CAUTION: EQUIPMENT
MAY START
WITHOUT WARNING

CAUTION

HIGH PRESSURE
PIPELINE













1/8/2016 9:30:25 AM EST



Coffer Dam

Coffer Dam





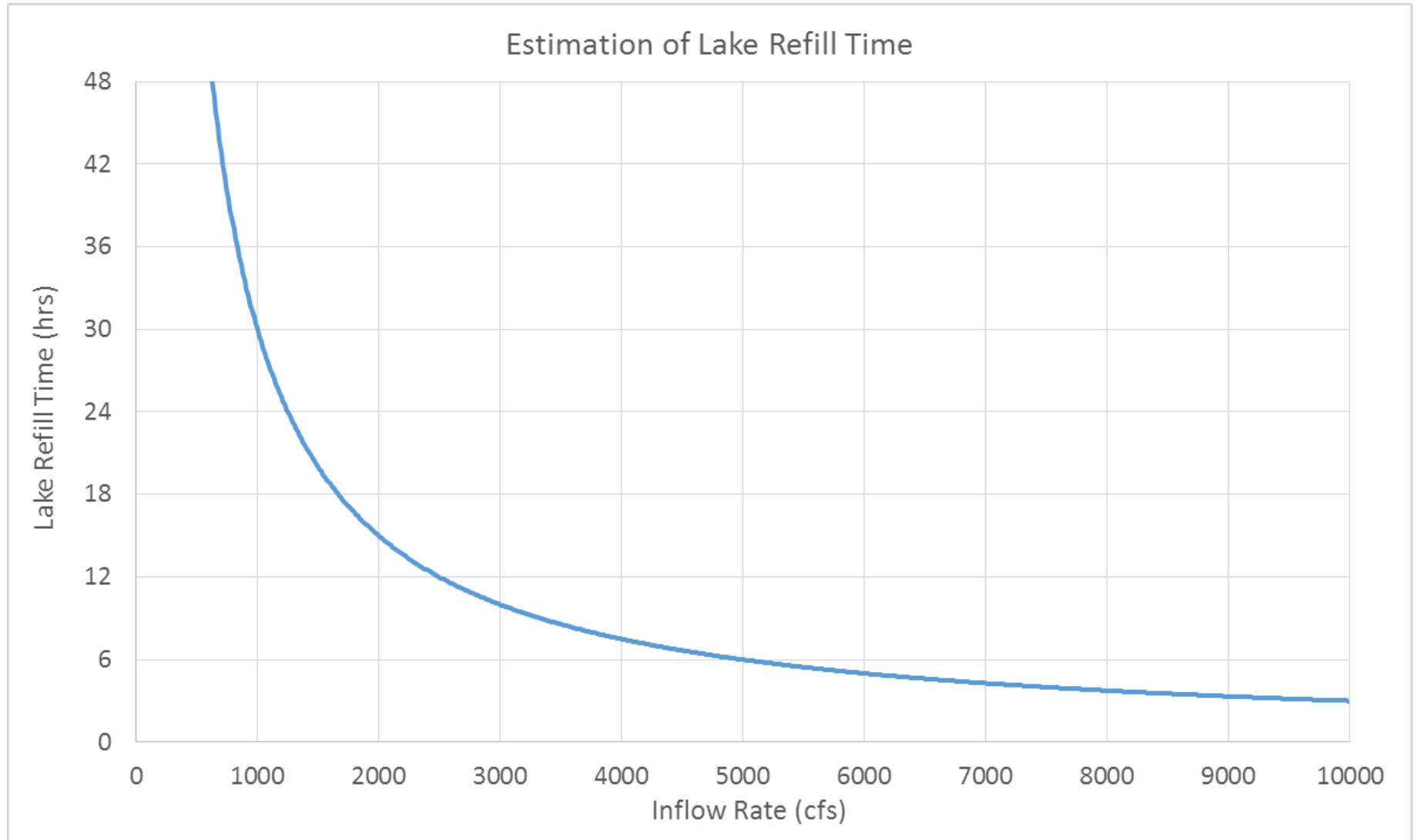
May 6, 2016
Lake Open to the Public



Inflows



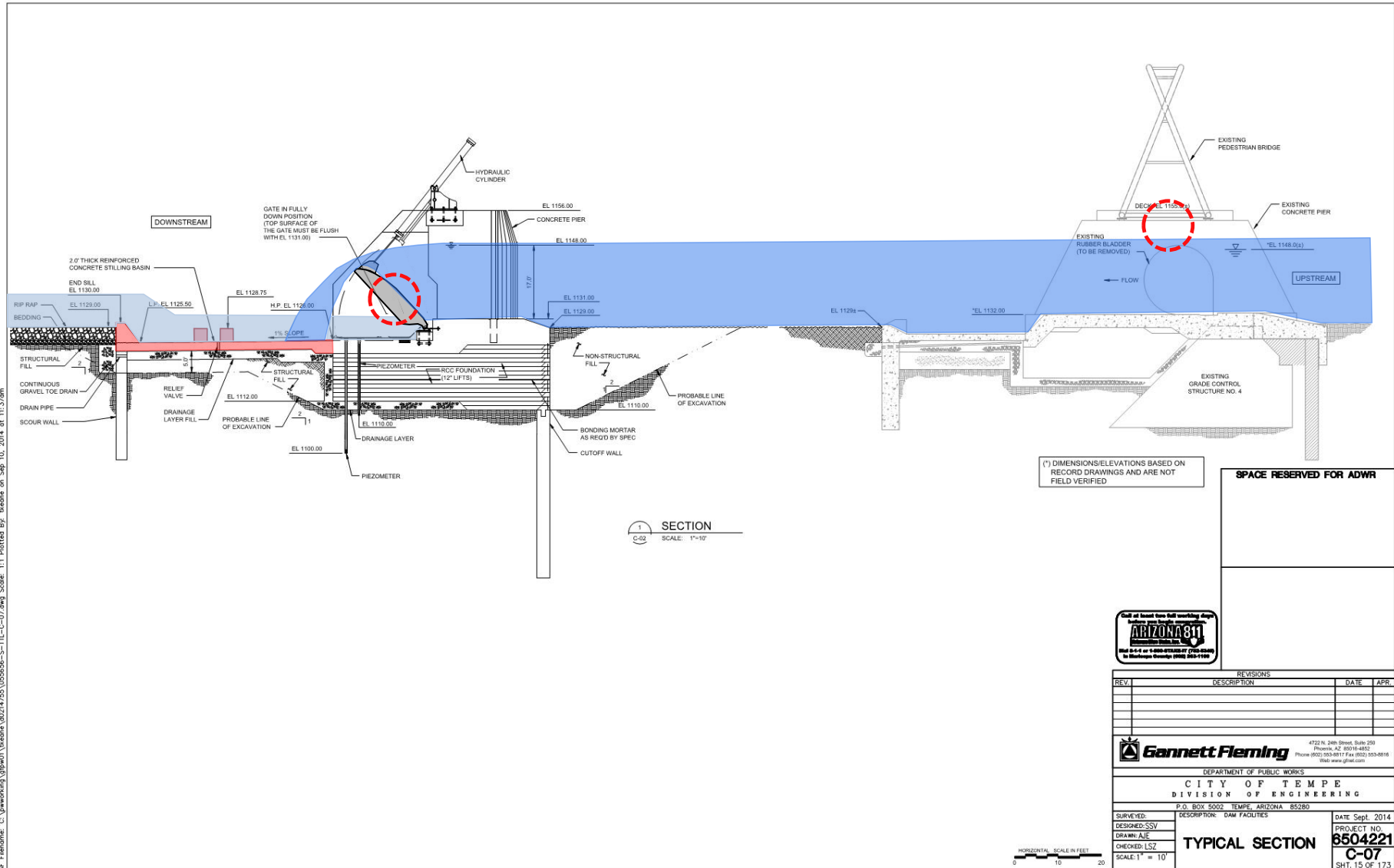
Lake Refill



Maintaining Lake Level



Maintaining Lake Level



(*) DIMENSIONS/ELEVATIONS BASED ON RECORD DRAWINGS AND ARE NOT FIELD VERIFIED

SPACE RESERVED FOR ADWR



REVISIONS		
REV.	DESCRIPTION	DATE

4722 N. 24th Street, Suite 250
Phoenix, AZ 85016-4802
Phone (602) 953-4811 Fax (602) 953-8816
Web: www.gfinc.com

DEPARTMENT OF PUBLIC WORKS
CITY OF TEMPE
DIVISION OF ENGINEERING

P.O. BOX 5002 TEMPE, ARIZONA 85280

SURVEYED: SSV	DESCRIPTION: DAM FACILITIES	DATE: Sept. 2014
DRAWN: AJE		PROJECT NO: 8504221
CHECKED: LS2		C-07
SCALE: 1" = 10'		SHT. 15 OF 173

TYPICAL SECTION

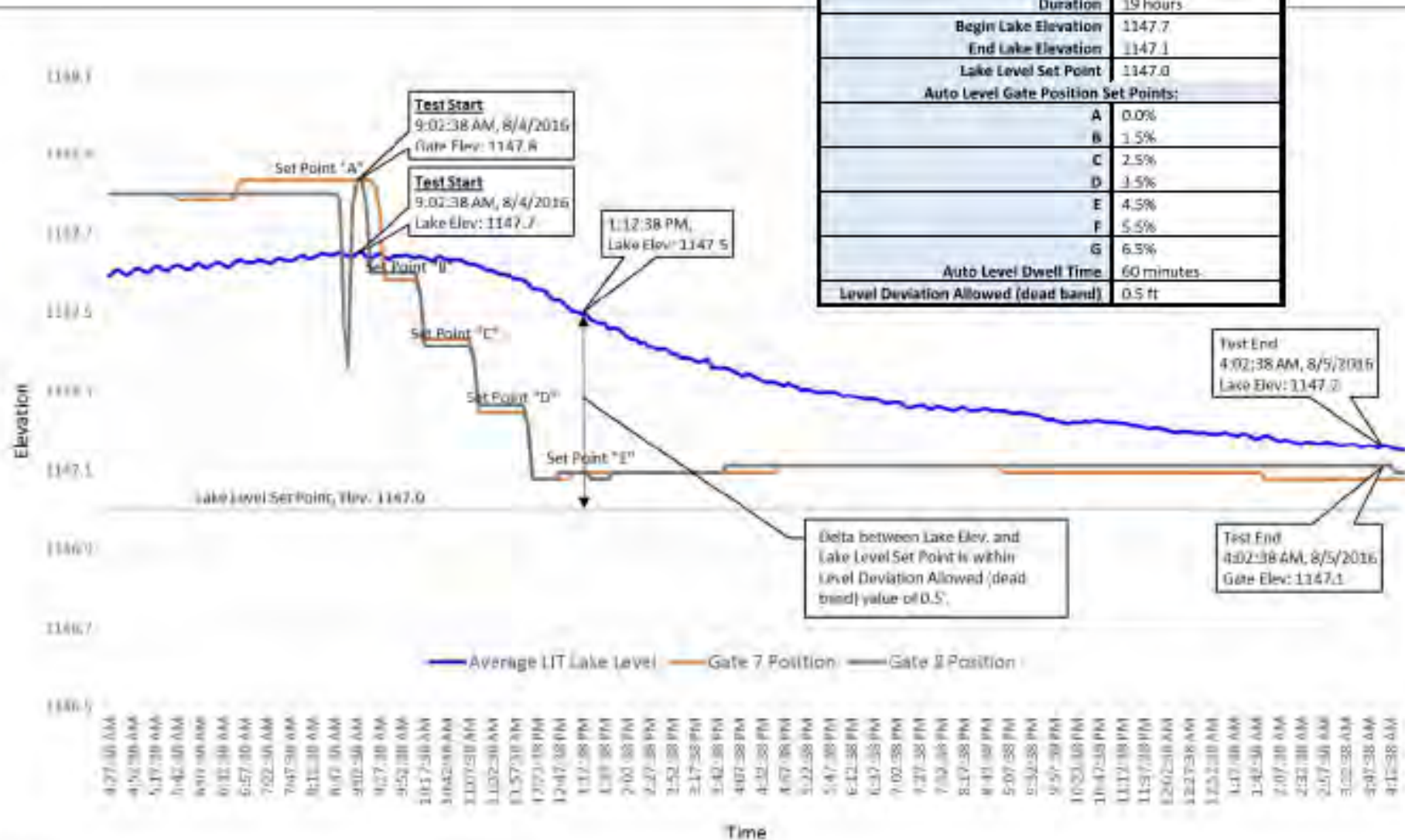
FINAL - FOR PERMIT APPROVAL

GF: F:\tempe\c:\working\gfl\tempe\021725\05656-6-TL-C-07.dwg Scale: 1:1 Plotted By: kstone on Sep 10, 2014 at 11:37am

Maintaining Lake Level

Recorded data for Wet Test No. 4b (8/4/2016 and 8/5/2016):

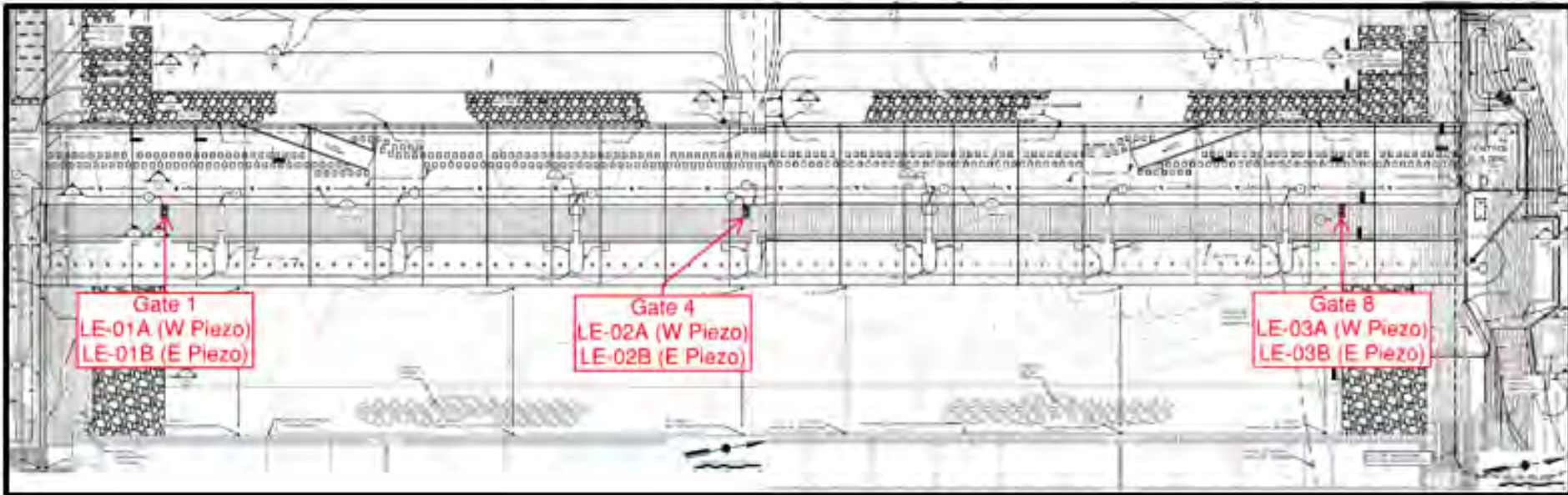
Begin Time	9:00am (8/4/2016)
End Time	4:00am (8/5/2016)
Duration	19 hours
Begin Lake Elevation	1147.7
End Lake Elevation	1147.1
Lake Level Set Point	1147.0
Auto Level Gate Position Set Points:	
A	0.0%
B	1.5%
C	2.5%
D	3.5%
E	4.5%
F	5.5%
G	6.5%
Auto Level Dwell Time	60 minutes
Level Deviation Allowed (dead band)	0.5 ft



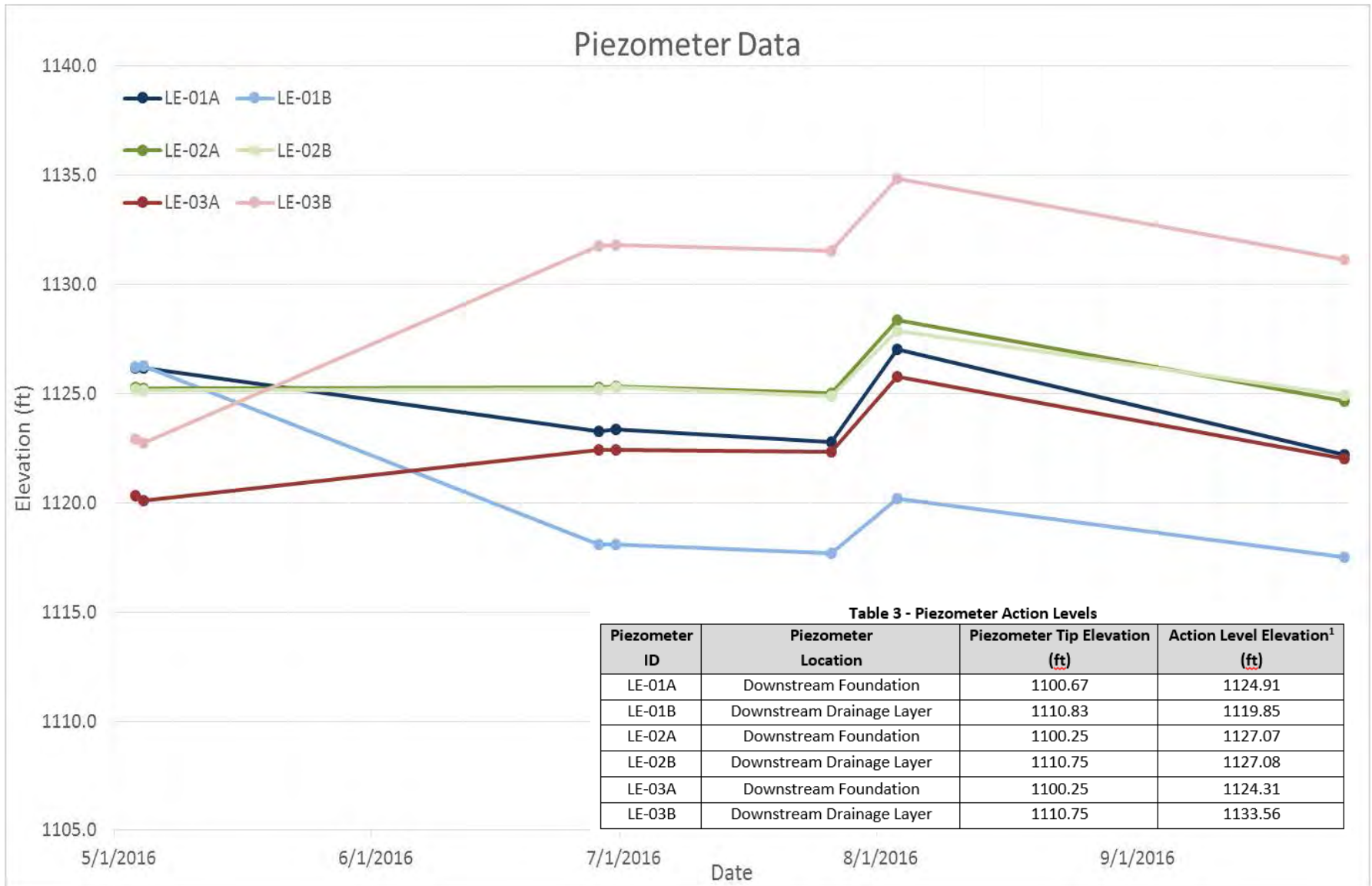


Foundation Monitoring

Figure 2 – Piezometer Location Map



Foundation Monitoring



Structure Monitoring

Figure 4 – Survey Monitoring Point Map

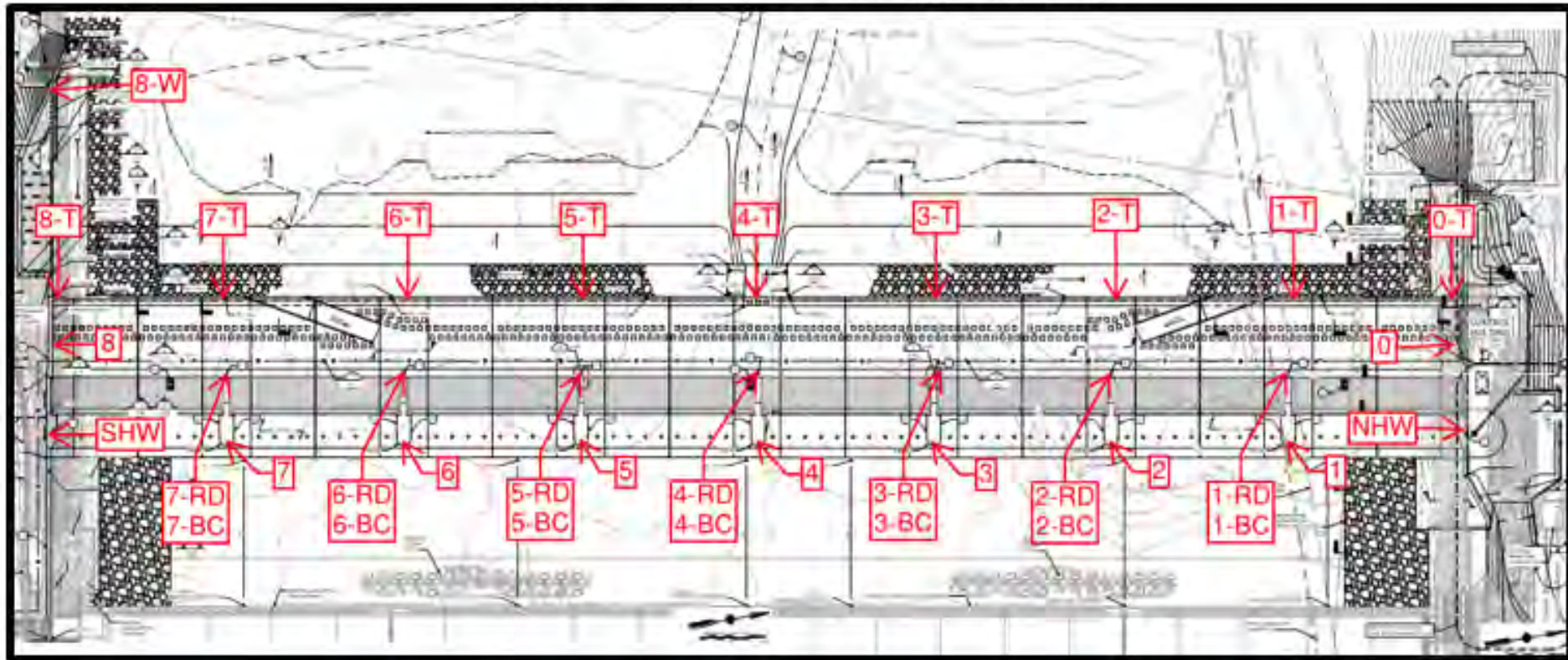
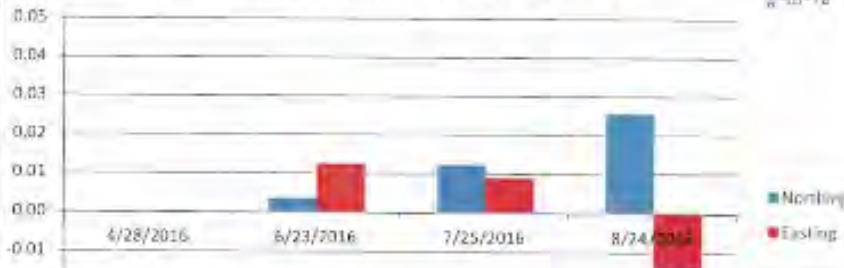


Table 4 - Survey Monument Threshold and Action Levels

Monument	Threshold Limit for Vertical or Horizontal Deformation (ft)	Action Level for Vertical or Horizontal Deformation (ft)
Caps/Disks	+/- 0.02	+/- 0.05
Prism	+/- 0.03	+/- 0.05



8/24/2016								
DESCRIPTION	ESTABLISHED	POINT #	NORTHING	EASTING	NORTHING	EASTING	DIFF N	DIFF E
BAS-ELINE		8005	2414.921	1741.097	2414.921	1741.097	0.000	0.000
BAS-ELINE	4/25/2016	8006N	1651.939	2280.332	1651.939	2280.332	0.000	0.000
CONTROL	4/26/2016	8002W	915.106	737.398	915.115	737.528	-0.009	0.020
CONTROL	2012	8003E	1796.718	532.923	1796.741	532.913	0.023	0.010
PIER	4/26/2016	1	1630.227	448.037	1630.257	448.034	0.029	0.003
PIER	4/26/2016	2	1527.702	487.710	1527.728	487.695	-0.025	0.015
PIER	4/26/2016	3	1425.086	527.326	1425.112	527.322	-0.026	0.004
PIER	4/26/2016	4	1322.524	567.086	1322.554	567.078	-0.030	0.009
PIER	4/26/2016	5	1220.005	606.683	1220.021	606.666	-0.017	0.016
PIER	4/26/2016	6	1117.372	646.352	1117.390	646.383	-0.013	0.029
PIER	4/26/2016	7	1014.794	686.108	1014.818	686.094	-0.024	0.014



Date of Survey	Area	Area	Area
Survey description	Baseline	Elevation	Distance
Point #			
BENCHMARK	SW	1120.253	
FRANK GAP	1.80	1120.253	-0.000
GRASS GAP	2.80	1120.253	-0.000
GRASS GAP	3.80	1120.253	-0.000
GRASS GAP	4.80	1120.253	-0.000
FRANK GAP	5.80	1120.253	-0.000
GRASS GAP	6.80	1120.253	-0.000
GRASS GAP	7.80	1120.253	-0.000
RAISED DISC	8.80	1120.253	-0.000
RAISED DISC	9.80	1120.253	-0.000
RAISED DISC	10.80	1120.253	-0.000
RAISED DISC	11.80	1120.253	-0.000
RAISED DISC	12.80	1120.253	-0.000
RAISED DISC	13.80	1120.253	-0.000
RAISED DISC	14.80	1120.253	-0.000
RAISED DISC	15.80	1120.253	-0.000
RAISED DISC	16.80	1120.253	-0.000
RAISED DISC	17.80	1120.253	-0.000
RAISED DISC	18.80	1120.253	-0.000
RAISED DISC	19.80	1120.253	-0.000
RAISED DISC	20.80	1120.253	-0.000
RAISED DISC	21.80	1120.253	-0.000
RAISED DISC	22.80	1120.253	-0.000
RAISED DISC	23.80	1120.253	-0.000
RAISED DISC	24.80	1120.253	-0.000
RAISED DISC	25.80	1120.253	-0.000
RAISED DISC	26.80	1120.253	-0.000
RAISED DISC	27.80	1120.253	-0.000
RAISED DISC	28.80	1120.253	-0.000
RAISED DISC	29.80	1120.253	-0.000
RAISED DISC	30.80	1120.253	-0.000
RAISED DISC	31.80	1120.253	-0.000
RAISED DISC	32.80	1120.253	-0.000
RAISED DISC	33.80	1120.253	-0.000
RAISED DISC	34.80	1120.253	-0.000
RAISED DISC	35.80	1120.253	-0.000
RAISED DISC	36.80	1120.253	-0.000
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RAISED DISC	39.80	1120.253	-0.000
RAISED DISC	40.80	1120.253	-0.000
RAISED DISC	41.80	1120.253	-0.000
RAISED DISC	42.80	1120.253	-0.000
RAISED DISC	43.80	1120.253	-0.000
RAISED DISC	44.80	1120.253	-0.000
RAISED DISC	45.80	1120.253	-0.000
RAISED DISC	46.80	1120.253	-0.000
RAISED DISC	47.80	1120.253	-0.000
RAISED DISC	48.80	1120.253	-0.000
RAISED DISC	49.80	1120.253	-0.000
RAISED DISC	50.80	1120.253	-0.000
RAISED DISC	51.80	1120.253	-0.000
RAISED DISC	52.80	1120.253	-0.000
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RAISED DISC	78.80	1120.253	-0.000
RAISED DISC	79.80	1120.253	-0.000
RAISED DISC	80.80	1120.253	-0.000
RAISED DISC	81.80	1120.253	-0.000
RAISED DISC	82.80	1120.253	-0.000
RAISED DISC	83.80	1120.253	-0



6-30-18

Inspections

Tempe Town Lake Dam Inspection

Abbreviated Checklist

Current Frequency of Inspections Using this Format

Weekly

Inspection Information

Date:	09/16/16
Temperature (F):	79
Lake Elevation (FLAMS):	1146.9

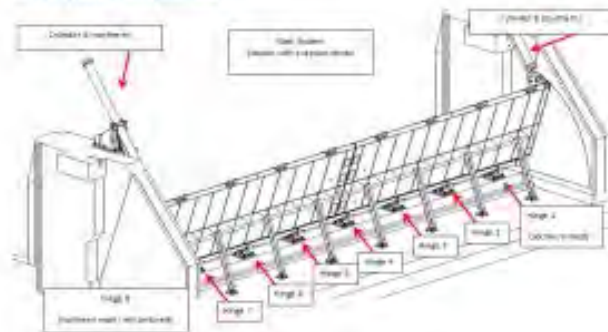
City:	P
Name:	craig cagliano
water utility:	

Non-C:	
Name:	Corrosi

Page | 1 of 8 Template Available:
2016/Maintenance Related Information

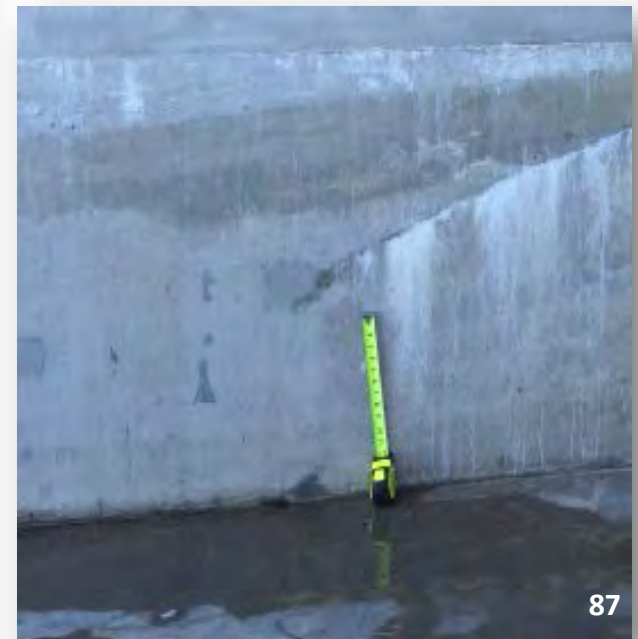


Gate System Components



Page | 2 of 8 Template Available: LH/Water/PUBLIC/Tempe Town Lake/Venue Dam
2016/Maintenance Related Information/Inspections/TTI Abbreviated Inspection Template.docx

- Weekly
- Monthly
- Annual
- ADWR (every 3-years)



Maintenance

- Immediate Maintenance
- Routine/Scheduled Maintenance
- Monitored Maintenance



Maintenance





Challenges

- Budget
- Schedule
- Weather
- Permitting
- Testing
- Beavers







4:37

65°



NEW TONIGHT

**ABC15
ARIZONA**

TEMPE BEAVER RELEASED BACK INTO THE WILD
ANIMAL WAS FOUND SICK IN THE LAKE LAST MONTH

abc15



10:18 65°

More information:

www.tempe.gov/lake

Dean B. Durkee - ddurkee@gfnet.com

Stewart S. Vaghti - svaghti@gfnet.com

Thank You

Acknowledgments:

- City of Tempe
- PCL Construction
- Steel-Fab, Inc.
- Oklahoma City



Gannett Fleming

