Culvert Inspection Program and Replacement Projects Case Studies

Washtenaw County Road Commission Presenters
Aaron Berkholz, PE
James Hui

@Washtenawroads

What are culverts?

- A channel that allows water to flow under the road
- Per MDOT, Culvert size is typically under 20’ span

Type of Culverts

- They come in many shapes and materials
  - Shapes: Circular, Box, Pipe Arch, Arch
  - Materials: Plastic, Metal, Aluminum, Concrete



Managing Culverts -Why is it important?

- Prevent culvert/road failures
- Advance Budgeting
- Inform the local officials and residents
- Coordinate with major construction

Small Culverts, Big Impact

Braun Road – May 2019

Over 12 regional media outlets covered the Braun Road failure.

Unconventional Fixes

Old US 12 Road Culvert

Example For Replacement

Hitchingham Road Culvert

- Culvert ID: C2017006
- Size: 17’ Span x 24’ Length
- Type: Jack Arch over Concrete Abutments
- Condition: Closed

Hitchingham Road Culvert

Hitchingham Road Culvert

HJ5

Poll

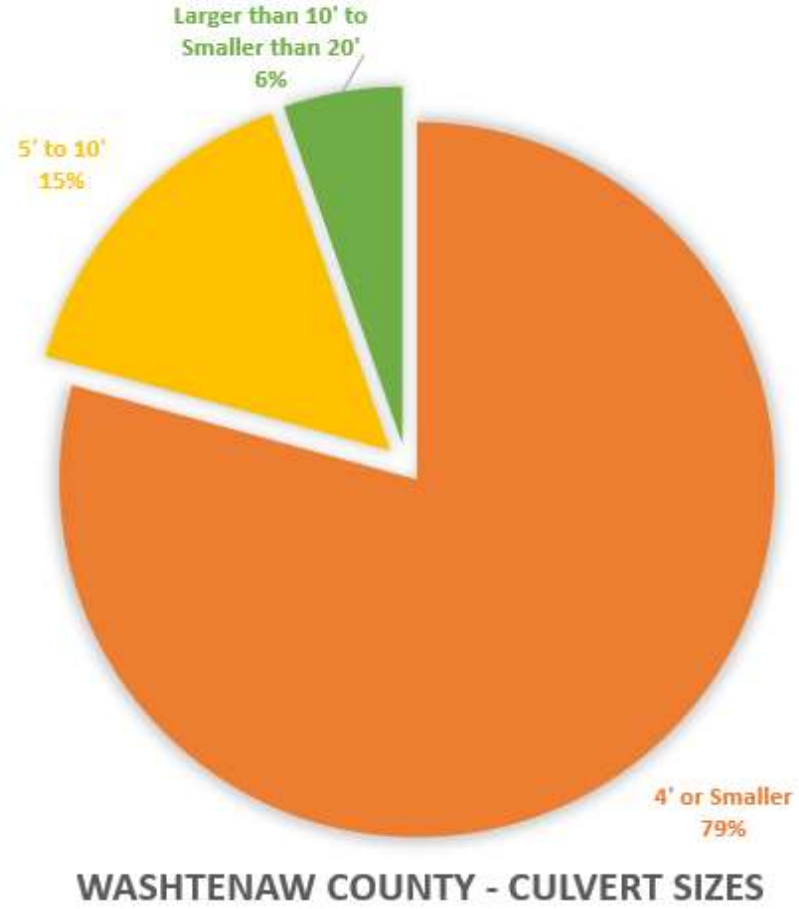
How many culverts are in your county?

A. Less than 1000
B. Between 1000-2000
C. Over 2000
D. More than I can count on one hand

Slide 10

HJ5 Set up a poll with Pete. Include multiple choice.
Hui, James, 2/4/2021

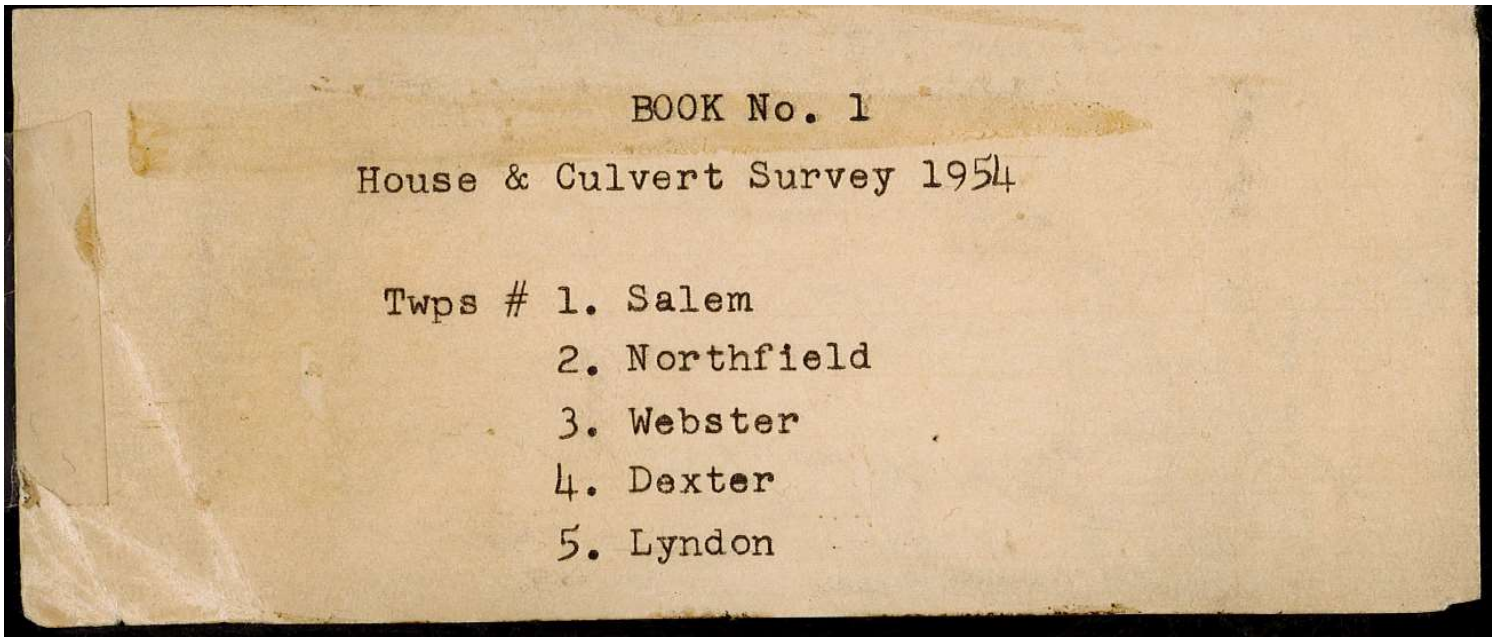
Washtenaw County Culvert Data



- Total of 2410 documented culverts

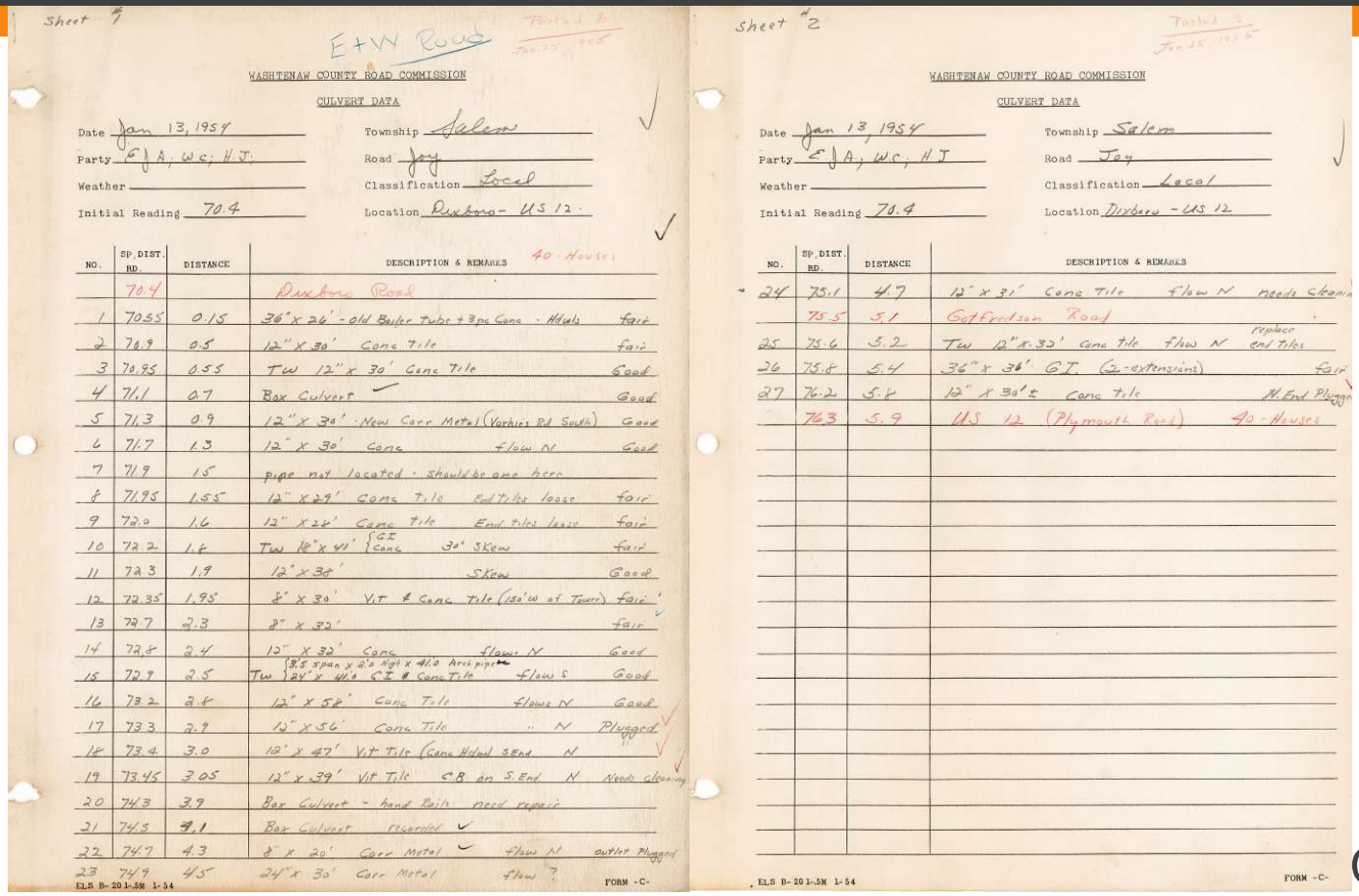
History of Asset Management -1950's

- In the beginning there was paper…… and it was good.



Culvert Book - 1954

History of Asset Management – 1950's



Sheet #1

E+W Road

WASHTENAW COUNTY ROAD COMMISSION

CULVERT DATA

Date Jan 13, 1954 Township Salem

Party E J A; W C; H J; Road Jay

Weather Classification Local

Initial Reading 70.4 Location Dixboro - US 12

40 Houses

NO.	SP. DIST. RD.	DISTANCE	DESCRIPTION & REMARKS	
	70.4		Dixboro Road	
1	70.55	0.15	36"x 26' - old Boiler Tube + 3pa Conc - Hdwls	fair
2	70.9	0.5	12" X 30' Conc Tile	fair
3	70.95	0.55	TW 12" x 30' Conc Tile	Good
4	71.1	0.7	Box Culvert	Good
5	71.3	0.9	12" X 30' New Corr Metal (Verhies Rd South)	Good
6	71.7	1.3	12" X 30' Conc flow N	Good
7	71.9	1.5	pipe not located - should be one here	
8	71.95	1.55	12" X 27' Conc Tile End Tiles loose	fair
9	72.0	1.6	12" X 26' Conc Tile End Tiles loose	fair
10	72.2	1.8	TW 18"x 41' CI Conc 30° Skew	fair
11	72.3	1.9	12" X 30' Skew	Good
12	72.35	1.95	8" X 30' V.I.T. & Conc Tile (150'W of Town)	fair
13	72.7	2.3	8" X 32'	fair
14	72.8	2.4	12" X 32' Conc flows N	Good
15	72.9	2.5	TW {3.5 Span x 2'0 High x 41.0 Arch pipe 24" X 41.0 CI & Conc Tile flow S	Good
16	73.2	2.8	12" X 58' Conc Tile flows N	Good
17	73.3	2.9	12" X 56' Conc Tile " N	Plugged
18	73.4	3.0	12" X 47' V.I.T. Tile (Conc Hdwl S End N	
19	73.45	3.05	12" X 39' V.I.T. Tile C.B. on S. End N	Needs Cleaning
20	74.3	3.9	Box Culvert - hand Rails need repair	
21	74.5	4.1	Box Culvert Regarded	
22	74.7	4.3	8" X 20' Corr Metal flow N	outlet Plugged
23	74.9	4.5	24" X 30' Corr Metal flow ?	

ELS B-20 1-5M 1-54 FORM -C-

Sheet #2

WASHTENAW COUNTY ROAD COMMISSION

CULVERT DATA

Date Jan 13, 1954 Township Salem

Party E J A; W C; H J Road Jay

Weather Classification Local

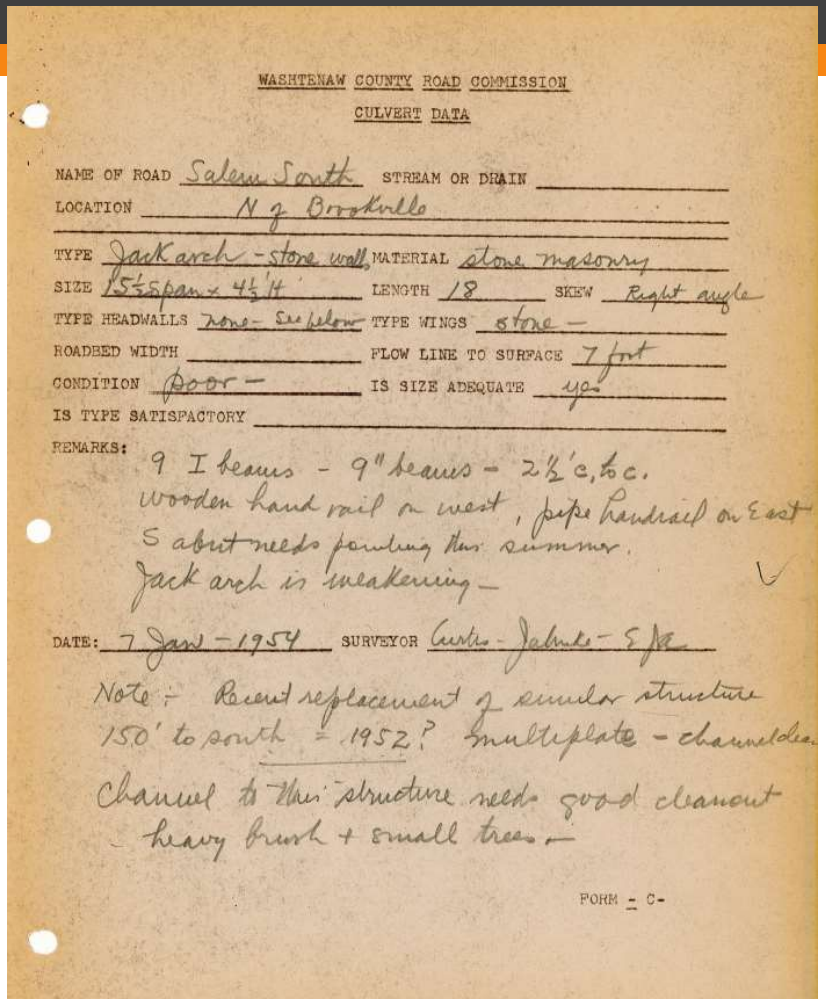
Initial Reading 70.4 Location Dixboro - US 12

NO.	SP. DIST. RD.	DISTANCE	DESCRIPTION & REMARKS	
24	75.1	4.7	12" X 31' Conc Tile flow N	needs cleaning
	75.5	5.1	Gottfredson Road	
25	75.6	5.2	TW 12" X 32' Conc Tile flow N	replace End Tiles
26	75.8	5.4	36" x 36' C.I. (2-extensions)	fair
27	76.2	5.8	12" X 30'± Conc Tile	N. End Plugged
	76.3	5.9	US 12 (Plymouth Road) 40 - Houses	

ELS B-20 1-5M 1-54 FORM -C-

Culvert Book - 1954

History of Asset Management – 1950's



WASHTENAW COUNTY ROAD COMMISSION

CULVERT DATA

NAME OF ROAD Salem South STREAM OR DRAIN _____

LOCATION N of Brookville

TYPE Jack arch - stone wall MATERIAL stone masonry

SIZE 15'Span x 4½'H LENGTH 18 SKEW Right angle

TYPE HEADWALLS none - See below TYPE WINGS stone -

ROADBED WIDTH _____ FLOW LINE TO SURFACE 7 feet

CONDITION poor - IS SIZE ADEQUATE yes

IS TYPE SATISPACTORY _____

REMARKS: 9 I beams - 9" beams - 2½'c,to c.
Wooden hand rail on west, pipe handrail on East
S about needs pointing this summer.
Jack arch is weakening -

DATE: 7 Jan - 1954 SURVEYOR Curtis - Jahnke - Eyre

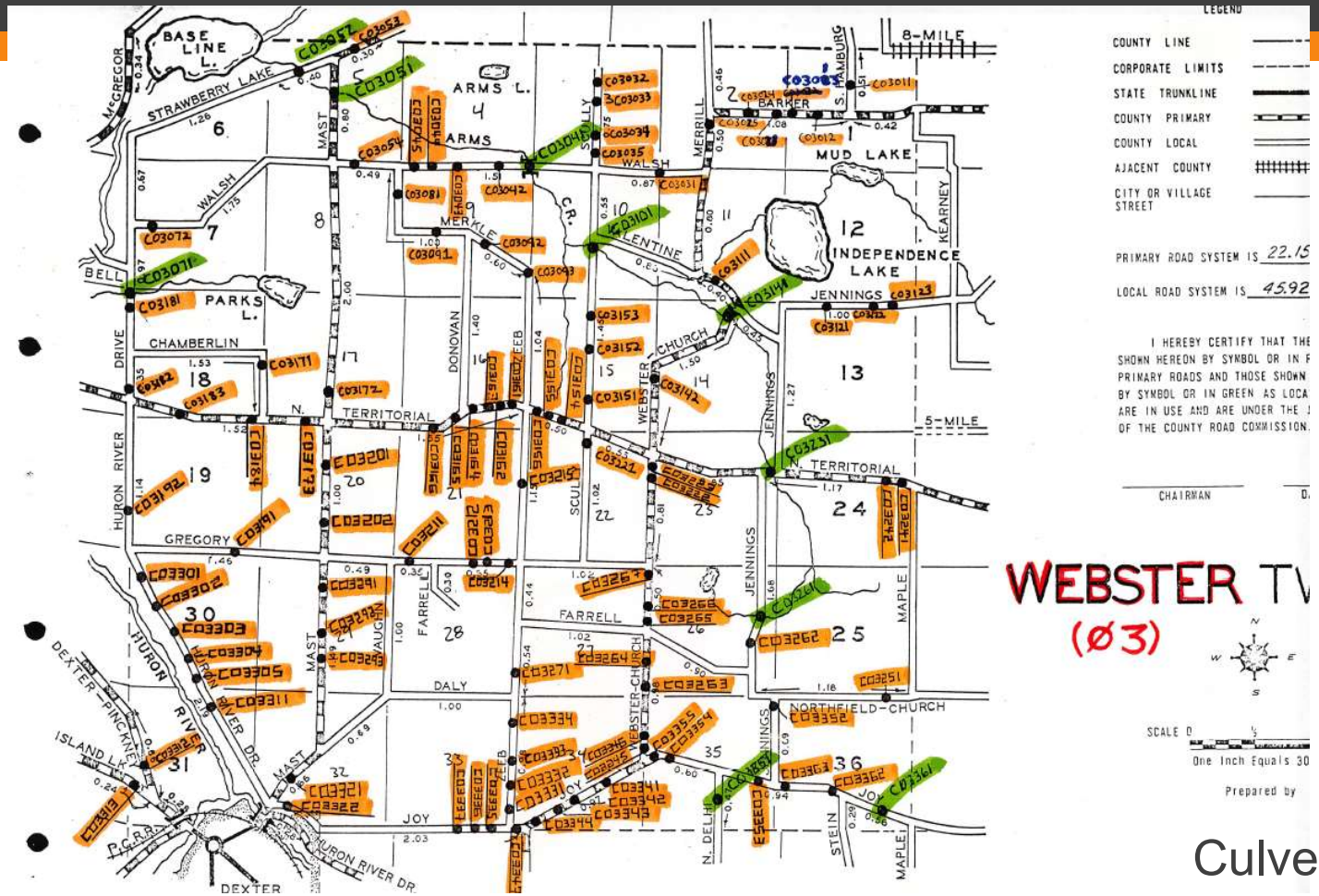
Note: Recent replacement of similar structure
150' to south - 1952? Smultiplate - channeled.

Channel to this structure needs good cleanout
- heavy brush + small trees -

FORM - C-

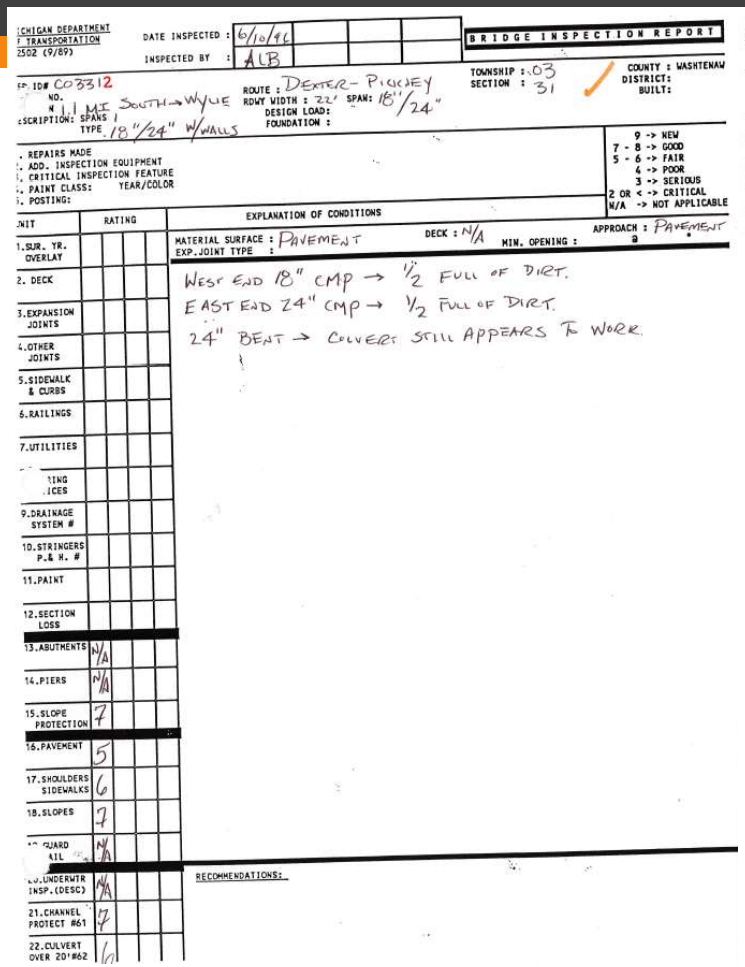
Culvert Book - 1954

History of Asset Management – 1990's



Culvert Book - 1996

History of Asset Management – 1990's



MICHIGAN DEPARTMENT OF TRANSPORTATION 2502 (9/89)

BRIDGE INSPECTION REPORT

DATE INSPECTED : 6/10/96
INSPECTED BY : ALB

ID# C03312 NO.
LOCATION: N.J. MI SOUTH → WYLIE
DESCRIPTION: SPANS 1 TYPE 18"/24" W/WALLS
ROUTE : DEXTER-PINCKNEY
RDWY WIDTH : 22' SPAN: 18"/24"
DESIGN LOAD:
FOUNDATION :
TOWNSHIP : 03
SECTION : 31
COUNTY : WASHTENAW
DISTRICT:
BUILT:

1. REPAIRS MADE
2. ADD. INSPECTION EQUIPMENT
3. CRITICAL INSPECTION FEATURE
4. PAINT CLASS: YEAR/COLOR
5. POSTING:

9 -> NEW
7 - 8 -> GOOD
5 - 6 -> FAIR
4 -> POOR
3 -> SERIOUS
2 OR < -> CRITICAL
N/A -> NOT APPLICABLE

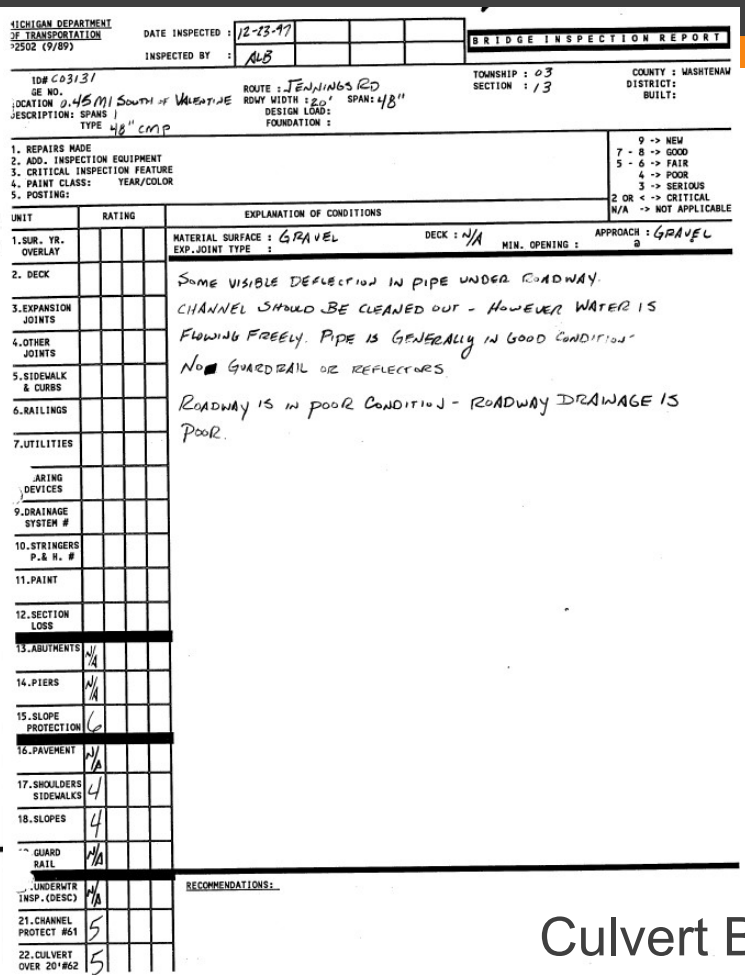
UNIT	RATING
1.SUR. YR. OVERLAY	
2. DECK	
3.EXPANSION JOINTS	
4.OTHER JOINTS	
5.SIDEWALK & CURBS	
6.RAILINGS	
7.UTILITIES	
ING ICES	
9.DRAINAGE SYSTEM #	
10.STRINGERS P.& H. #	
11.PAINT	
12.SECTION LOSS	
13.ABUTMENTS	N/A
14.PIERS	N/A
15.SLOPE PROTECTION	7
16.PAVEMENT	5
17.SHOULDERS SIDEWALKS	6
18.SLOPES	7
GUARD RAIL	N/A
UNDERWTR INSP.(DESC)	N/A
21.CHANNEL PROTECT #61	7
22.CULVERT OVER 20'#62	6

EXPLANATION OF CONDITIONS

MATERIAL SURFACE : PAVEMENT DECK : N/A MIN. OPENING : APPROACH : PAVEMENT
EXP.JOINT TYPE :

WEST END 18" CMP → 1/2 FULL OF DIRT.
EAST END 24" CMP → 1/2 FULL OF DIRT.
24" BENT → CULVERT STILL APPEARS TO WORK.

RECOMMENDATIONS:



MICHIGAN DEPARTMENT OF TRANSPORTATION 2502 (9/89)

BRIDGE INSPECTION REPORT

DATE INSPECTED : 12-13-97
INSPECTED BY : ALB

ID# C03131 GE NO.
LOCATION 0.45 MI SOUTH OF VALENTINE
DESCRIPTION: SPANS 1 TYPE 48" CMP
ROUTE : JENNINGS RD
RDWY WIDTH : 20' SPAN: 48"
DESIGN LOAD:
FOUNDATION :
TOWNSHIP : 03
SECTION : 13
COUNTY : WASHTENAW
DISTRICT:
BUILT:

1. REPAIRS MADE
2. ADD. INSPECTION EQUIPMENT
3. CRITICAL INSPECTION FEATURE
4. PAINT CLASS: YEAR/COLOR
5. POSTING:

9 -> NEW
7 - 8 -> GOOD
5 - 6 -> FAIR
4 -> POOR
3 -> SERIOUS
2 OR < -> CRITICAL
N/A -> NOT APPLICABLE

UNIT	RATING
1.SUR. YR. OVERLAY	
2. DECK	
3.EXPANSION JOINTS	
4.OTHER JOINTS	
5.SIDEWALK & CURBS	
6.RAILINGS	
7.UTILITIES	
ARING DEVICES	
9.DRAINAGE SYSTEM #	
10.STRINGERS P.& H. #	
11.PAINT	
12.SECTION LOSS	
13.ABUTMENTS	N/A
14.PIERS	N/A
15.SLOPE PROTECTION	6
16.PAVEMENT	N/A
17.SHOULDERS SIDEWALKS	4
18.SLOPES	4
GUARD RAIL	N/A
UNDERWTR INSP.(DESC)	N/A
21.CHANNEL PROTECT #61	5
22.CULVERT OVER 20'#62	5

EXPLANATION OF CONDITIONS

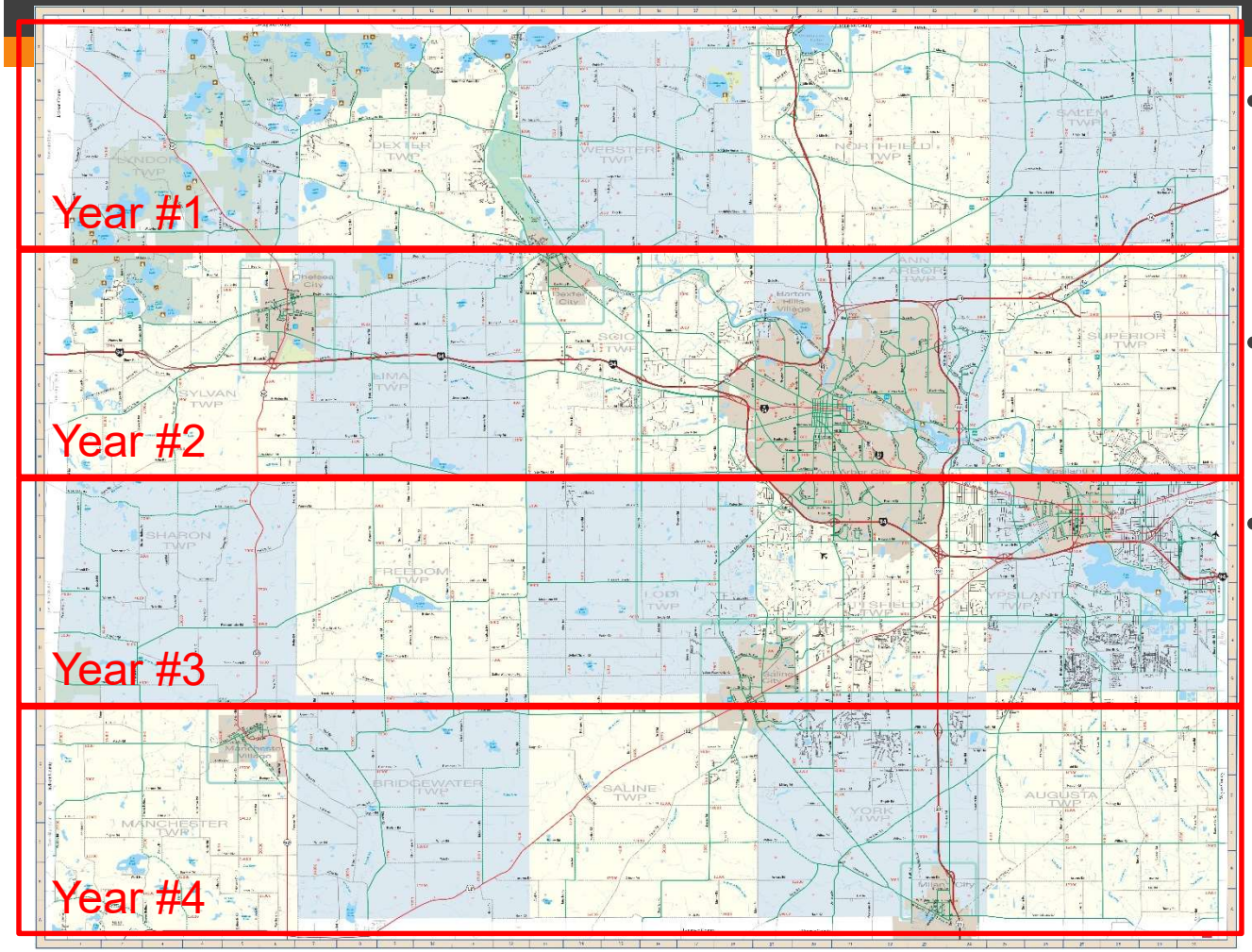
MATERIAL SURFACE : GRAVEL DECK : N/A MIN. OPENING : APPROACH : GRAVEL
EXP.JOINT TYPE :

SOME VISIBLE DEFLECTION IN PIPE UNDER ROADWAY.
CHANNEL SHOULD BE CLEANED OUT - HOWEVER WATER IS FLOWING FREELY. PIPE IS GENERALLY IN GOOD CONDITION.
NO GUARDRAIL OR REFLECTORS
ROADWAY IS IN POOR CONDITION - ROADWAY DRAINAGE IS POOR.

RECOMMENDATIONS:

Culvert Book - 1997

Culvert Inspection



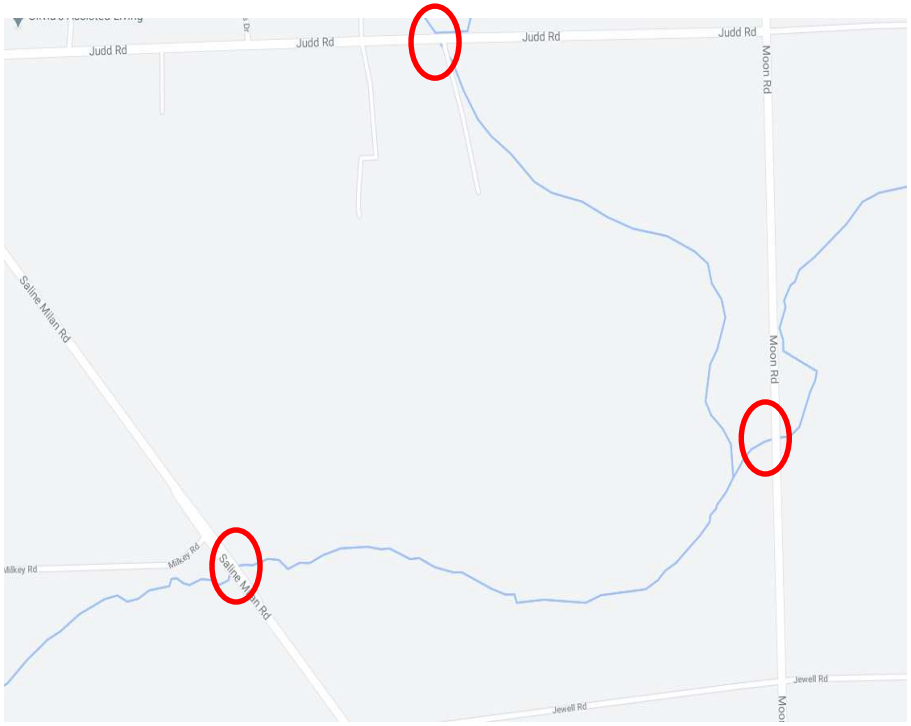
- Professional Inspection: Great Lakes Engineering
- 4 year inspection cycle for all culverts
- 2 year inspection cycle for **critical** culverts

Management Software

- Roadsoft – GIS Mapping Tool
  - Created by Center for Technology & Training

From Paper to Server

- Conversion of paper documentation
- New data (Existing and Replacement)
  - Interns
  - District Foremen
  - Proposed culvert replacement



HJ6

Question

Has your agency determined how many culverts to replace this upcoming year?

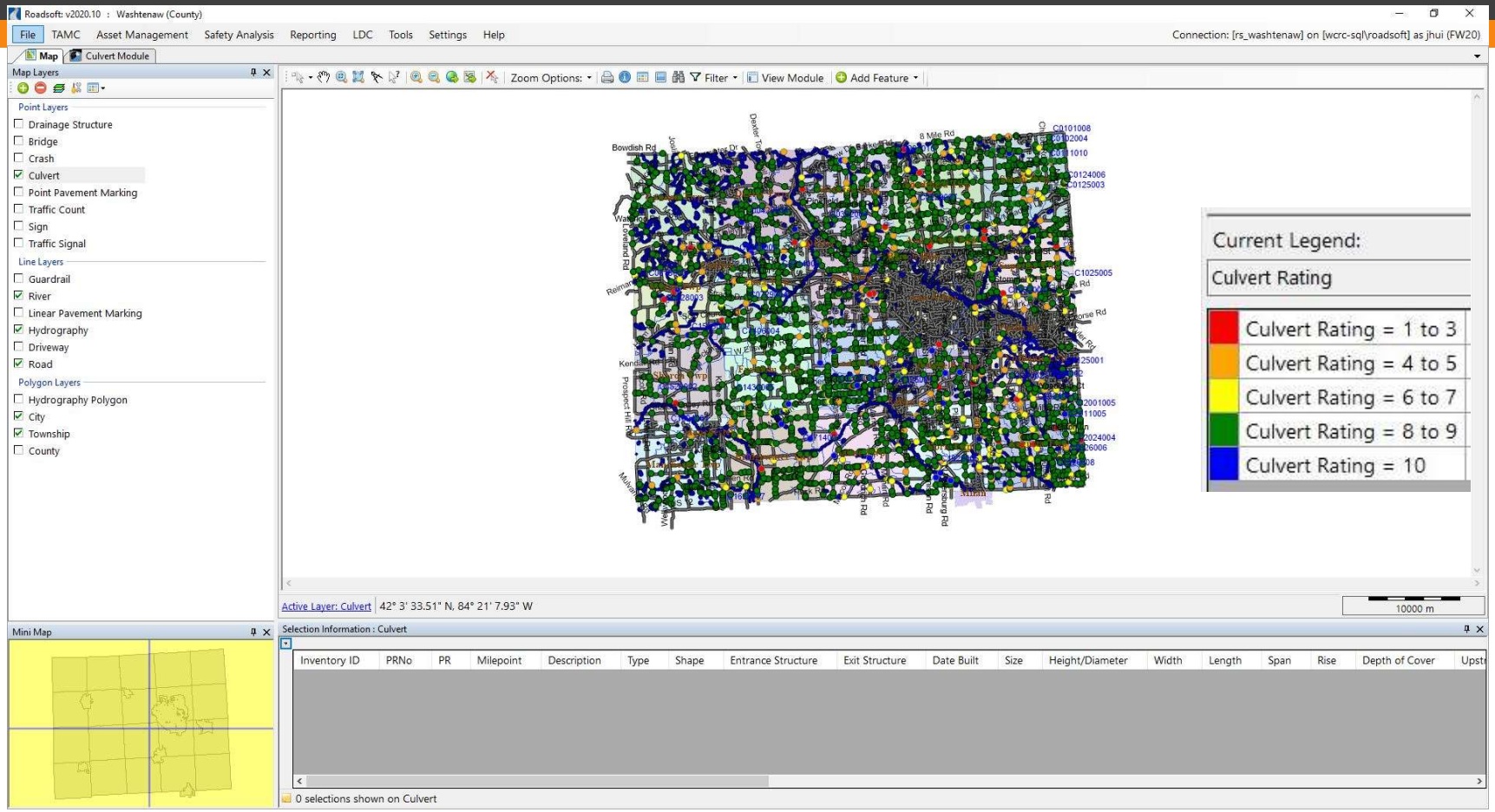
A. Yes
B. No
C. Working on them now
D. We usually decide when problem arises

Slide 20

HJ6 Work with Pete on a poll

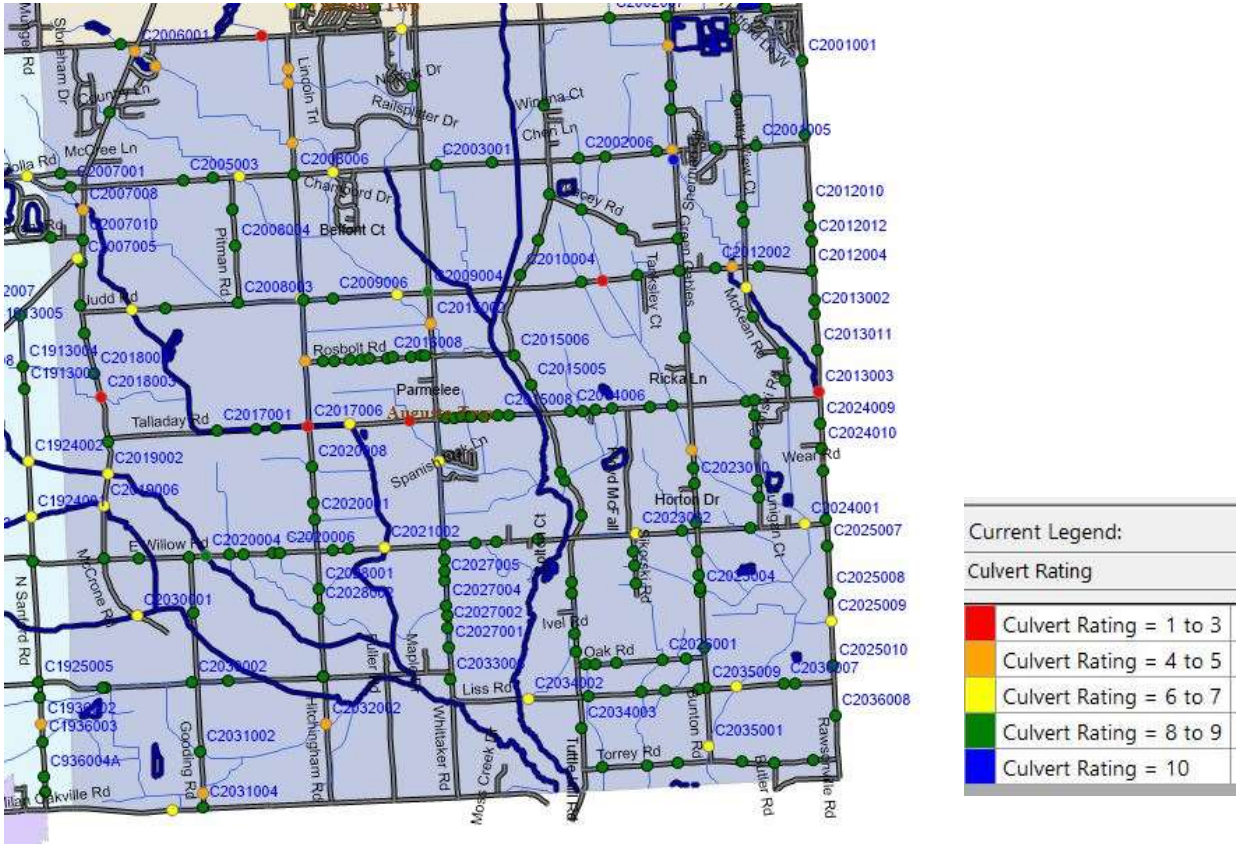
Hui, James, 2/4/2021

Roadsoft



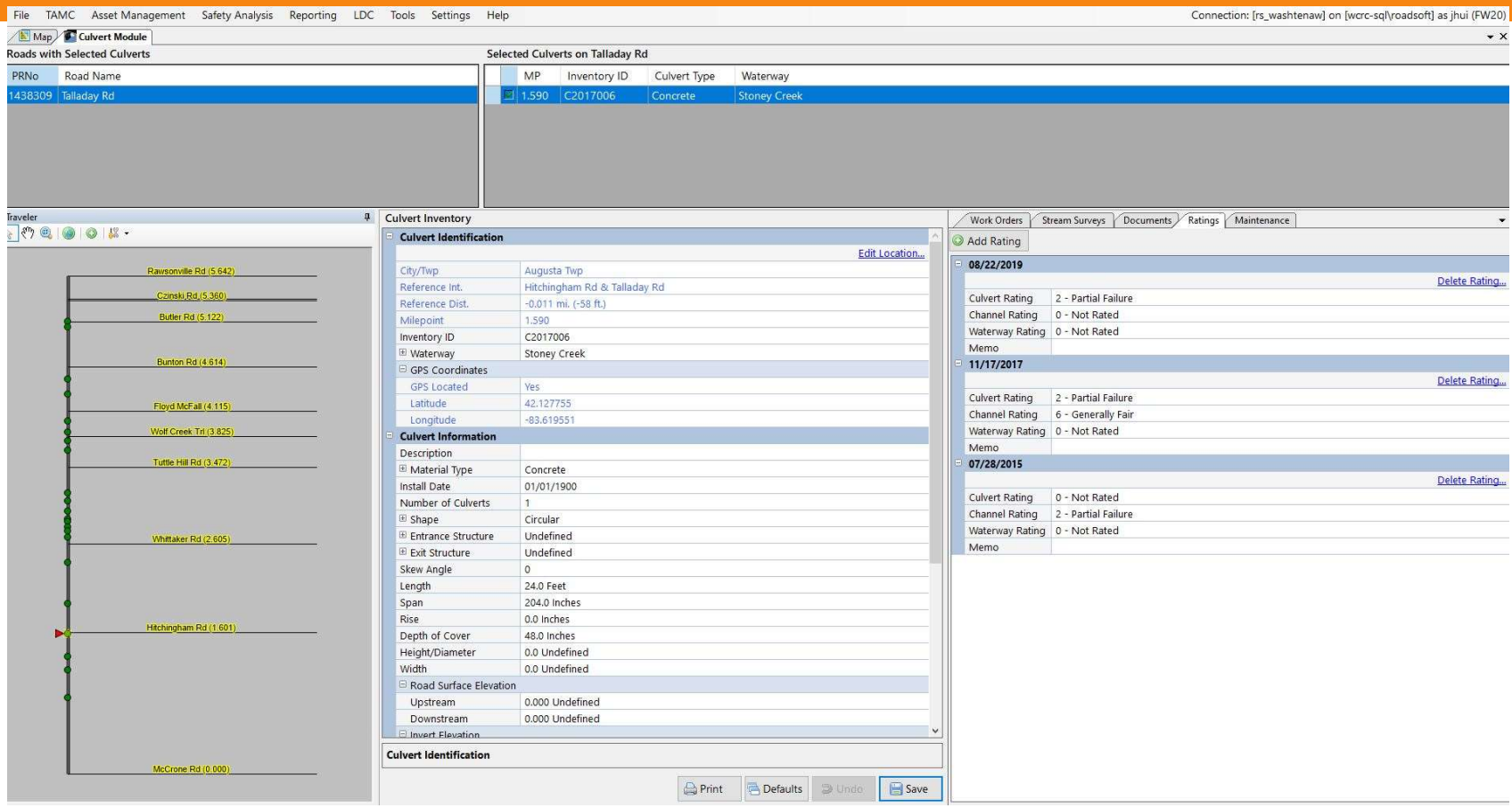
All culverts in Washtenaw

Roadsoft



Augusta Township, Washtenaw

Roadsoft



Culvert Module

Roadsoft

Bridge Safety Inspection Report

Facility	Federal Structure ID	Inspector Name	Agency/Consultant	Inspection Date
Hitchingham Rd		Ryan Lefere	GLEG	11/17/2017

Feature	Latitude	Longitude	Struc Num	Insp Freq	Insp Key
Stony Creek			C2017006	24	

Location	Length	Width	Year Built	Year Recon	Br Type		Scour Eval	No. Pins
Augusta Twp, Sect 17	17	24.0			3	2	3	

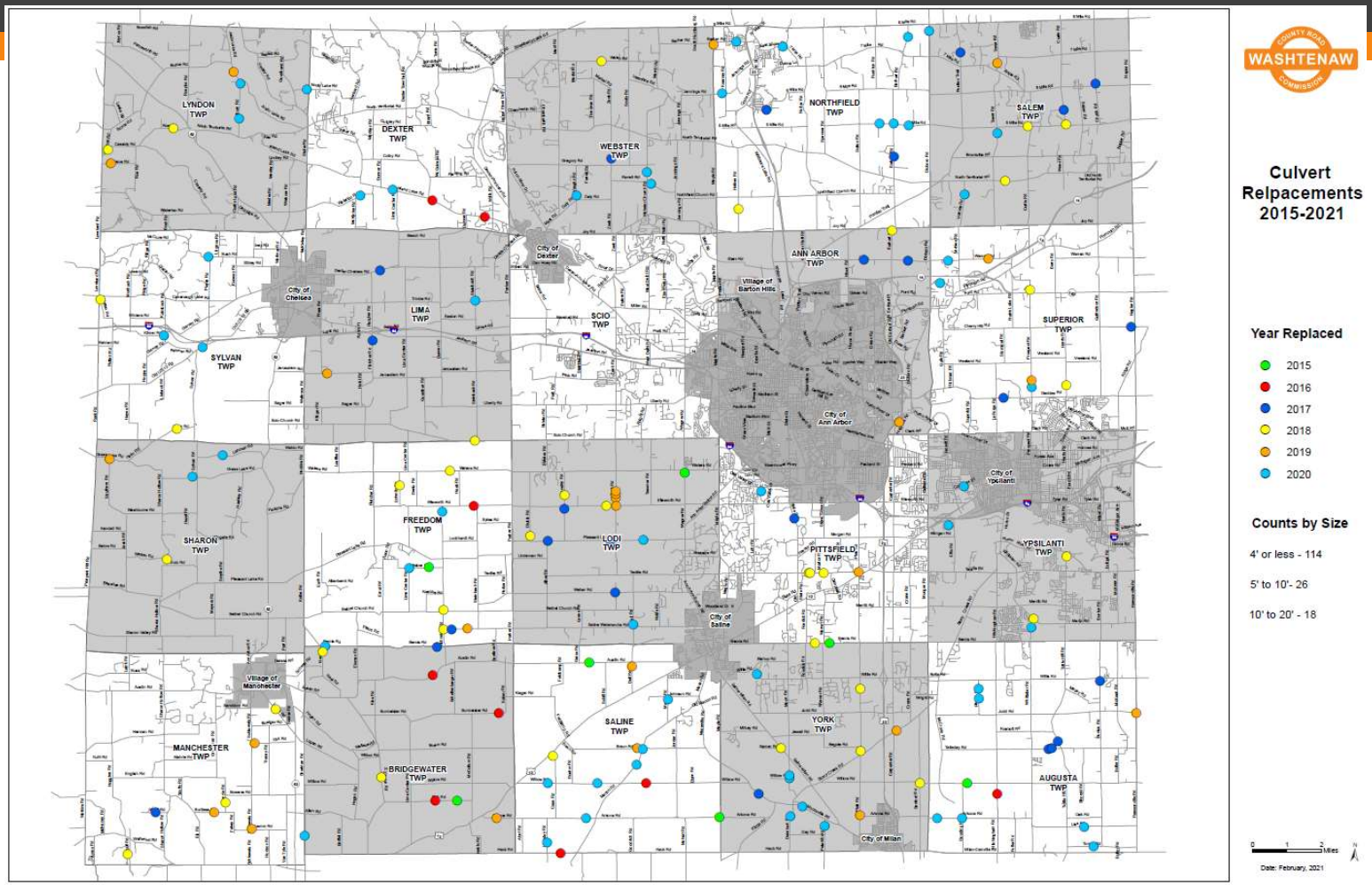
LEGEND	
9	New
7-8	Good
5-6	Fair
3-4	Poor
2 or less	Critical

Deck

1. Surface *SIA-58A*	6	Graded gravel over concrete. Outside 3' of deck surface closed. Barrels utilized to close shoulders. Missing barrels along both railings.
2. Expansion Jts	N	
3. Other Jts	N	
4. Railings	1	Railing attached to fascia channels. Both fascia channels have failed, therefore railings have no support.
5. Sidewalks or Curbs	N	

Culvert Report

Roadsoft – Completion Analysis



Replacement Priorities

- Budget for design and construction
- Township agreements
- Guardrails
- Primary Road vs Local Road
- Haul/Truck Route

Planning for Replacement

Time/Cost Factors

- ✓ EGLE Permits
- ✓ Drain Commission Permits
- ✓ ROW Needs
- ✓ Utility Conflicts

MISS DIG 811

EGLE

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

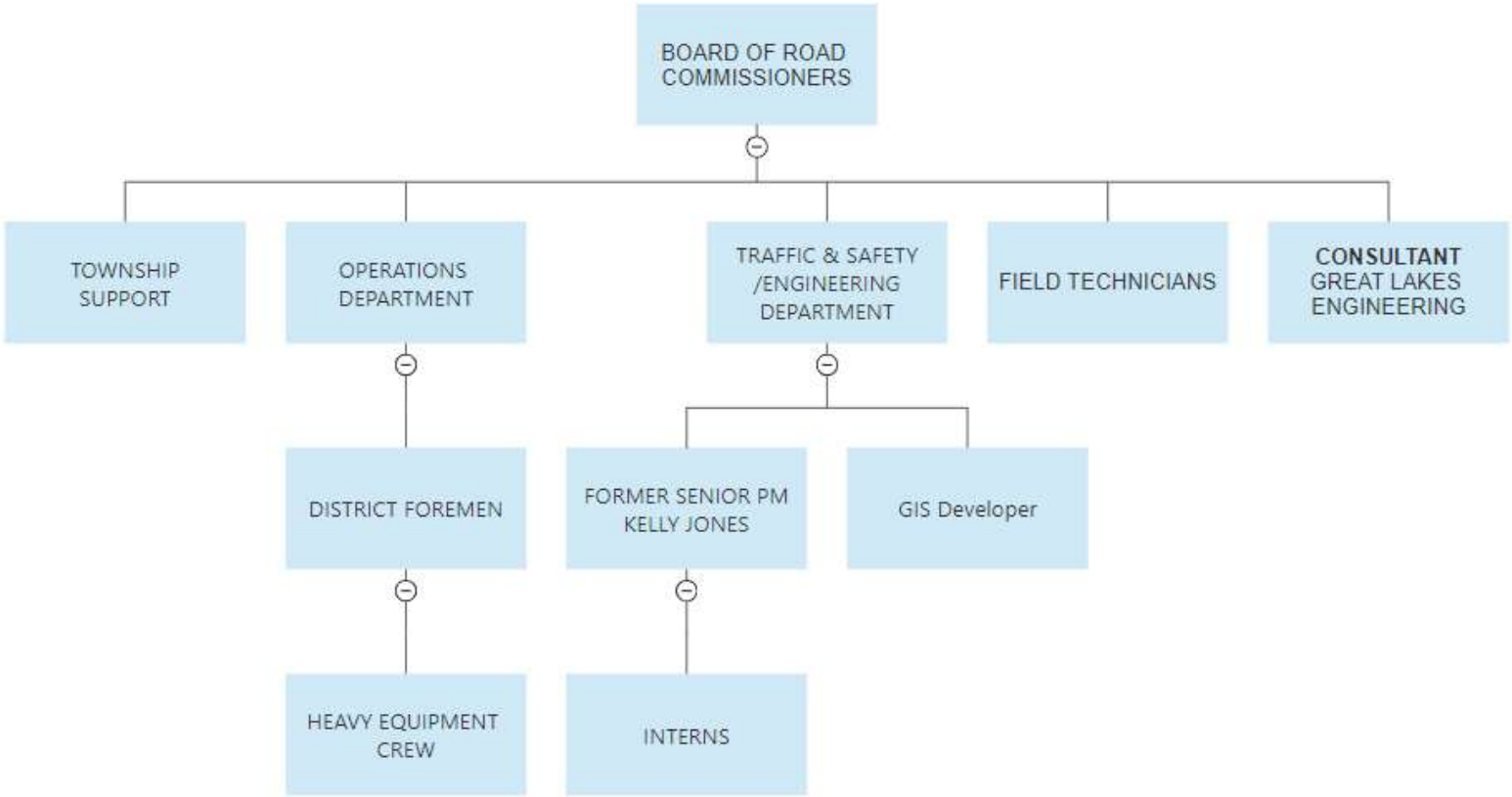
WASHTENAW COUNTY WATER RESOURCES COMMISSIONER

Planning for Replacement

Cost Efficiency Methods

- Ordering multiple culverts
- Packaging multiple culverts for bid
- Packaging culverts with nearby projects

To be Successful, It Takes a Village



THANK YOU!

COUNTY ROAD
WASHTENAW
COMMISSION

Halbert Road Culvert Replacement

2021 COUNTY ENGINEERS WORKSHOP

WIGHTMAN
it's all about people

CALHOUN COUNTY ROAD DEPARTMENT
ORGANIZED 1833
MICHIGAN

GOWIGHTMAN.COM

TODAY'S

Presentation

+ SAMUEL LEATCH, P.E.

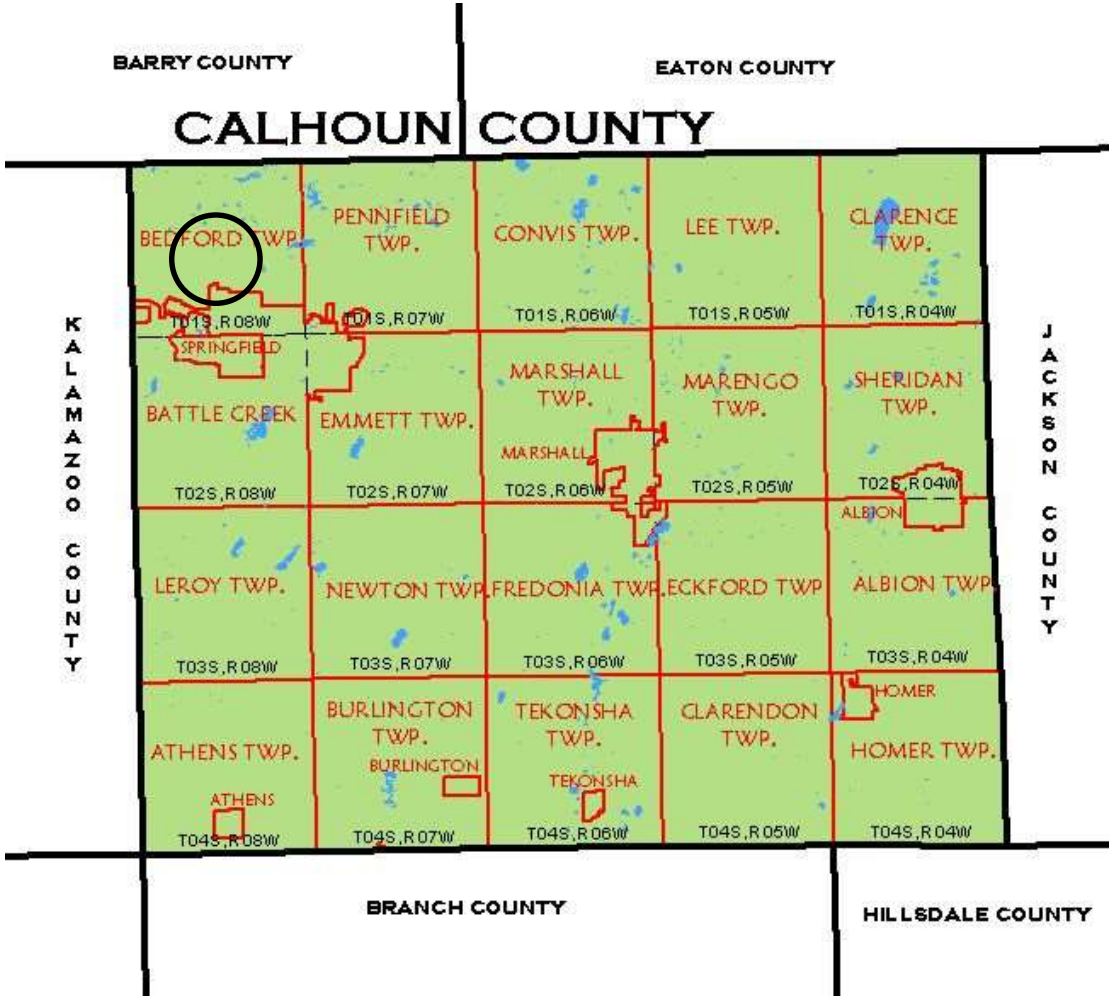
  WIGHTMAN & ASSOCIATES, INC.

  PROJECT MANAGER

PROJECT LOCATION

+ HALBERT ROAD OVER WAUBASCON CREEK
+ BEDFORD CHARTER TOWNSHIP
+ CALHOUN COUNTY

+ ±5 MILES NORTHWEST OF BATTLE CREEK



PROJECT LOCATION

+ HALBERT ROAD OVER WAUBASCON CREEK
+ BEDFORD CHARTER TOWNSHIP
+ CALHOUN COUNTY

+ ±5 MILES NORTHWEST OF BATTLE CREEK

PROJECT LOCATION

+ HALBERT ROAD OVER WAUBASCON CREEK
+ BEDFORD CHARTER TOWNSHIP
+ CALHOUN COUNTY

+ ±5 MILES NORTHWEST OF BATTLE CREEK

ORIGINAL CROSSING

- THREE 36-INCH CMP CULVERTS
- TWO 12-INCH CMP CULVERTS
- ±62 FEET IN LENGTH
- ORIGINAL CULVERTS WERE ALIGNED DOWNSTREAM, HOWEVER, WERE ±30-DEGREES MISALIGNED UPSTREAM
- ROADWAY HAD A SLIGHT BEND AT THE LOCATION OF THE CROSSING

ORIGINAL ALIGNMENT

PROJECT NEED

- ONE OF THE CULVERTS HAD FAILED
- BACKFILL WAS CONTINUOUSLY FALLING INTO THE CULVERT CAUSING PAVEMENT FAILURE
- REQUIRED ROUTINE HMA PATCHING
- EROSION UPSTREAM OF CULVERTS

ALTERNATIVE ANALYSIS

+ ALTERNATIVE 1 – DO NOTHING
  - MAINTAIN EXISTING CROSSING
  - NOT ACCEPTABLE DUE TO SAFETY CONCERNS

+ ALTERNATIVE 2 – CLEAR SPAN BRIDGE
  - ±60 FOOT SPAN FROM BANK TO BANK
  - FREEBOARD CLEARANCE CONCERNS DUE TO THE LOW PROFILE OF THE ROADWAY
  - INCREASED WETLAND IMPACTS
  - ESTIMATED CONSTRUCTION COST: $750,000

ALTERNATIVE ANALYSIS

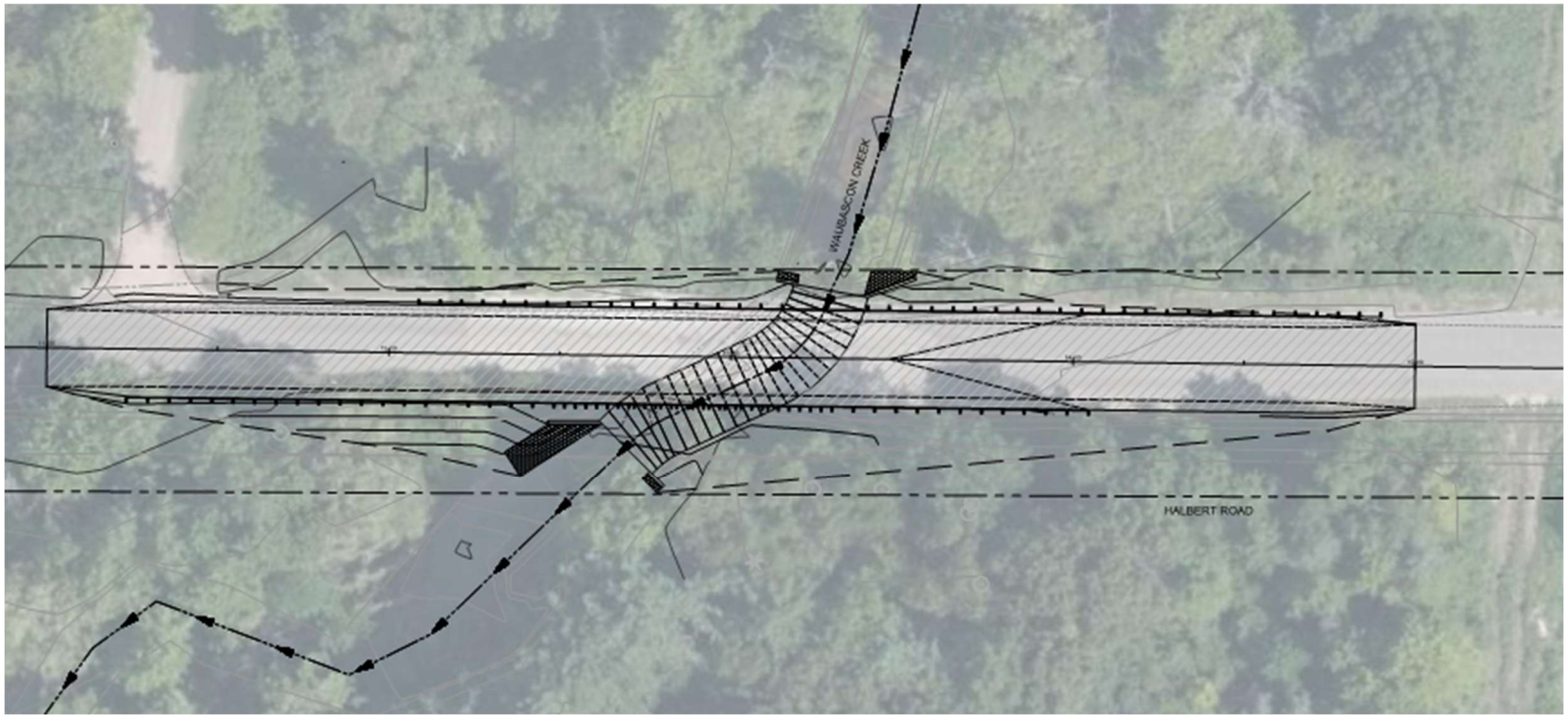
+ ALTERNATIVE 3 – TRADITIONAL CULVERT
  - STRAIGHT CULVERT
  - WOULD NOT SOLVE ALIGNMENT ISSUES
  - EROSION/SCOUR CONCERNS DUE TO THE MISALIGNMENT OF THE CULVERT

+ ALTERNATIVE 4 – CURVED CULVERT
  - UNIQUE SOLUTION THAT COULD SOLVE ALIGNMENT ISSUES
  - MITIGATE EROSION/SCOUR CONCERNS
  - COST EFFECTIVE

PROPOSED DESIGN

- 20-FOOT BY 5-FOOT CURVED CONCRETE BOX CULVERT
- 23 TOTAL CONCRETE BOX SECTIONS
- 15 SKEWED SECTIONS (5-DEGREE SKEW)
- 8 STANDARD STRAIGHT SECTIONS
- ALIGNED THE CULVERT WITH BOTH THE UPSTREAM AND DOWNSTREAM SECTIONS OF THE CREEK
- 1-FOOT OF NATIVE MATERIAL WITHIN CULVERT TO PROVIDE A NATURAL STREAM BOTTOM
- INSTALL RIPRAP AT INLET/OUTLET TO MITIGATE EROSION CONCERNS
- CUSTOM GUARDRAIL DESIGN TO ENSURE GUARDRAIL POSTS DID NOT INTERFERE WITH THE CULVERT JOINTS
- RE-ALIGN ROADWAY TO REMOVE THE SLIGHT BEND

PROPOSED ALIGNMENT



DURING CONSTRUCTION

FINAL IMAGERY

SIDE-BY-SIDE

PROJECT SUMMARY

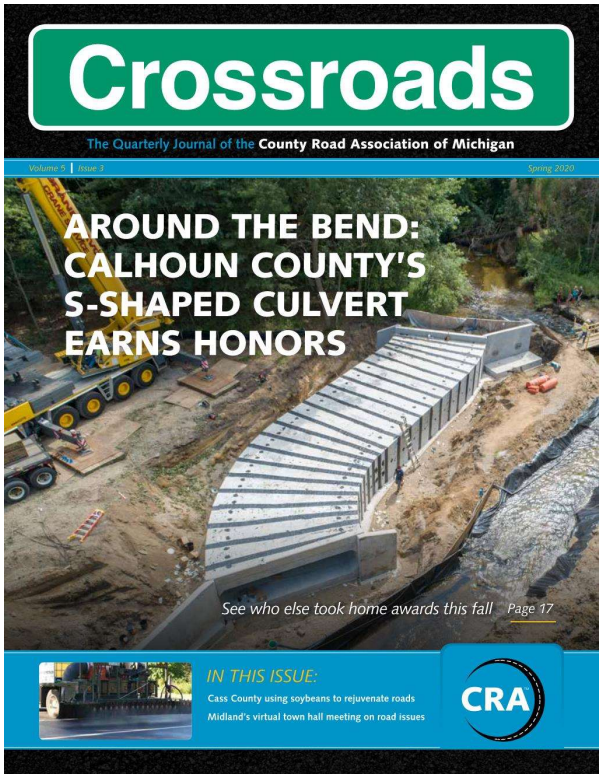
+ PROJECT SUCCESSES
  - MINIMIZED WETLAND IMPACTS
  - PROVIDE PROPER ALIGNMENT
  - REDUCED SCOUR POTENTIAL
  - IMPROVED ROADWAY SAFETY

+ PROJECT STATS
  - CONSTRUCTION START: JULY 15, 2019
  - FINAL COMPLETION: AUGUST 30, 2019
  - 2 DAYS TO INSTALL THE STRUCTURE
  - AWARDED BID: $308,555

AWARDS

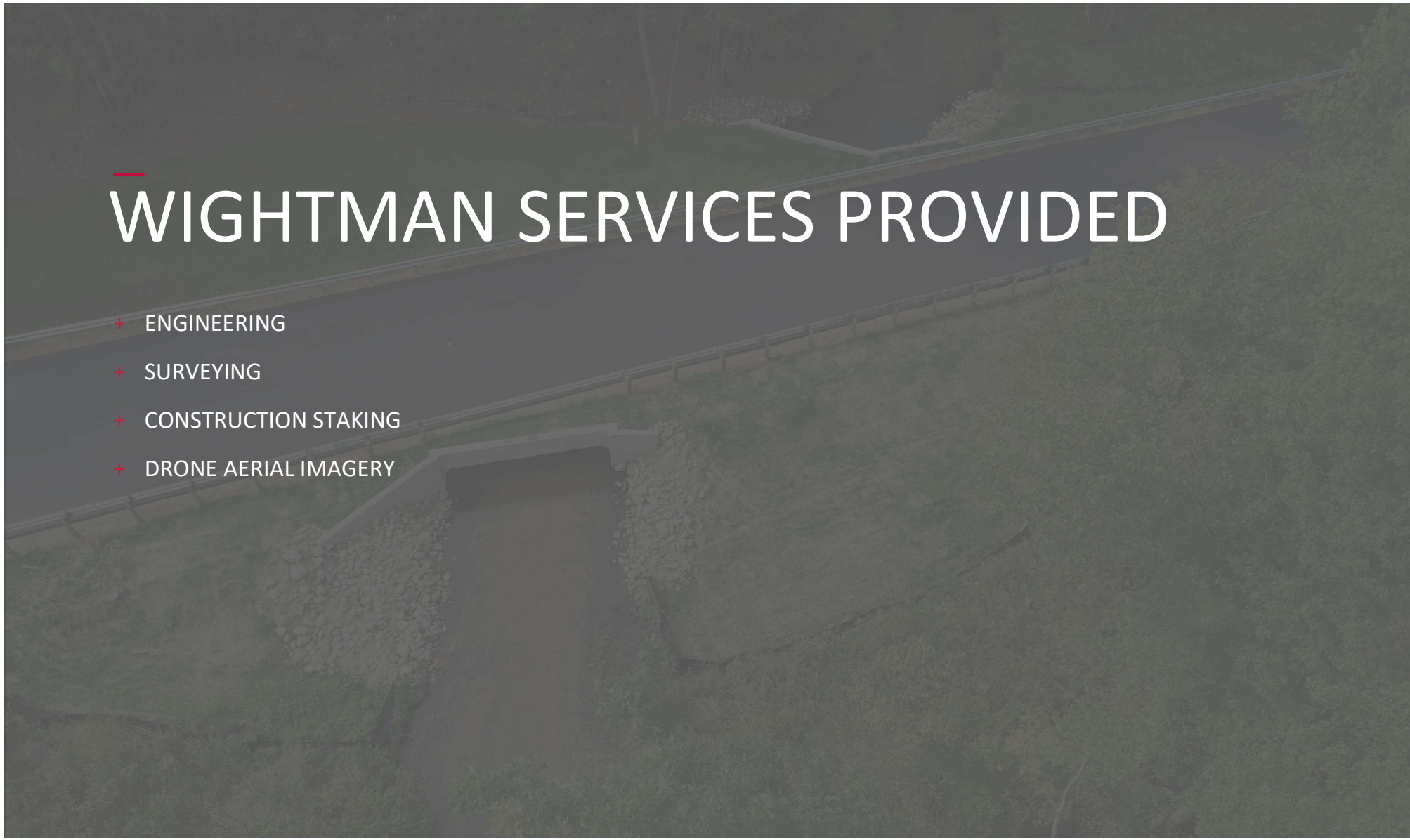
+ MICHIGAN CONCRETE ASSOCIATION'S 2020 MICHIGAN AWARDS OF EXCELLENCE
  - CATEGORY: STRUCTURAL – TRANSPORTATION
  - OVER 50 PROJECTS SUBMITTED

PUBLICATIONS



PARTNERSHIPS

- OWNER - CALHOUN COUNTY ROAD DEPARTMENT
- PERMITTING AGENCY - MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES & ENERGY
- SUPPLIER - NORTHERN CONCRETE PIPE
- PRIME CONTRACTOR - BALKEMA EXCAVATING
- ENGINEER – WIGHTMAN & ASSOCIATES, INC.



WIGHTMAN SERVICES PROVIDED

- ENGINEERING
- SURVEYING
- CONSTRUCTION STAKING
- DRONE AERIAL IMAGERY

QUESTIONS?

+ SAMUEL LEATCH, P.E.

WIGHMAN & ASSOCIATES, INC.

PROJECT MANAGER

(269) 487-9106

SLEATCH@GOWIGHTMAN.COM