

Vermilion River Dam

Reclassification of the Downstream Hazard Rating

Presented by: Ted LaBelle | Crawford, Murphy & Tilly, Inc.



ILMA-LAKES
ILLINOIS LAKES MANAGEMENT ASSOCIATION

2014 Annual Conference
April 10-12, 2014



Project Goals

- Reclassify dam from downstream Hazard **Class 2** (Medium) to **Class 3** (Low)
- Volume of water impounded by dam
- Sediment accumulation in lake

Benefits of Reclassifying Dam

- Dam inspection – 3 years versus 5 years
- Emergency Action Plan for Class 2 dam but not Class 3
- IDNR Regulations – Design for major modification less stringent for Class 3

Steps for Reclassification

- First – Determine head loss across dam for spillway design flood - 100 year flood
- Second – Perform dam breach analysis if significant head loss
- Third – Determine if increased risk for loss of life due to breach
- Fourth – Reclassify only if no increase in risk of loss of life due to breach

Topographic Mapping

- Field survey for control points
- Mapping with aerial photography
- Mapping with LiDAR
- Mapping with hydrographic survey

Field Survey for Control Points

- Several points set with GPS control
- Surveyed crest elevation of spillway
- Found one error in ground control





Aerial Photography

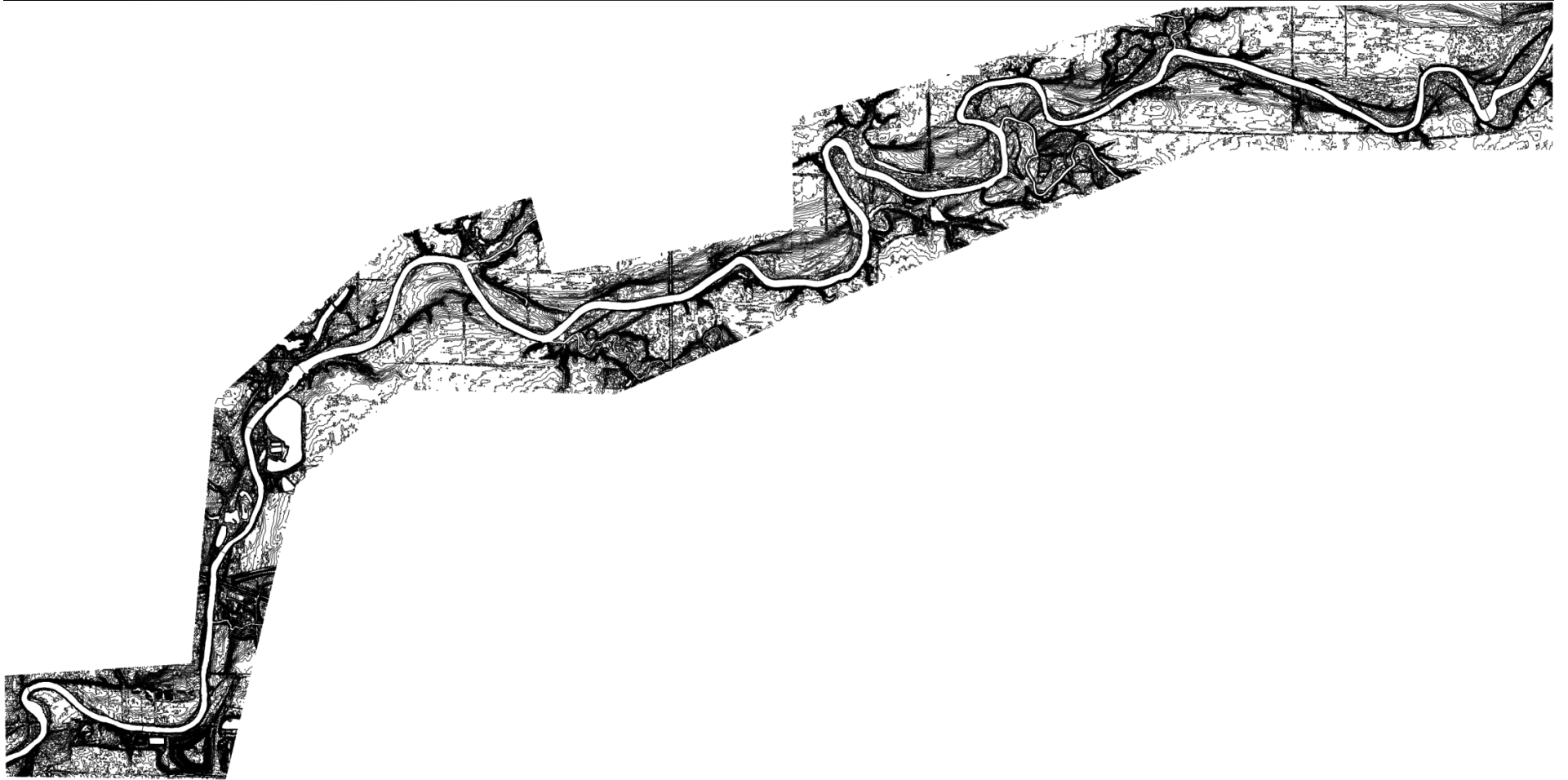


LiDAR

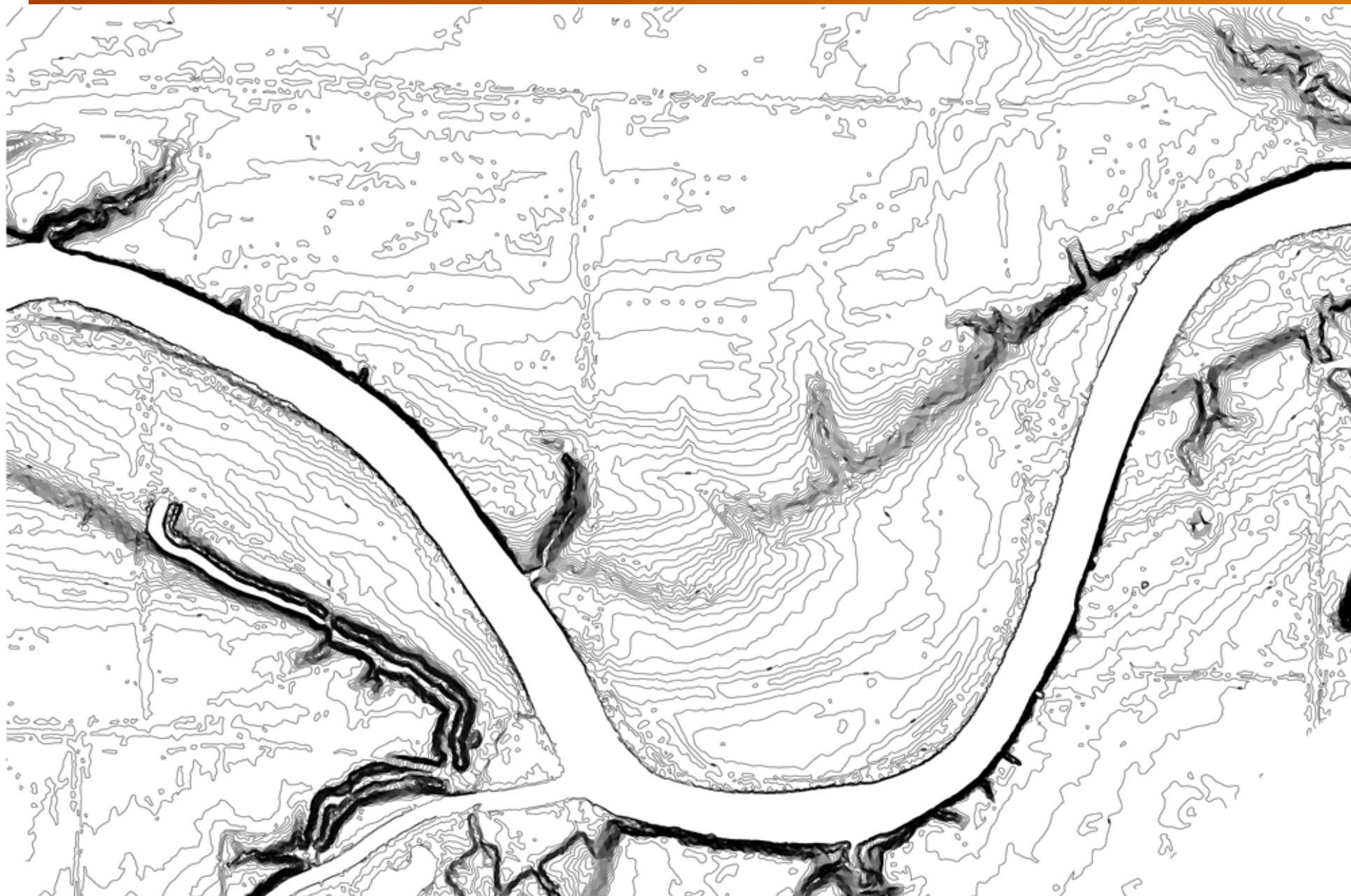
- Combination of light and radar
- Light source is laser
- Ultraviolet, visible or near infrared
- Can be performed day or night
- Higher resolution
- Shows both ground and canopy of vegetation



LiDAR Map – Entire River Length



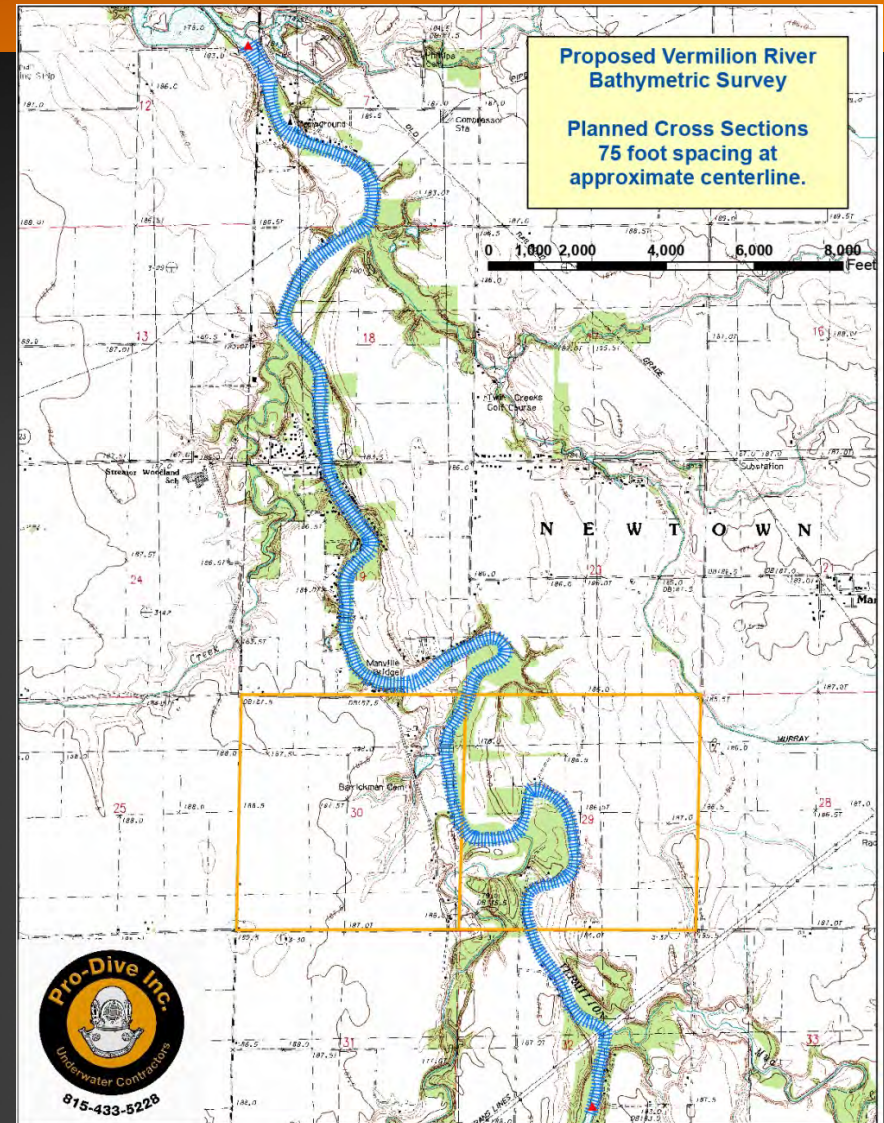
LiDAR Map Closeup

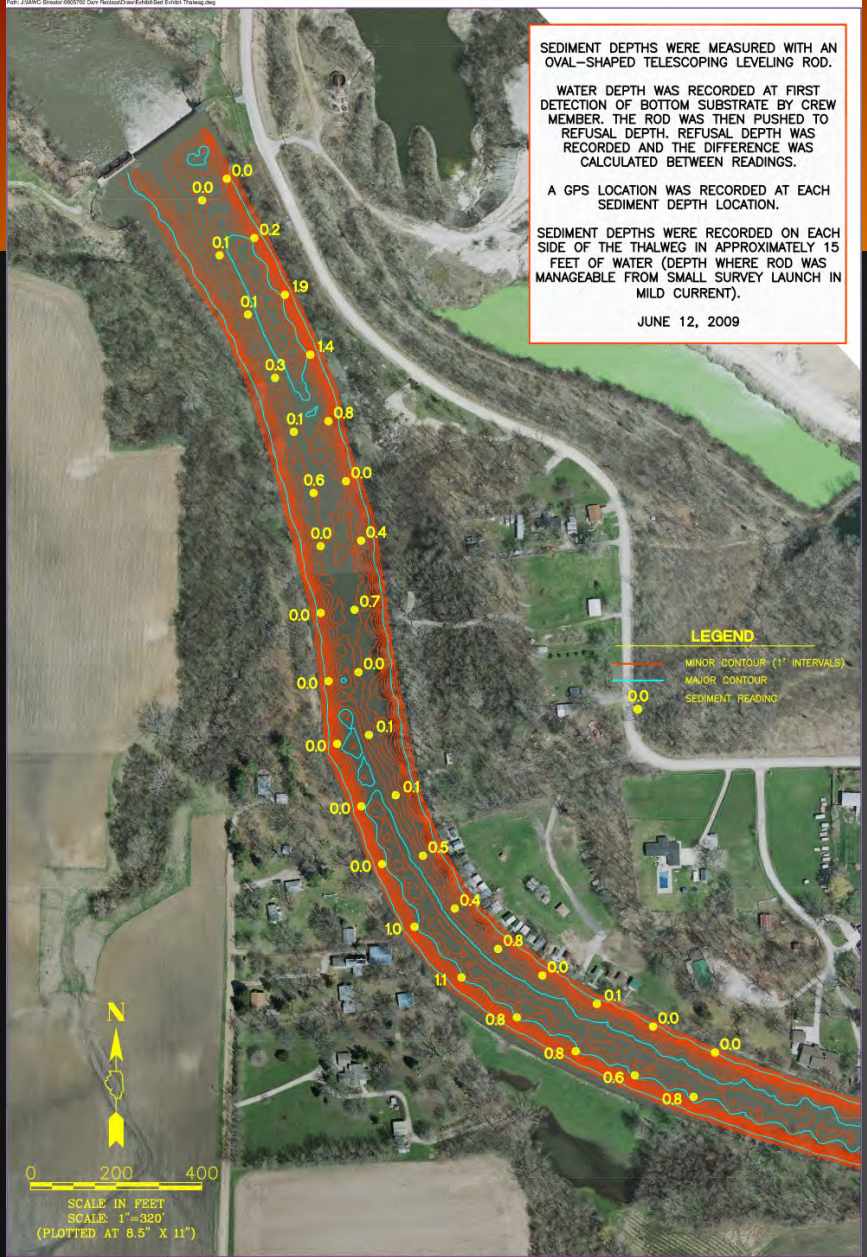


Hydrographic Mapping

Couples two technologies

- Ultrasonic depth
- GPS horizontal coordinates at water surface





SEDIMENT DEPTHS WERE MEASURED WITH AN OVAL-SHAPED TELESCOPING LEVELING ROD.

WATER DEPTH WAS RECORDED AT FIRST DETECTION OF BOTTOM SUBSTRATE BY CREW MEMBER. THE ROD WAS THEN PUSHED TO REFUSAL DEPTH. REFUSAL DEPTH WAS RECORDED AND THE DIFFERENCE WAS CALCULATED BETWEEN READINGS.

A GPS LOCATION WAS RECORDED AT EACH SEDIMENT DEPTH LOCATION.

SEDIMENT DEPTHS WERE RECORDED ON EACH SIDE OF THE THALWEG IN APPROXIMATELY 15 FEET OF WATER (DEPTH WHERE ROD WAS MANAGEABLE FROM SMALL SURVEY LAUNCH IN MILD CURRENT).

JUNE 12, 2009

LEGEND

- MINOR CONTOUR (1' INTERVALS)
- MAJOR CONTOUR
- SEDIMENT READING

CMT
 CRAWFORD, MURPHY & TILLY, INC.
 CONSULTING ENGINEERS
 License No. 181-000113

DATE: 10/09
 DRAWN BY:
 CHKD BY:

SHEET TITLE
**SEDIMENT DEPTH VALUES
 VERMILLION RIVER RAM TO 1/2 MILE UPSTREAM**

PROJECT
IAWC - VERMILLION RIVER STUDY

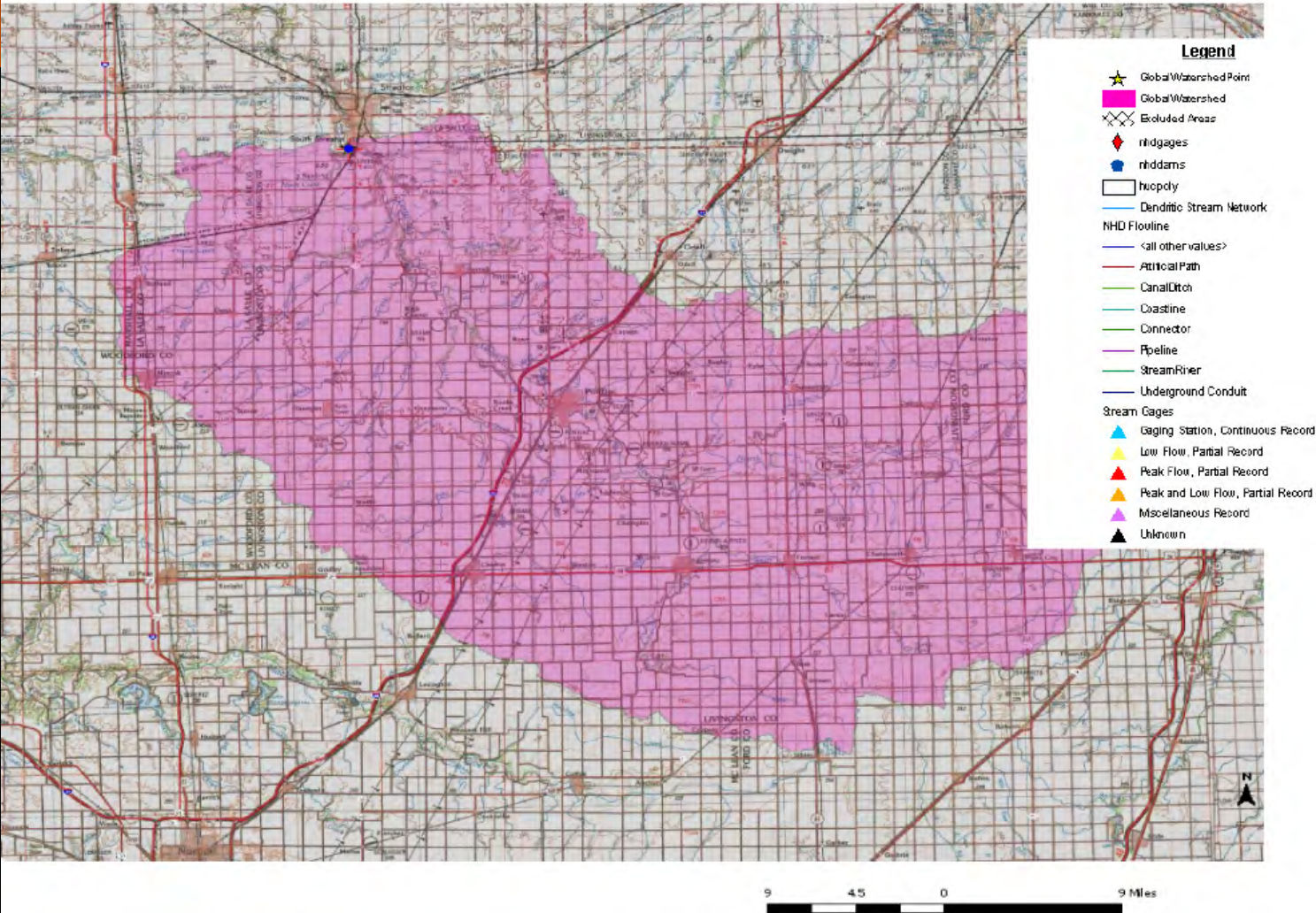
DRAWING
1

Hydrology

- 100 year flow - USGS Streamstats
- No flow hydrographs developed
- Based on stream flow records rather than watershed characteristics and rainfall

Vermillion River

Downstream Illinois Route 23



10/27/2009 1:17:49 PM



Illinois Streamstats

Streamstats Ungaged Site Report

Date: Tue Oct 27 2009 13:11:55 Mountain Daylight Time

Site Location: Illinois

NAD83 Latitude: 41.0933 (41 05 36)

NAD83 Longitude: -88.8377 (-88 50 15)

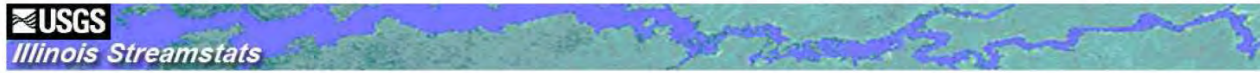
NAD27 Latitude: 41.0933 (41 05 36)

NAD27 Longitude: -88.8377 (-88 50 15)

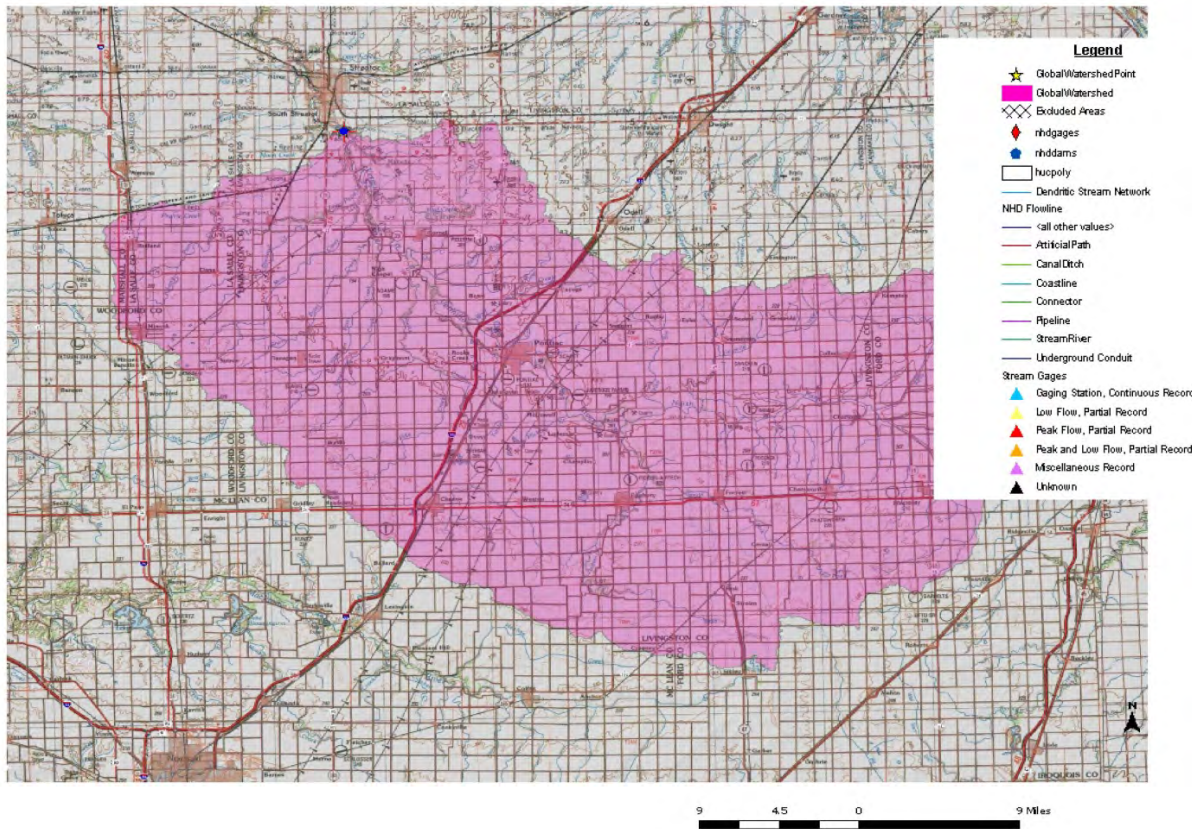
Drainage Area: 1116.7 mi²

Peak Flows Region Grid Basin Characteristics			
100% Region 3 AMS (1120 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	1120	0.03	9554
Stream Slope 10 and 65 Method (feet per mi)	1.309	0.81	317
Average Soil Permeability (inches per hour)	1.301	0.3	8
Region 3 Indicator enter 1 (dimensionless)	1	1	1

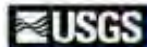
Peak Flows Region Grid Streamflow Statistics					
Statistic	Flow (ft ³ /s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	7520	40	2.7	4050	14000
PK5	12500	40	3.2	6690	23400
PK10	15900	42	3.9	8330	30500
PK25	20400	44	4.7	10300	40500
PK50	23700	47	5.3	11600	48600
PK100	27000	49	5.6	12700	57100
PK500	34700	55	6.2	15100	79500



Vermillion River
IAWC Streator Dam



10/27/2009 1:23:11 PM


Illinois Streamstats

Streamstats Ungaged Site Report

Date: Wed Aug 26 2009 07:34:19 Mountain Daylight Time

Site Location: Illinois

NAD83 Latitude: 41.0870 (41 05 13)

NAD83 Longitude: -88.8144 (-88 48 51)

NAD27 Latitude: 41.0869 (41 05 12)

NAD27 Longitude: -88.8143 (-88 48 51)

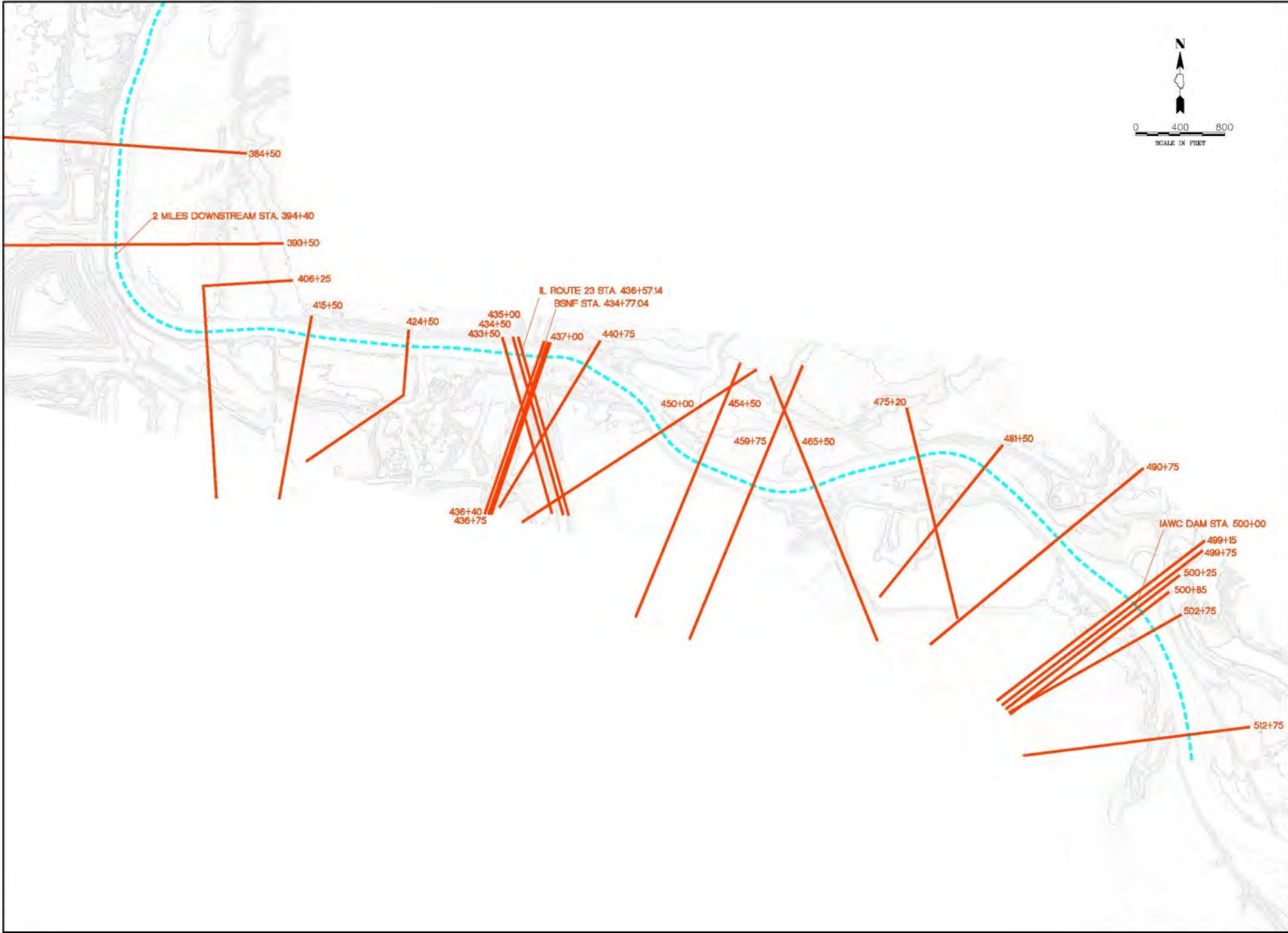
Drainage Area: 1072.22 mi²

Peak Flows Region Grid Basin Characteristics			
100% Region 3 AMS (1070 mi ²)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	1070	0.03	9554
Stream Slope 10 and 65 Method (feet per mi)	1.345	0.81	317
Average Soil Permeability (inches per hour)	1.097	0.3	8
Region 3 Indicator enter 1 (dimensionless)	1	1	1

Peak Flows Region Grid Streamflow Statistics					
Statistic	Flow (ft ³ /s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK2	7380	40	2.7	3970	13700
PK5	12300	40	3.2	6570	23000
PK10	15700	42	3.9	8190	30000
PK25	20100	44	4.7	10100	39800
PK50	23400	47	5.2	11400	47800
PK100	26500	49	5.6	12500	56300
PK500	34100	55	6.2	14900	78300

Hydraulics

- HEC-RAS model with graphical input
 - LiDAR contours imported into Geopak software
 - Hydrographic contours imported into Geopak
 - Steady flow analysis
- Select cross sections
- Manning's "n" values estimated
- Normal depth for peak flow downstream
- Modeled dam structure and bridges from drawings
- Sensitivity analysis for "n" value and downstream channel bottom and water surface elevation



REVISION	
NUMBER	BY

0 1
THIS BAR IS EQUAL TO FULL SCALE

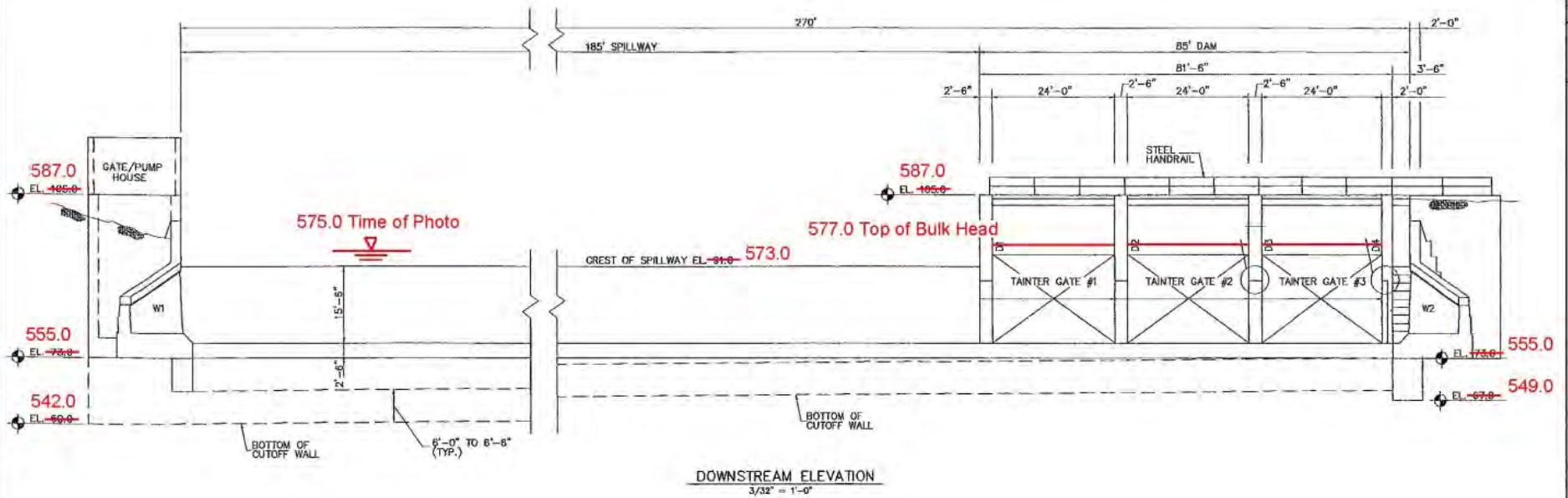
**ILLINOIS AMERICAN WATER COMPANY
STREATOR, LASALLE COUNTY, IL**

© Copyright 2011, IAWC, Inc.
CMT
CONWARD, MARRAS & TILLY, INC.
CONSULTING ENGINEERS
License No. 04-000000

DESIGN BY:
DRAWN BY:
CHECKED BY:
APPROVED BY:
DATE: 10/10/11
JOB No: 08057

SHEET 01 OF 01

Dam Cross Section

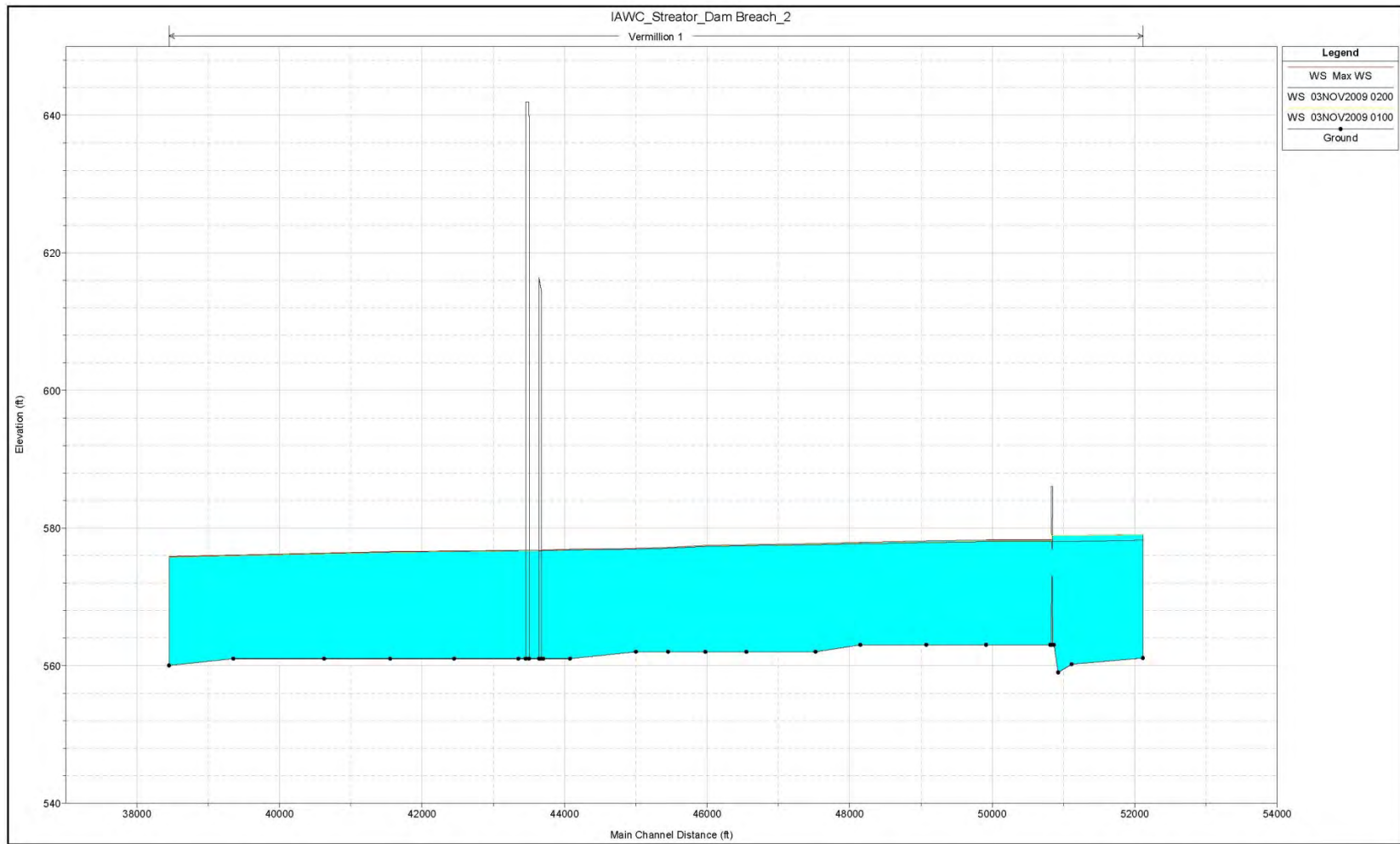


Dam Breach Analysis

- Dam removed in 5 minutes
- Area flooded by 100 year flood with dam
- Area flooded by 100 year flood with no dam
- Review the incremental area

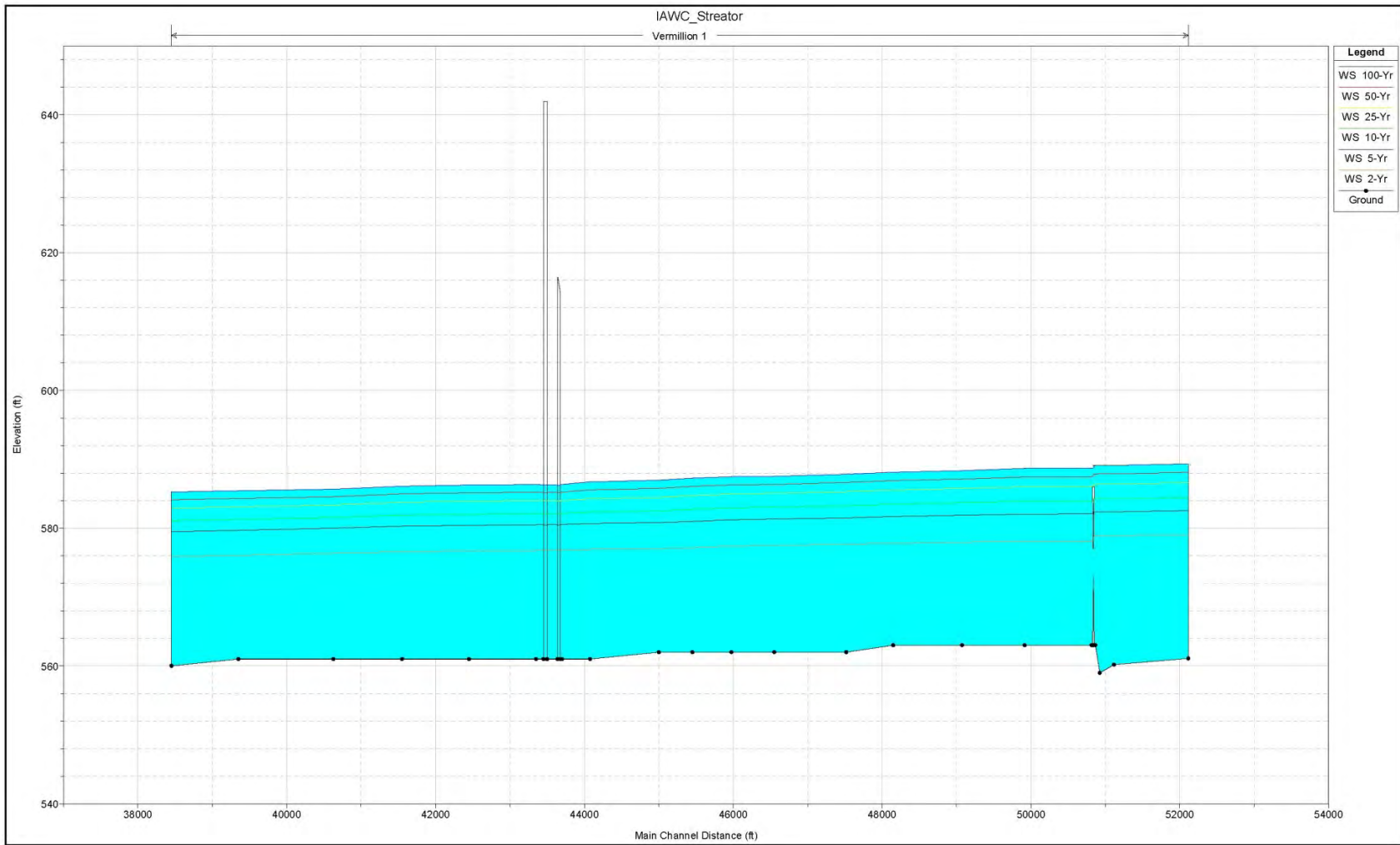
Results

- First - Head Loss across dam
 - 100 year flood – 0.3 feet
 - 2, 5, 10, 25, 50 year frequency – 0.8 to 0.4 feet
- Second - Dam breach analysis if significant head loss
 - Increase in water level range - 0.13 to 0.27 feet
 - Not required by IDNR
- Third – No increase risk of loss of life
- Fourth – Dam classification revised to Class 3



100 Year Flood Delineation

- First detailed analysis of this segment
- No residences impacted
- RV resort affected by flooding
- Affected by floods 5 year flood or larger
- Dam owner adopted policy to notify RV resort
- Bridges and water plant protected from 100 year flood






100 Year Flood Zone





0 200 400
SCALE IN FEET

LEGEND

-  100-YEAR FLOOD CONTOUR
-  OUTLINE OF EXISTING STRUCTURES
-  CALCULATED 100-YEAR FLOOD (ROUNDED TO NEXT HIGHEST CONTOUR)





Water Volume

- Volume calculated by computer software
- Volume of 262 million gallons at normal pool



CMT
CRAWFORD, MURPHY & TILLY, INC.
CONSULTING ENGINEERS

PROJECT: IAWC - Streator Dam
JOB CODE: 08057-02
DESIGNED: JM
DATE: 10/30/09

River Pool Volumes :

Elevation Interval	Incr Volume (CY)	Total Volume (CY)	Incr Volume (MG)	Total Volume (MG)
555	556	0.00	0.00	0.00
556	557	40.11	40.11	0.01
557	558	402.46	442.57	0.08
558	559	2427.81	2870.38	0.49
559	560	6621.43	9491.81	1.34
560	561	12468.43	21960.24	2.52
561	562	20787.35	42747.59	4.20
562	563	32793.41	75541.00	6.62
563	564	47199.35	122740.35	9.53
564	565	62542.18	185282.53	12.63
565	566	78082.31	263364.84	15.77
566	567	94675.79	358040.63	19.12
567	568	113874.20	471914.83	23.00
568	569	135203.25	607118.08	27.31
569	570	153255.65	760373.73	30.96
570	571	166947.37	927321.10	33.72
571	572	178658.23	1105979.33	36.09
572	573	189674.74	1295654.07	38.31

Total Volume Below Spillway EL 573.0 (CY) :	6250883	TOTAL (MG):	1263
---	---------	-------------	------

```

*****
**
** Plane To TIN volume Report -- Tue Sep 29 13:39:38 2009
**
** From Elevation <574.350> to TIN <:\IAWC-Streator\0805702 Dam rec1
**
** Prismoïda Volume
**
*****
**
** Total Cut = 1568249.263 Cubic Yards
** Total Fill = 35.189 Cubic Yards
** Area = 619276.268 Sq Yards
** Balance = 1568214.073 Cubic Yards
**
**
** Elevation Range used
** 550.000 to 551.000 Cut = 0.000 F111 = 0.000
** 551.000 to 552.000 Cut = 0.000 F111 = 0.000
** 552.000 to 553.000 Cut = 0.000 F111 = 0.000
** 553.000 to 554.000 Cut = 0.000 F111 = 0.000
** 554.000 to 555.000 Cut = 0.000 F111 = 0.000
** 555.000 to 556.000 Cut = 0.000 F111 = 0.000
** 556.000 to 557.000 Cut = 40.111 F111 = 0.000
** 557.000 to 558.000 Cut = 402.458 F111 = 0.000
** 558.000 to 559.000 Cut = 2427.805 F111 = 0.000
** 559.000 to 560.000 Cut = 6621.427 F111 = 0.000
** 560.000 to 561.000 Cut = 12468.431 F111 = 0.000
** 561.000 to 562.000 Cut = 20787.347 F111 = 0.000
** 562.000 to 563.000 Cut = 32793.408 F111 = 0.000
** 563.000 to 564.000 Cut = 47199.346 F111 = 0.000
** 564.000 to 565.000 Cut = 62542.177 F111 = 0.000
** 565.000 to 566.000 Cut = 78082.313 F111 = 0.000
** 566.000 to 567.000 Cut = 94675.791 F111 = 0.000
** 567.000 to 568.000 Cut = 113874.197 F111 = 0.000
** 568.000 to 569.000 Cut = 135203.252 F111 = 0.000
** 569.000 to 570.000 Cut = 153255.654 F111 = 0.000
** 570.000 to 571.000 Cut = 166947.372 F111 = 0.000
** 571.000 to 572.000 Cut = 178658.230 F111 = 0.000
** 572.000 to 573.000 Cut = 189674.743 F111 = 0.000
** 573.000 to 574.000 Cut = 200397.892 F111 = 0.000
** 574.000 to 574.350 Cut = 72197.348 F111 = 0.000
**
*****

```

Note: River pools volumes are taken from the dam to the upstream extent of the hydrographic survey

Sediment

- Measured during hydrographic survey
- Location upstream of dam
- Heaviest sediment at intakes

\\011-j:\gmp\crescent\user\user\reservoir\river\river\river.dwg

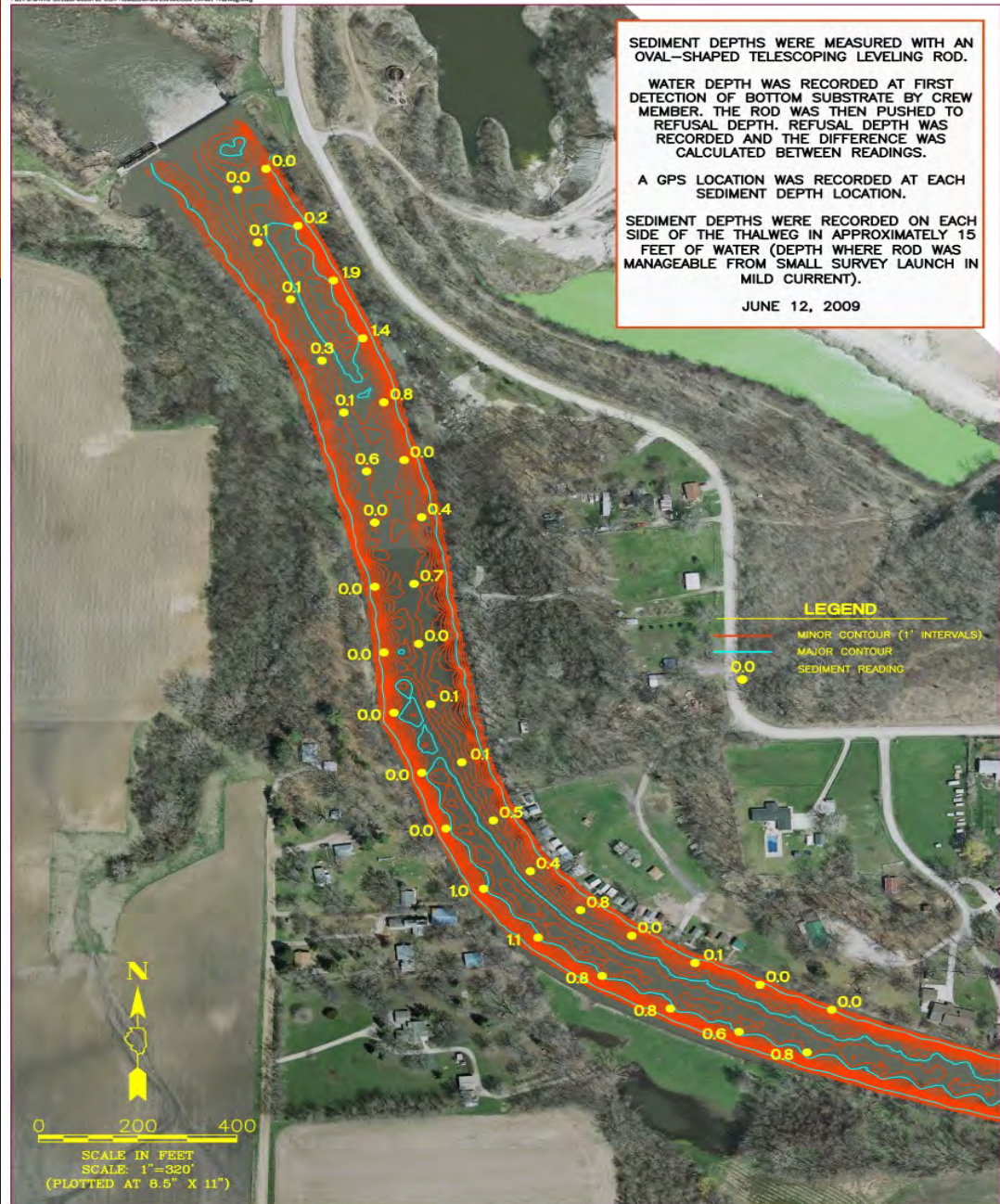
SEDIMENT DEPTHS WERE MEASURED WITH AN OVAL-SHAPED TELESCOPING LEVELING ROD.

WATER DEPTH WAS RECORDED AT FIRST DETECTION OF BOTTOM SUBSTRATE BY CREW MEMBER. THE ROD WAS THEN PUSHED TO REFUSAL DEPTH. REFUSAL DEPTH WAS RECORDED AND THE DIFFERENCE WAS CALCULATED BETWEEN READINGS.

A GPS LOCATION WAS RECORDED AT EACH SEDIMENT DEPTH LOCATION.

SEDIMENT DEPTHS WERE RECORDED ON EACH SIDE OF THE THALWEG IN APPROXIMATELY 15 FEET OF WATER (DEPTH WHERE ROD WAS MANAGEABLE FROM SMALL SURVEY LAUNCH IN MILD CURRENT).

JUNE 12, 2009



LEGEND

- MINOR CONTOUR (1' INTERVALS)
- MAJOR CONTOUR
- SEDIMENT READING

N

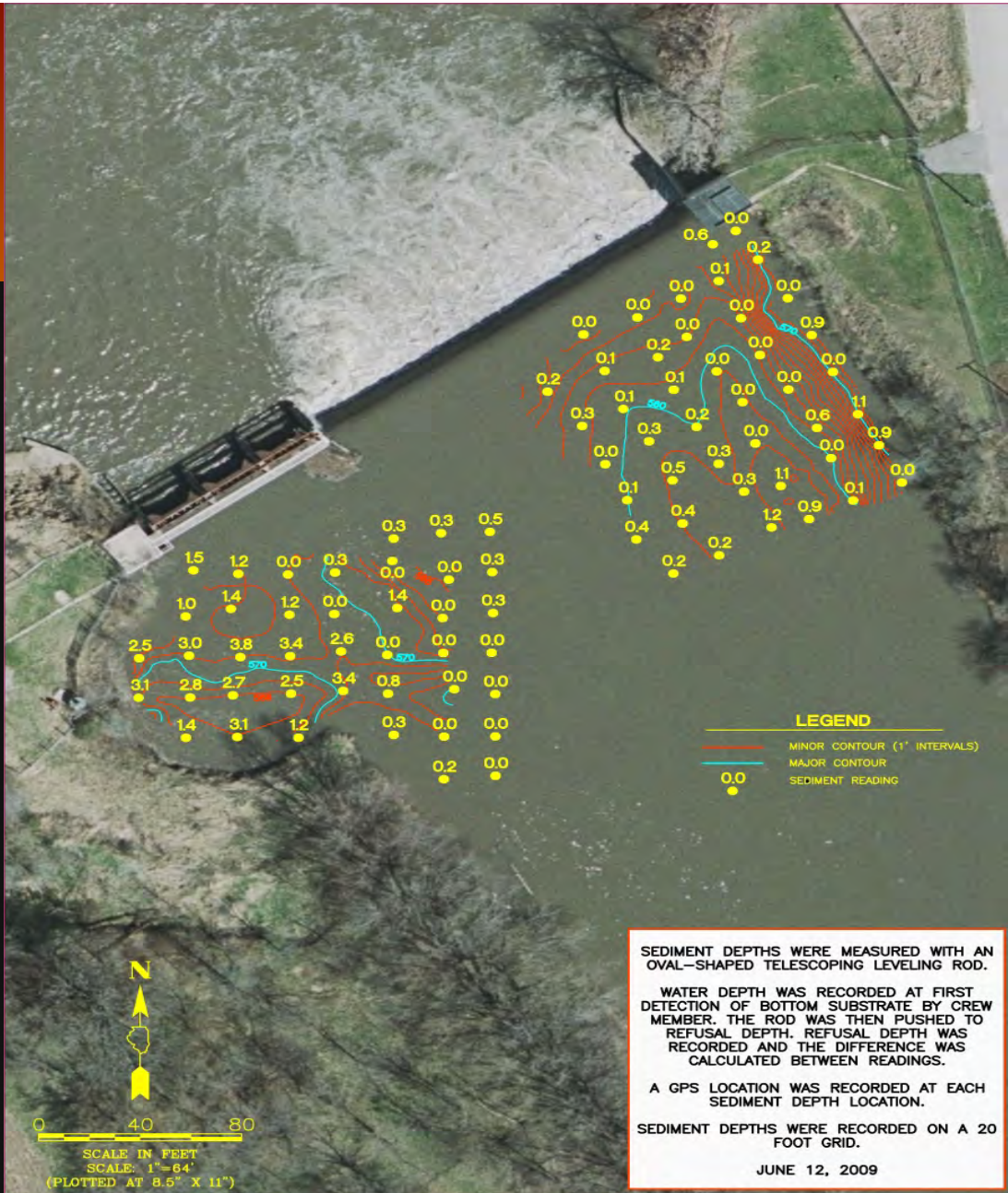
0 200 400

SCALE IN FEET
SCALE: 1"=320'
(PLOTTED AT 8.5" X 11")

CMT
CRAWFORD, MURPHY & TILLY, INC.
CONSULTING ENGINEERS
Licensed No. 184 000613

DATE: 10/09
DRAWN BY:
CHK'D BY:

SHEET TITLE	SEDIMENT DEPTH VALUES VERMILLION RIVER RAM TO 1/2 MILE UPSTREAM	
PROJECT	IAWC - VERMILLION RIVER STUDY	
DRAWING	1	



SEDIMENT DEPTHS WERE MEASURED WITH AN OVAL-SHAPED TELESCOPING LEVELING ROD.

WATER DEPTH WAS RECORDED AT FIRST DETECTION OF BOTTOM SUBSTRATE BY CREW MEMBER. THE ROD WAS THEN PUSHED TO REFUSAL DEPTH. REFUSAL DEPTH WAS RECORDED AND THE DIFFERENCE WAS CALCULATED BETWEEN READINGS.

A GPS LOCATION WAS RECORDED AT EACH SEDIMENT DEPTH LOCATION.

SEDIMENT DEPTHS WERE RECORDED ON A 20 FOOT GRID.

JUNE 12, 2009

CMT
 CRAWFORD, MURPHY & TILLY, INC.
 CONSULTING ENGINEERS
 License No. 194-000813

DATE: 10/09
 DRAWN BY:
 CHK'D BY:

SHEET TITLE	SEDIMENT DEPTH VALUES VICINITY - INTAKES	
PROJECT	IAWC - VERMILLION RIVER STUDY	DRAWING 1

Joint Effort

- Illinois American Water Company
- Crawford Murphy and Tilly Inc.
- AeroMetric (now part of Quantum Spatial)
- ProDive and Kentucky Hydrografx
- Illinois Department of Natural Resources

QUESTIONS AND COMMENTS

