



US Army Corps
of Engineers
Kansas City &
Omaha Districts

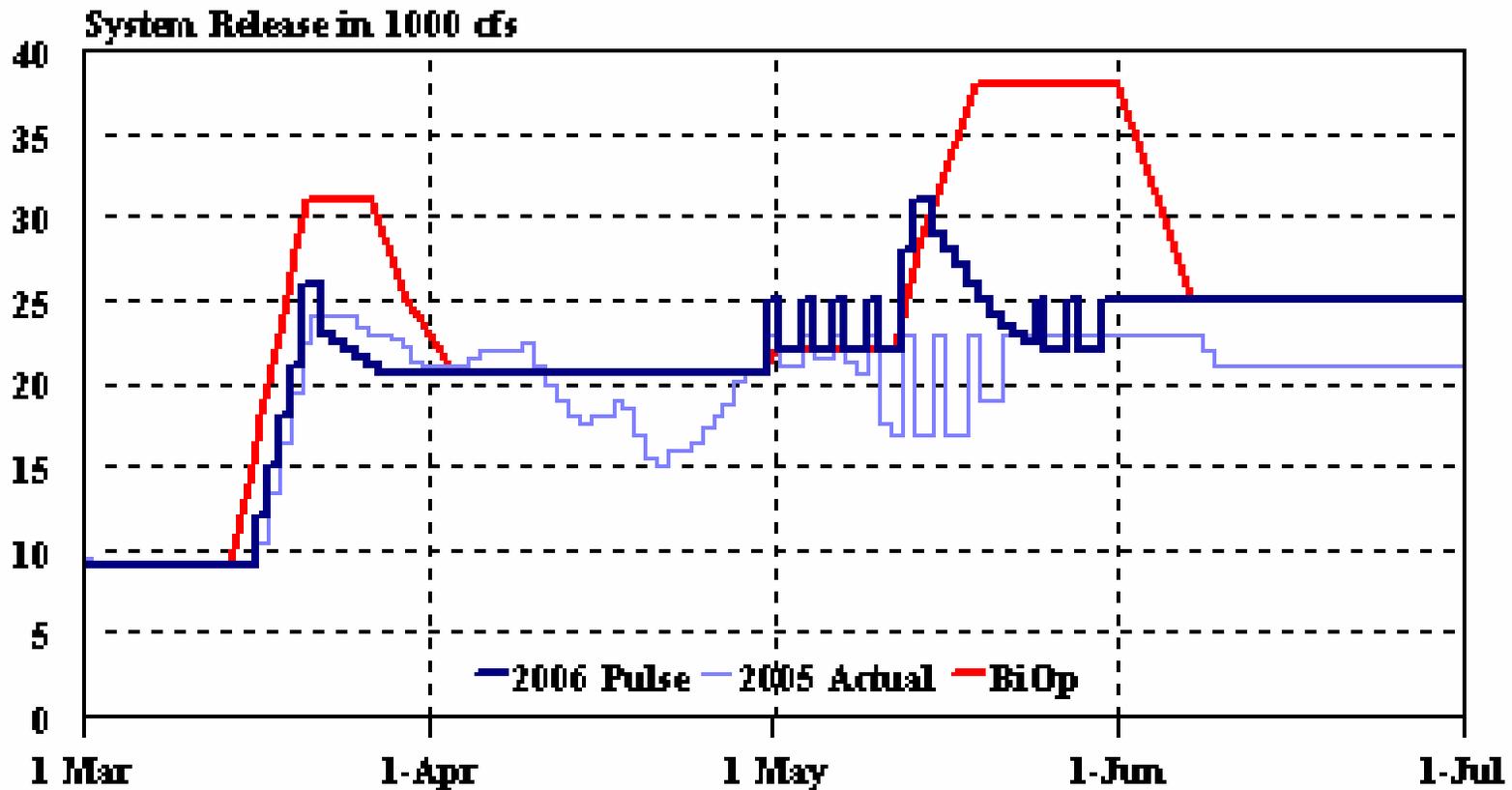
Missouri River Spring Pulse Interior Drainage Monitoring Plan

As of: February 28, 2006

Gavins Point Dam

Gavins Point

Estimated 2006 Spring Pulse Releases





US Army Corps
of Engineers
Kansas City &
Omaha Districts

Expected Stage Change (Feet)

Location	March Pulse		May Pulse	
	Nav Target	Rise & Fall	Nav Target	Rise & Fall
Omaha	2.4	1.3	0.8	1.3
Boonville	1.0	0.7	0.4	0.7





US Army Corps
of Engineers
Kansas City &
Omaha Districts

Expected Impacts

- Flows within channel
- Maximum stage 0.7-1.3 feet higher with pulse
- No overbank flooding from Pulse
- Overbank flooding could occur with heavy rainfall over downstream tributaries
- High flows from tributaries will mask pulse
- Pulse will attenuate more with overbank flows
- In case expected does not occur – “Monitoring Plan” to collect data and sort out impacts





US Army Corps
of Engineers
Kansas City &
Omaha Districts

Objectives

- Monitor Spring Pulse
- Collect Hydrologic Data
- Evaluate Impacts of Pulse on Drainage
- Document whether or not Drainage impacted by Spring Pulse
- Make Data Collected Available to Public





US Army Corps
of Engineers
Kansas City &
Omaha Districts

Data Collection

- **Aerial Photography (Gavins to St Louis)**
 - Prior to initiating releases in March & May
 - At or following peak stage from each pulse
- **River Stage**
 - USGS/Corps gages
 - Additional Monitoring sites
 - Staff Gages
 - Data Loggers
- **Survey Existing Drainage Structures**
- **Tributary Inflows**
- **Precipitation**
- **Groundwater**





US Army Corps
of Engineers
Kansas City &
Omaha Districts

Products

- **Levee Drainage Structure Database**
 - Surveys (location, elevations, size)
 - Photos of Inlet & Outlet
 - Material & Gates
 - Federal Levees (2006), Private (2007)
- **Aerial Photographs**
 - Gavins Point Dam to St Louis
 - Approximate Scale 1" = 200' on 10" x 10"
 - Digital 10 megapixel color with time & date
- **River Stage Hydrographs**
 - 36 locations from Gavins to St Louis
 - Compare with Simulated from Unsteady Flow Model



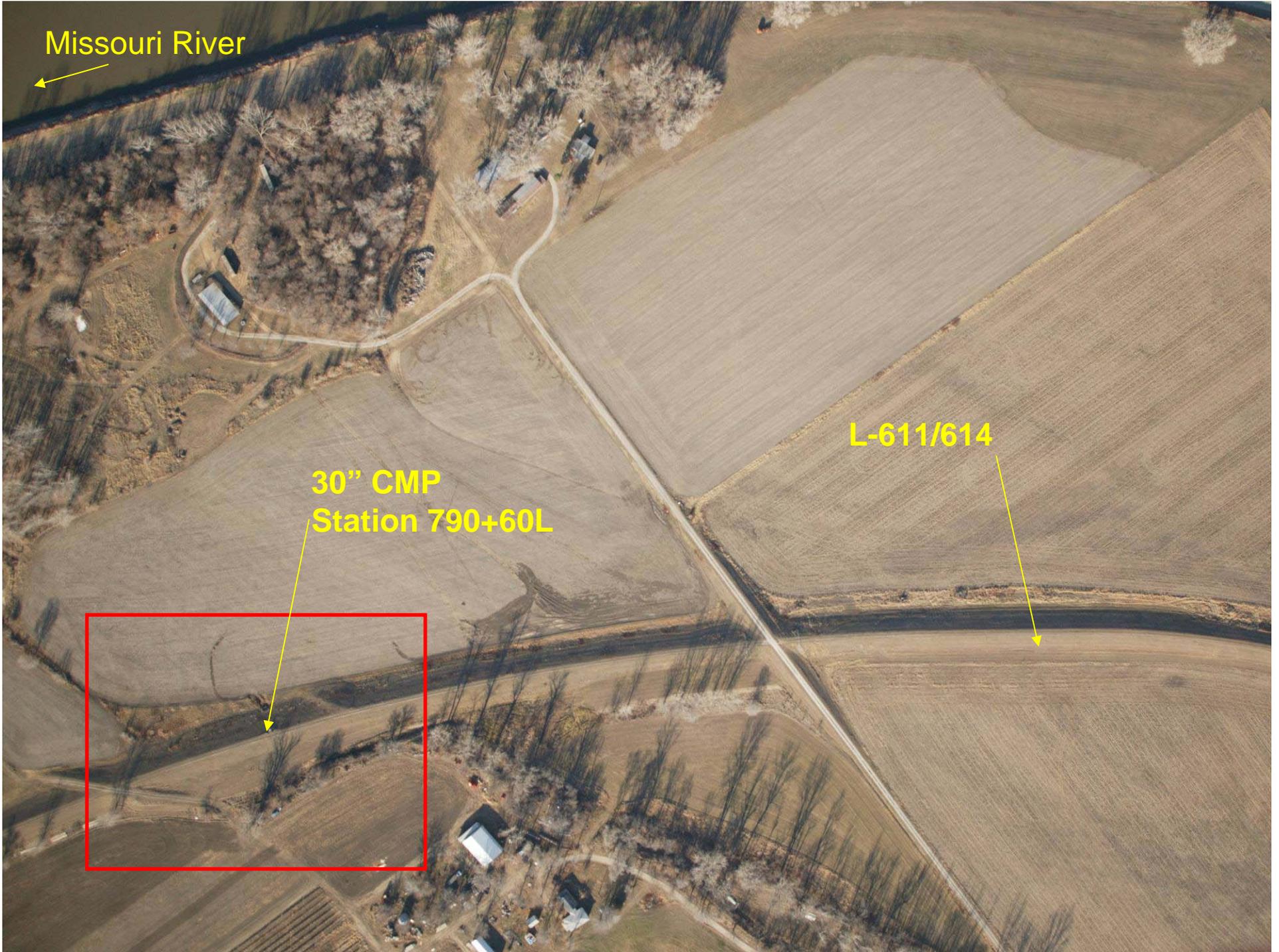
Missouri River



30" CMP
Station 790+60L



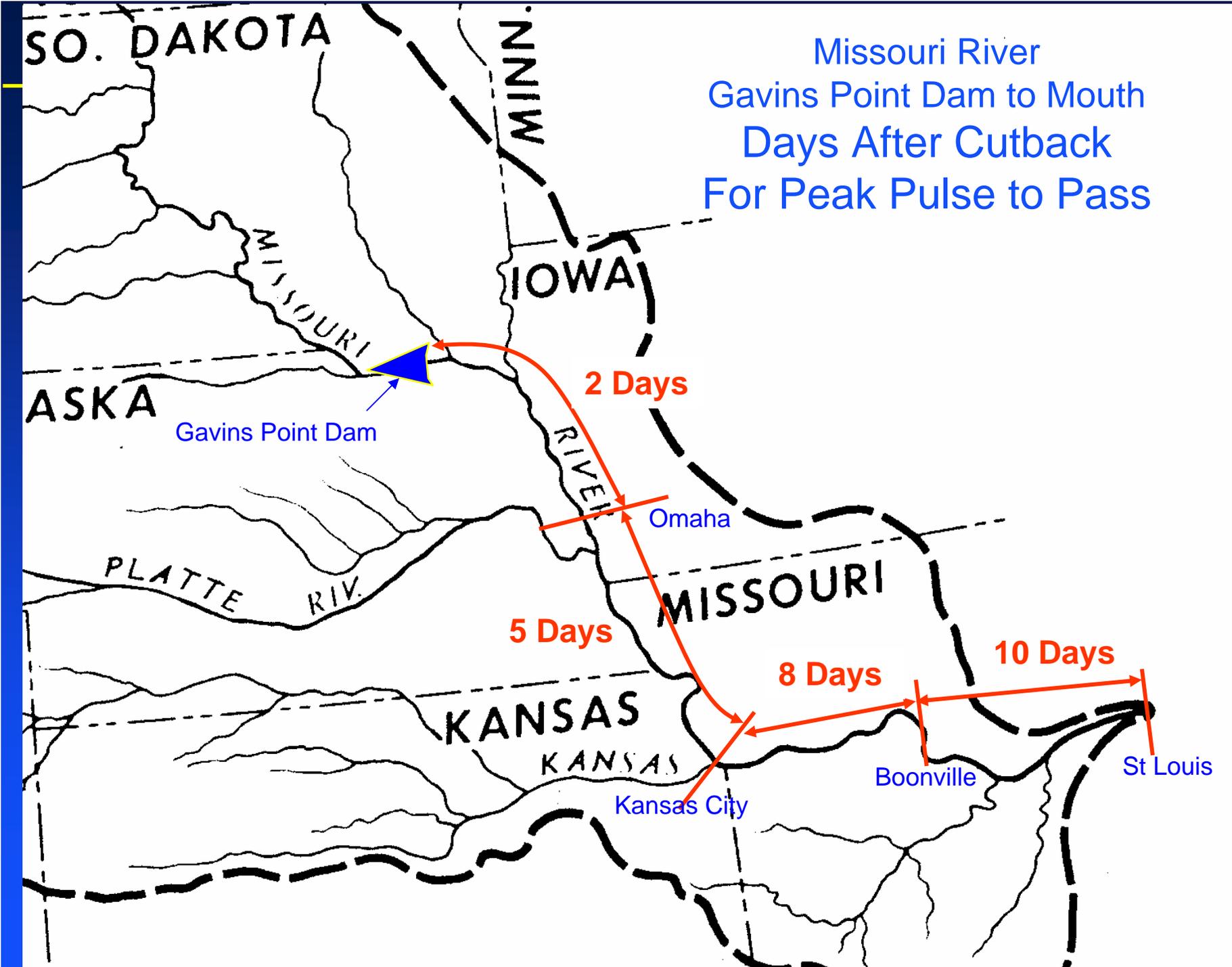
L-611/614





**30" CMP
Station 790+60L**

Missouri River
Gavins Point Dam to Mouth
Days After Cutback
For Peak Pulse to Pass





US Army Corps
of Engineers
Kansas City &
Omaha Districts

River Stage Monitoring Sites

USGS/Corps Gages (Hourly Stage/Discharge)

- Yankton
- Gayville
- Maskell
- Ponca
- Sioux City
- Decatur
- Blair
- Omaha
- Plattsmouth
- Nebraska City
- Brownville
- Rulo
- St Joseph
- Kansas City
- Napoleon
- Waverly
- Glasgow
- Boonville
- Jefferson City
- Hermann
- St Charles





US Army Corps
of Engineers
Kansas City &
Omaha Districts

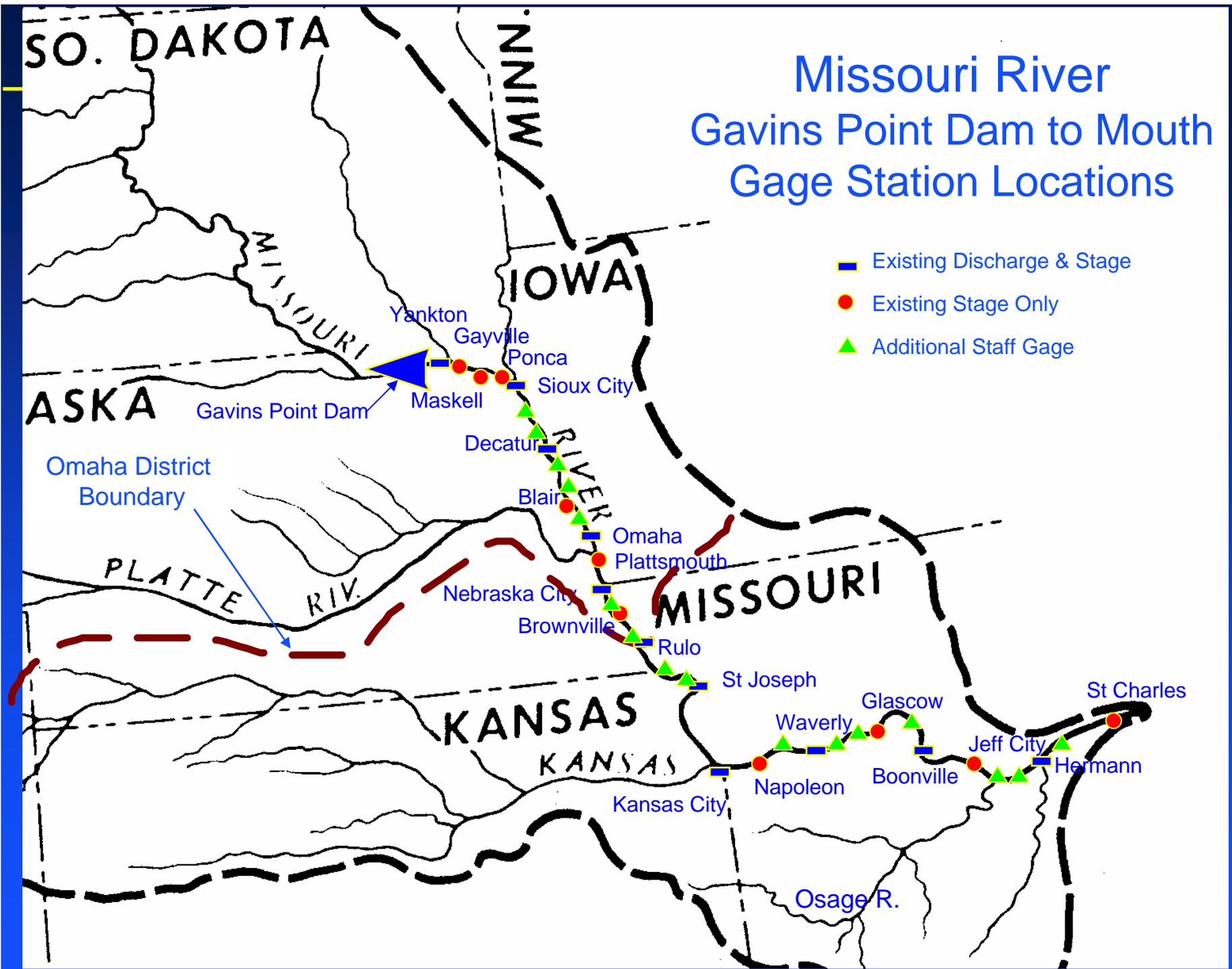
River Stage Monitoring Sites

Additional Staff Gage Sites

#	River Mile (mi)	Gage	Type	Travel Time (Days)
1	699.5	Ruth Lighthouse Marina	Logger/Staff	1.9
2	665.0	Combination Ditch	2 Staff	2.3
3	650.6	California Bend	Logger, 4 Staff	2.5
4	637.1	McIntosh	3 Staff	2.7
5	545.0	L-575 #23	2 Staff	3.8
6	521.5	L-536 #8	2 Staff	4.1
7	490.9	KC Site 1	2 Staff	4.5
8	477.0	L497	2 Staff	4.7
9	326.2	KC Site 3	2 Staff	6.6
10	277.2	KC Site 4	2 Staff	7.2
11	243.0	L246	2 Staff	7.6
12	221.8	KC Site 6	2 Staff	7.9
13	141.4	KC Site 7	2 Staff	8.9
14	99.6	KC Site 8	2 Staff	9.4
15	94.9	Tri County LD #2	2 Staff	9.5



Missouri River Gavins Point Dam to Mouth Gage Station Locations



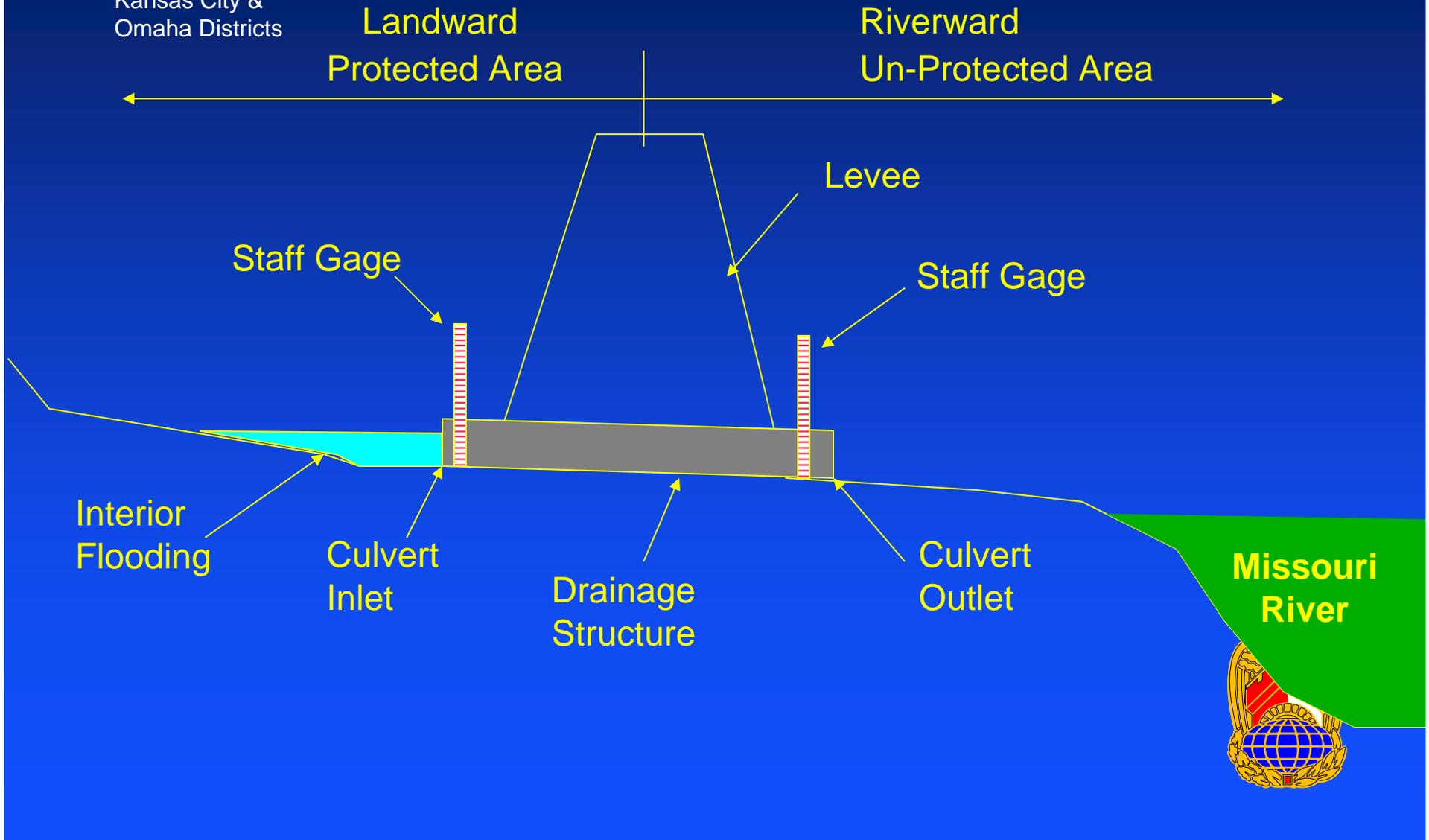


3. 4. 2004



US Army Corps
of Engineers
Kansas City &
Omaha Districts

Sketch of Interior Drainage





US
of
Ka
Or

OD Site #5
L-575 Structure #23
River Mile 545.0

L-575

Staff

R-562





US Army
Corps of Engineers
Kansas City District
Omaha

OD Site #2 Combination Ditch River Mile 665.0





US Army Corps
of Engineers
Kansas City &
Omaha Districts

Future Efforts

- Identify all private levees
- Survey all drainage structures on private levees
- Install staff gages along private levees at key locations
- Have private levee owners read staff gages during pulse events
- Staff gage data furnished to Corps thru website
- Update and refine unsteady flow model for future pulses



Questions/Comments ??





US Army Corps
of Engineers
Kansas City &
Omaha Districts





Proposed Schedule for Reading Staff Gages

US A
of En
Kans
Omal

Gage	Travel Time (days)	Begin Daily	Begin 2x Daily	End 2x Daily	End Daily
OD #1	1.9	D	D+3	C+2	C+10
OD #2	2.3	D+1	D+4	C+3	C+11
OD #3	2.5	D+1	D+4	C+3	C+11
OD #4	2.7	D+1	D+4	C+3	C+11
OD #5	3.8	D+2	D+5	C+4	C+12
OD #6	4.1	D+2	D+5	C+5	C+13
KCD #1	4.5	D+3	D+6	C+5	C+13
KCD #2	4.7	D+3	D+6	C+5	C+13
KCD #3	6.6	D+5	D+8	C+7	C+15
KCD #4	7.2	D+5	D+8	C+8	C+16
KCD #5	7.6	D+6	D+9	C+8	C+16
KCD #6	7.9	D+6	D+9	C+8	C+16
KCD #7	8.9	D+6	D+9	C+9	C+17
KCD #8	9.4	D+7	D+10	C+10	C+18
KCD #9	9.5	D+7	D+10	C+10	C+18

Note: D=Date of Spring Pulse Initiation
C=Date of Spring Pulse Cutback





US
of E
Kan
Oma



OD Site #1
Ruth Lighthouse Marina
River Mile 699.5

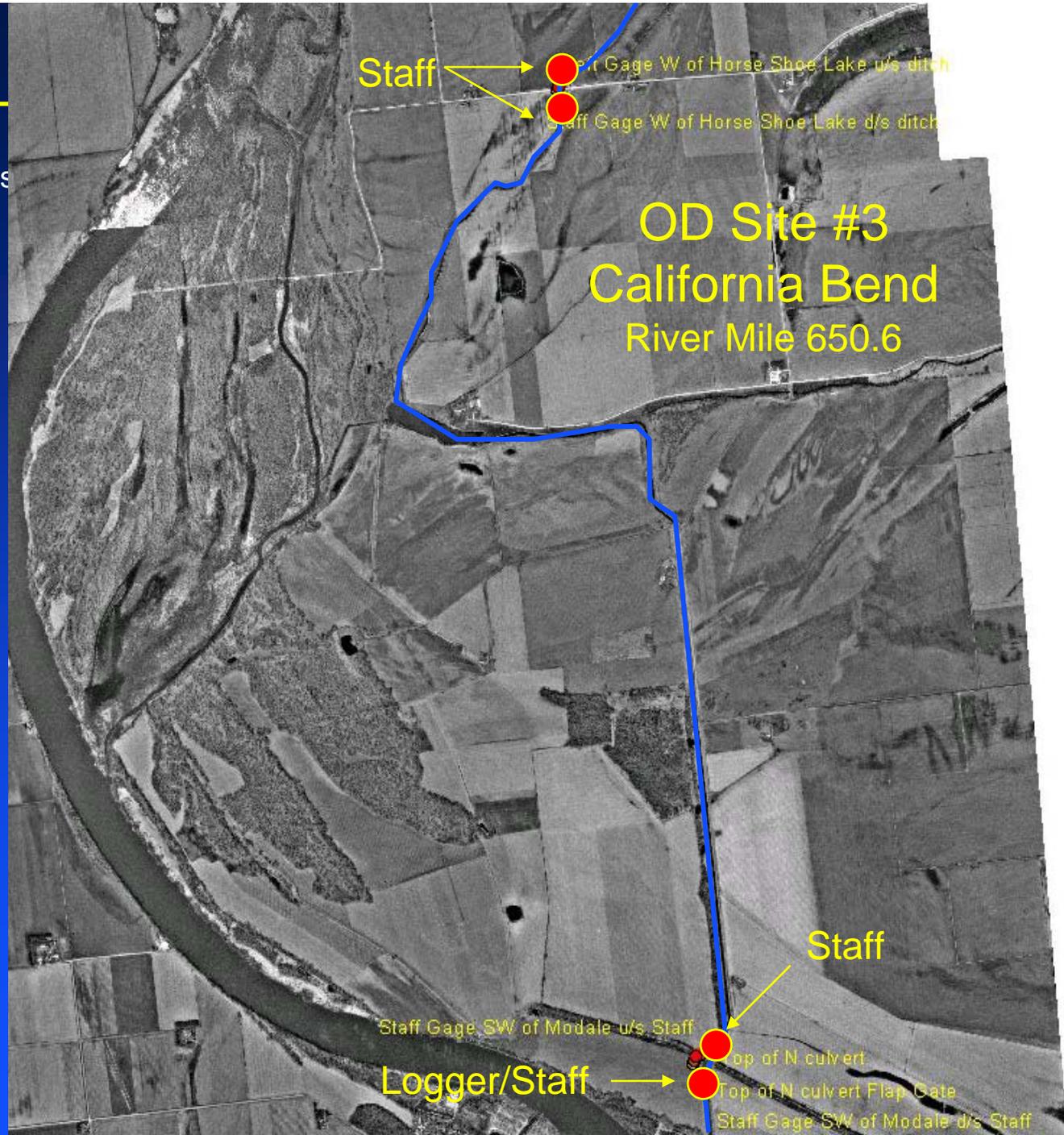
Log & Staff

Blackbird Creek





US Army Corps
of Engineers
Kansas City &
Omaha Districts





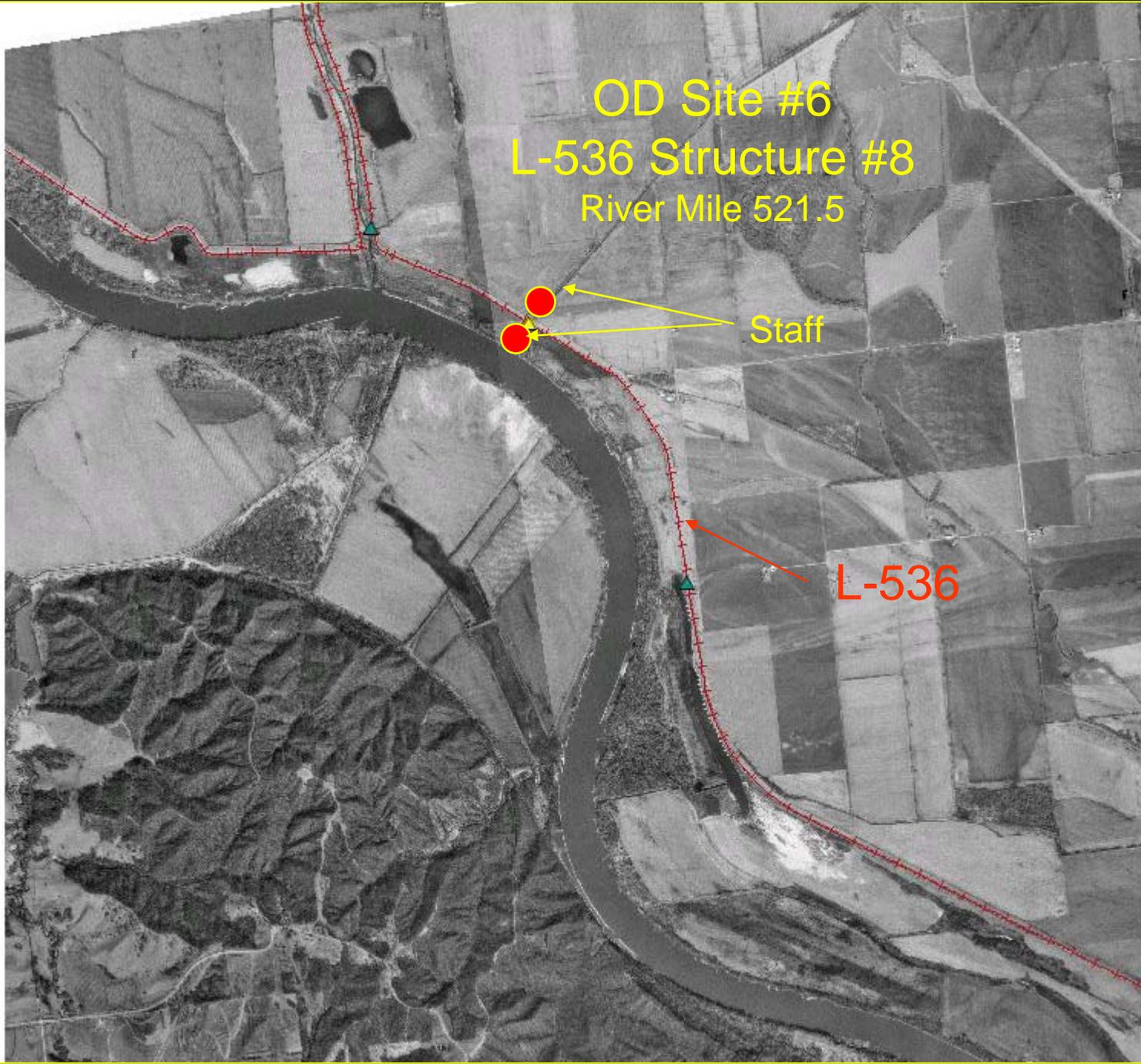
US
of
Kan
Om

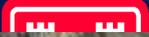
OD Site #4 McIntosh Ditch River Mile 637.1





US
of Ka
Or





KCD Site #1
River Mile 490.7

Staff





US Army Corps

KCD Site #2
Main Outfall for L-497
River Mile 477

Staff

An aerial photograph showing a river outfall. A road or canal runs horizontally across the upper portion of the image. A river flows from the top center towards the bottom right. Two red circular markers are placed on the riverbank, with yellow arrows pointing from the word 'Staff' to each marker. The surrounding area includes agricultural fields and some vegetation.



KCD Site #3
River Mile 326.2
2-96" CMP

Staff

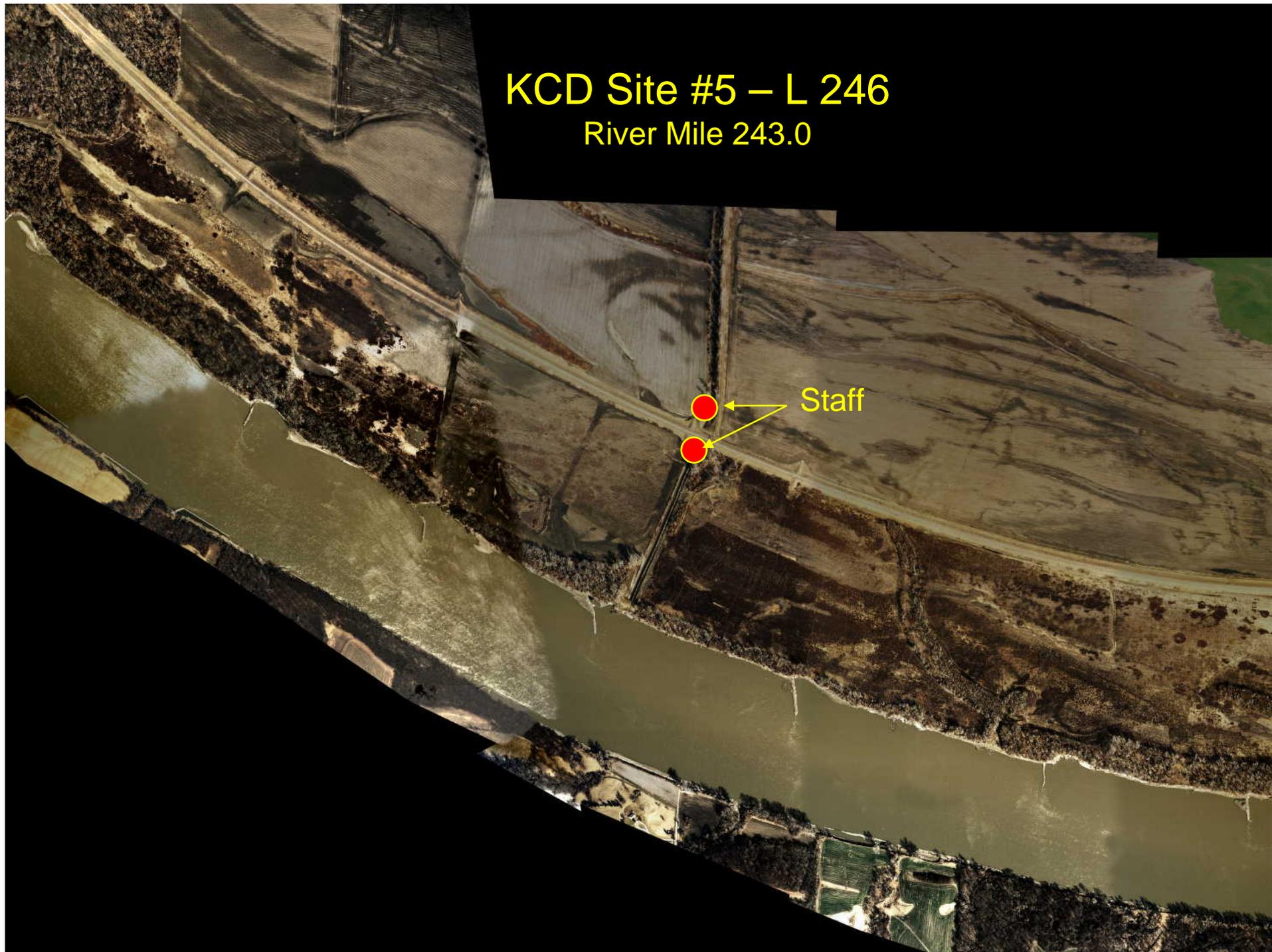


KCD Site #4
River Mile 277.2

Staff



KCD Site #5 – L 246
River Mile 243.0



KCD Site #6

River Mile 221.8

Staff





KCD Site #7
River Mile 141.4

Staff

KCD Site #8
River Mile 99.6

Staff





US Army Corps
of Engineers
Kansas City &
Omaha Districts

KCD Site #9 Tri-County LD #2 River Mile 94.9



#	Gage	River Mile (mi)	Type	Owner	Data	Interval	Datum (ft msl)	Flood Stg (ft)	Travel Time (Days)	Drainage Area (sq mi)
1	Gavins Point Dam	811.1	Auto	USACE	Q, S	Hourly			0.0	279,480
2	Yankton	805.8	Auto	USGS	Q, S	Hourly	1139.7	32	0.1	279,500
3	Gayville	796.0	Auto	USACE	S	Hourly	1100.0		0.3	300,700
4	Maskell	775.6	Auto	USGS	S	Hourly	1124.1	10	0.7	301,400
5	Ponca	751.0	Auto	USACE	S	Hourly	1080.0	24	1.2	305,600
6	Sioux City	732.3	Auto	USGS	Q, S	Hourly	1057.0	30	1.5	314,600
7	Port Neal Powerplant	718.4	Staff	IPL	S	Daily			1.7	315,800
8	Ruth Lighthouse Marina	699.5	Logger/Staff	USACE	S	Hourly			1.9	316,100
9	Decatur	691.0	Auto	USGS	Q, S	Hourly	1010.0	35	2.0	316,200
10	Combination Ditch	665.0	2 Staff	USACE	S	Daily			2.3	320,900
11	California Bend	650.6	Logger, 4 Staff	USACE	S	Hourly			2.5	321,400
12	Blair	648.3	Auto	USACE	S	Hourly	977.3	29	2.6	321,500
13	McIntosh	637.1	3 Staff	USACE	S	Daily			2.7	321,600
14	Omaha	615.9	Auto	USGS	Q, S	Hourly	948.2	29	3.0	322,800
15	Plattsmouth	591.5	Auto	USACE	S	Hourly	928.2	26	3.3	409,100
16	Nebraska City	562.6	Auto	USGS	Q, S	Hourly	905.4	18	3.6	410,000
17	L-575 #23	545.0	2 Staff	USACE	S	Daily	894.8		3.8	410,200
18	Brownville	535.3	Auto	USACE	S	Hourly	860.0	32	4.0	413,000
19	L-536 #8	521.5	2 Staff	USACE	S	Daily	868.9		4.1	414,100
20	Rulo	498.1	Auto	USGS	Q, S	Hourly	837.2	17	4.4	414,900
21	KC Site 1	490.9	2 Staff	USACE	S	Daily			4.5	417,500
22	L497	477.0	2 Staff	USACE	S	Daily			4.7	418,200
23	St Joseph	448.2	Auto	USGS	Q, S	Hourly	788.2	17	5.1	420,100
24	Kansas City	366.1	Auto	USGS	Q, S	Hourly	706.4	32	6.1	484,100
25	KC Site 3	326.2	2 Staff	USACE	S	Daily			6.6	485,200
26	Napoleon	328.7	Auto	USACE	S	Hourly	680.2	17	6.5	485,200
27	Waverly	293.4	Auto	USGS	Q, S	Hourly	646.0	20	7.0	485,900
28	KC Site 4	277.2	2 Staff	USACE	S	Daily			7.2	486,300
29	L246	243.0	2 Staff	USACE	S	Daily			7.6	494,600
30	Glasgow	226.3	Auto	USACE	S	Hourly	586.1	25	7.8	497,900
31	KC Site 6	221.8	2 Staff	USACE	S	Daily			7.9	497,900
32	Boonville	197.1	Auto	USGS	Q, S	Hourly	565.4	21	8.2	500,700
33	Jefferson City	143.9	Auto	USACE	S	Hourly	520.1	23	8.9	502,400
34	KC Site 7	141.4	2 Staff	USACE	S	Daily			8.9	502,400
35	KC Site 8	99.6	2 Staff	USACE	S	Daily			9.4	522,500
36	Hermann	97.9	Auto	USGS	Q, S	Hourly	481.6	21	9.4	522,500
37	Tri County LD #2	94.9	2 Staff	USACE	S	Daily			9.5	522,500
38	St Charles	28.2	Auto	USACE	S	Hourly	413.7	25	10.3	524,000