Use TAMS-HydInfra Suggested Repair Method to develop an automated Culvert Repair Cost Estimate

DEPARTMENT OF TRANSPORTATION

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Statewide Pipe Repairs Cost Estimate from TAMS-HydInfra Suggested Repair Report could be automated

		Repair method
District	1	
		CIPL
		Grout
		Jack
		Paved Invert
		Reset
		Slipline
		Trench

Cost
$183.973
$77.387
$968.165
$40.212
$323.374
$1.552.383
$2.260.010

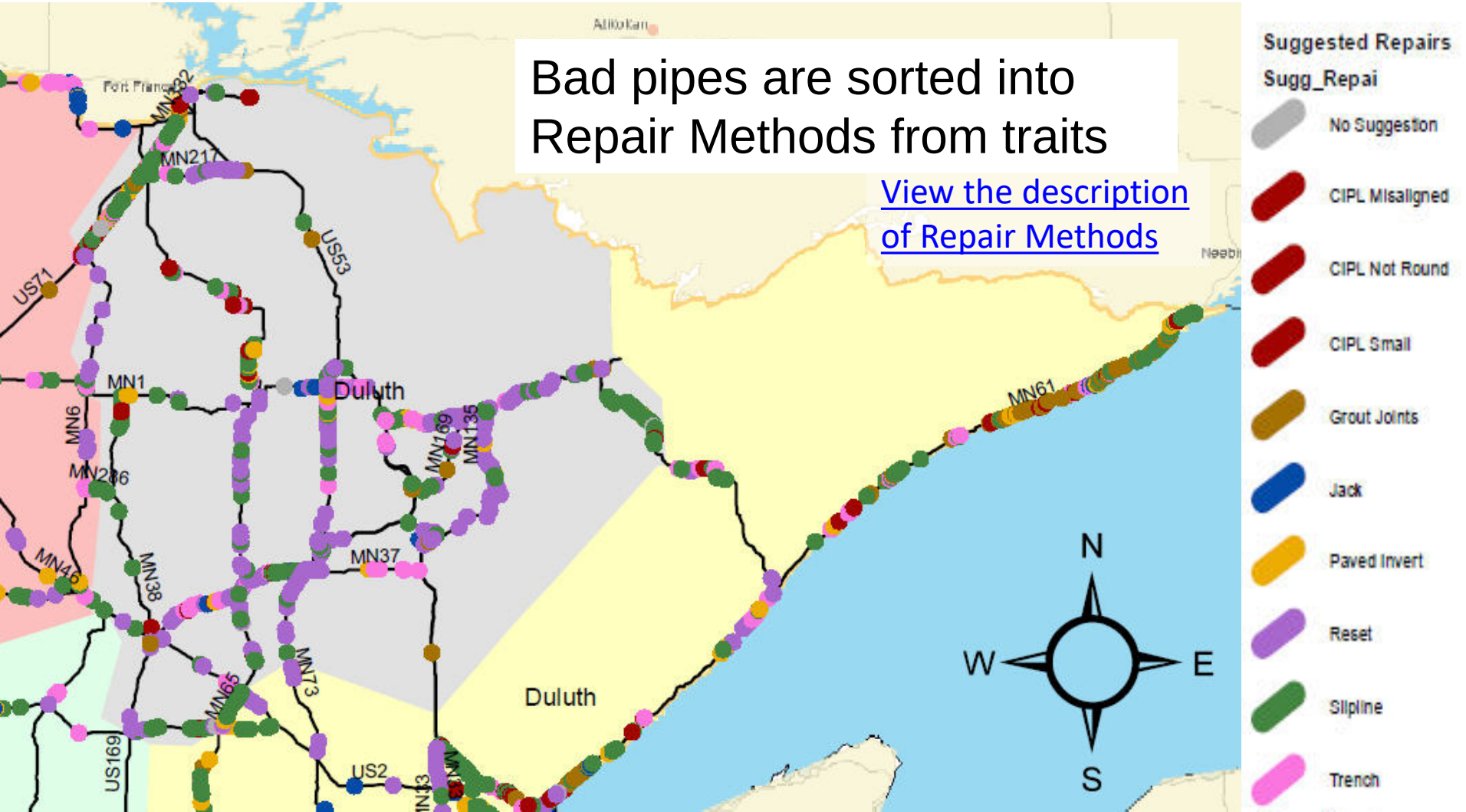
	A	B	C					H	I	L	R
1			Repair me					ntract average bid			Contract
2								Unit Pi		tract	Total Cost
3	District	1									
4			CIPL							,973	
5			Grout							,387	
6			Jack							,165	
7			Paved Inv							,212	
8			Reset					$2,4		,374	
9			Slipline							,383	
10			Trench					$26,3		,010	$5,405,504
11	District	2									
12			CIPL							,533	
13			Grout							,978	
14			Jack							,593	
15			Paved Inv							,597	
16			Reset					$2,4		,980	
17			Slipline	45	3562	$93.22	foot			$365,255	
18			Trench	21	1633	$65.37	foot	$26,362.84	each	$726,406	$1,893,341
19	District	3									
20			CIPL							$518,691	
21			Grout							$23,009	
22			Jack							$1,025,585	
23			Paved Invert							$2,715	
24			Reset							$29,643	
25			Slipline							$393,043	2010
26			Trench							$915,860	$2,908,546

In 2010, HydInfra data with Suggested Repair Method was used to calculate costs for repair or replacement of MnDOT's bad pipes state-wide, by D8 Johnston and Solsrud

TAMS-HydInfra Inspection finds bad culverts and suggests a repair method for each

- HydInfra Culvert Inventory and Inspection captures pipe traits:
  - Size
  - Shape
  - Material
  - Defects
  - Depth of cover
- Suggested Repair Method is an automated selection process that sorts bad pipes by traits to estimate types of repairs needed
- Costs could be applied to all HydInfra pipes based on the Suggested Repair. This was done in a spreadsheet in 2010, using ballpark costs.

TAMS-HydInfra Suggested Repair sorts pipes by traits

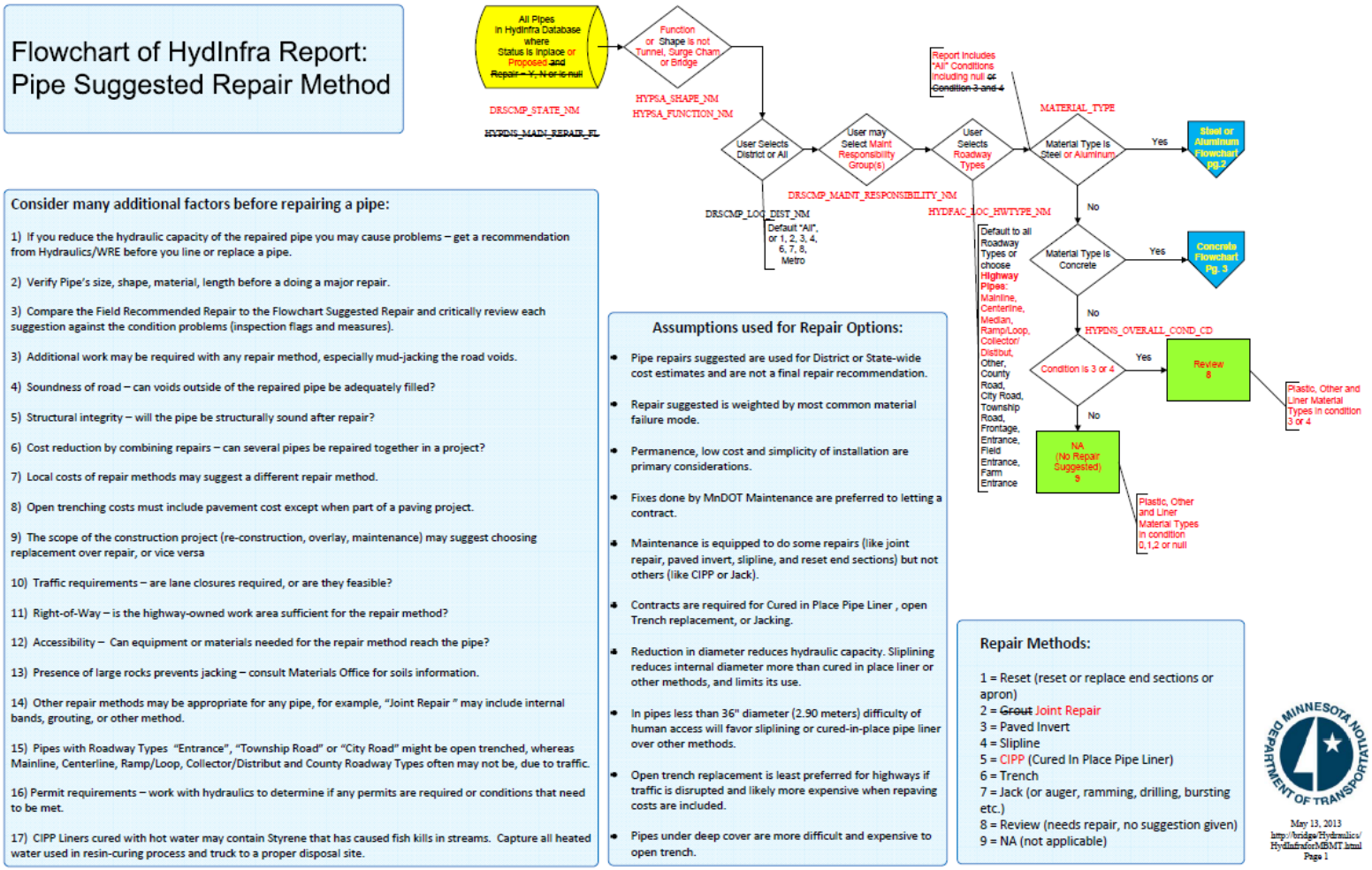


“Suggested Repair Method” selects bad culverts for 7 potential repairs

	A	B	C	D	E	F	G	H	J	K	L	M	S	X	Z
1	Pipe	Route Numb	BMP	Roadway Type	Current Pipe Shap	Current Inside Material	Inside Width (In)	Inside Height (In)	Pipe Width (In)	Pipe Height (In)	Total Length (Ft)	Cover at Upstream Road Edge (Ft)	Inv Suggested Repai	Inspection Date	Overall Conditio n
1358	2181552	MN23	174.0545	Centerline	Round	Corg. Steel (CSP)	24	24	24	24	75	8	Install Pipe - Trench	7/19/2017	4 - Severe
1361	384619	MN23	174.566	Centerline	Box	Concrete	48	72	36	60	75	8	Reset	7/19/2017	3 - Poor
1366	2304896	MN23	176.3186	Centerline	Box	Concrete	48	72	48	72	100	8	Reset	7/19/2017	2 - Fair
1367	2181741	MN23	176.3344	Mainline	Round	Concrete	30	30	24	24	80	15	Reset	7/19/2017	4 - Severe
1369	2181742	MN23	176.5738	Mainline	Round	Concrete	24	24	24	24	75	4	Joint Repair	5/9/2017	3 - Poor
1370	2181743	MN23	177.0911	Mainline	Round	Concrete	24	24			60	4	Reset	8/1/2017	4 - Severe
1371	2181744	MN23	178.1267	Mainline	Round	Concrete	24	24			80	4	Joint Repair	5/9/2017	3 - Poor
1375	2181745	MN23	178.9889	Mainline	Round	Concrete	24	24	24	24	100	15	Joint Repair	8/1/2017	3 - Poor
1382	2181734	MN23	180.6827	Mainline	Round	Concrete	24	24	24	24	200	15	Reset	8/1/2017	4 - Severe
1386	2181735	MN23	180.9052	Mainline	Round	Concrete	30	30	36	36	60	4	Reset	8/1/2017	3 - Poor
1505	2246391	MN23	196.2964	Centerline	Round	Corg. Steel (CSP)	24	24	24	24	400	15	Paved Invert	7/16/2018	4 - Severe
1536	2246346	MN23	199.2569	Median	Round	Concrete	18	18	18	18	10	4	Reset	7/16/2018	4 - Severe
1550	2304968	MN23	206.0624	Mainline	Round	Corg. Steel (CSP)	18	18	18	18	70	2	Reset	11/2/2017	3 - Poor
1562	2181608	MN23	208.0934	Mainline	Round	Concrete	30	30	30	30	172	4	Reset	11/2/2017	3 - Poor
1566	2181611	MN23	208.6363	Mainline	Round	Corg. Steel (CSP)	18	18	18	18	66	4	Paved Invert	11/2/2017	3 - Poor
1706	2246071	MN23	218.7151	Mainline	Round	Concrete	24	24	24	24	88	4	Reset	8/24/2016	3 - Poor
1726	2246072	MN23	219.7427	Mainline	Round	Concrete	30	30	30	30	60	4	Reset	9/5/2017	4 - Severe
1747	2246078	MN23	222.589	Mainline	Round	Concrete	24	24	24	24	66	4	Reset	9/6/2017	3 - Poor
1823	2246667	MN23	230.4245	Centerline	Round	Concrete	24	24	24	24	138	20	Joint Repair	7/16/2018	4 - Severe
1831	2246668	MN23	231.0052	Mainline	Round	Concrete	24	24	24	24	80	8	Joint Repair	7/16/2018	4 - Severe
1834	2246669	MN23	231.3603	Centerline	Round	Concrete	30	30	30	30	100	8	Joint Repair	9/4/2018	4 - Severe

Suggested Repair Method is calculated in a TAMS data field.

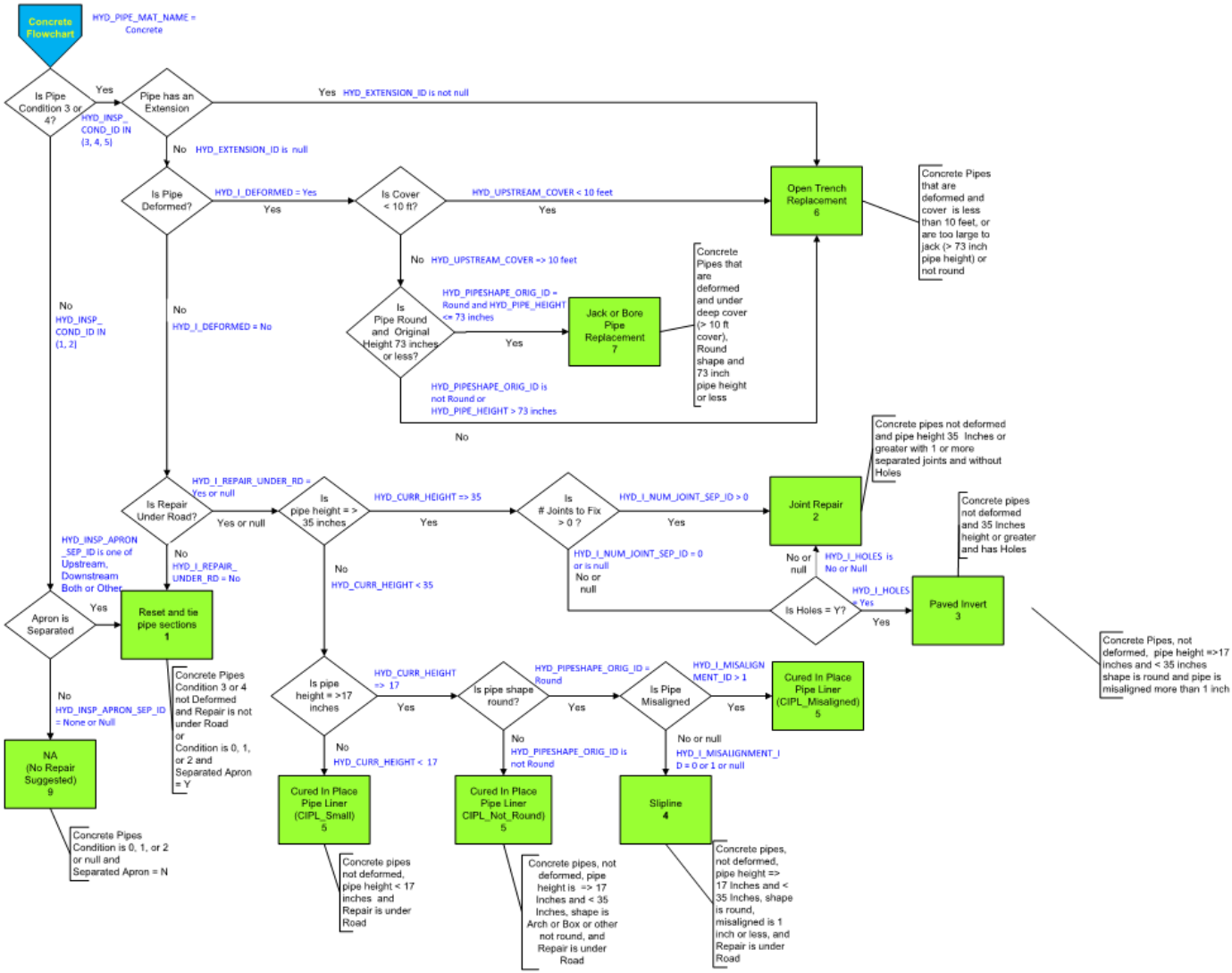
The sorting process for HydInfra Suggested Repair is described in this flowchart



Flowchart – HydInfra Suggested Repair Method for Highway Culverts (PDF)

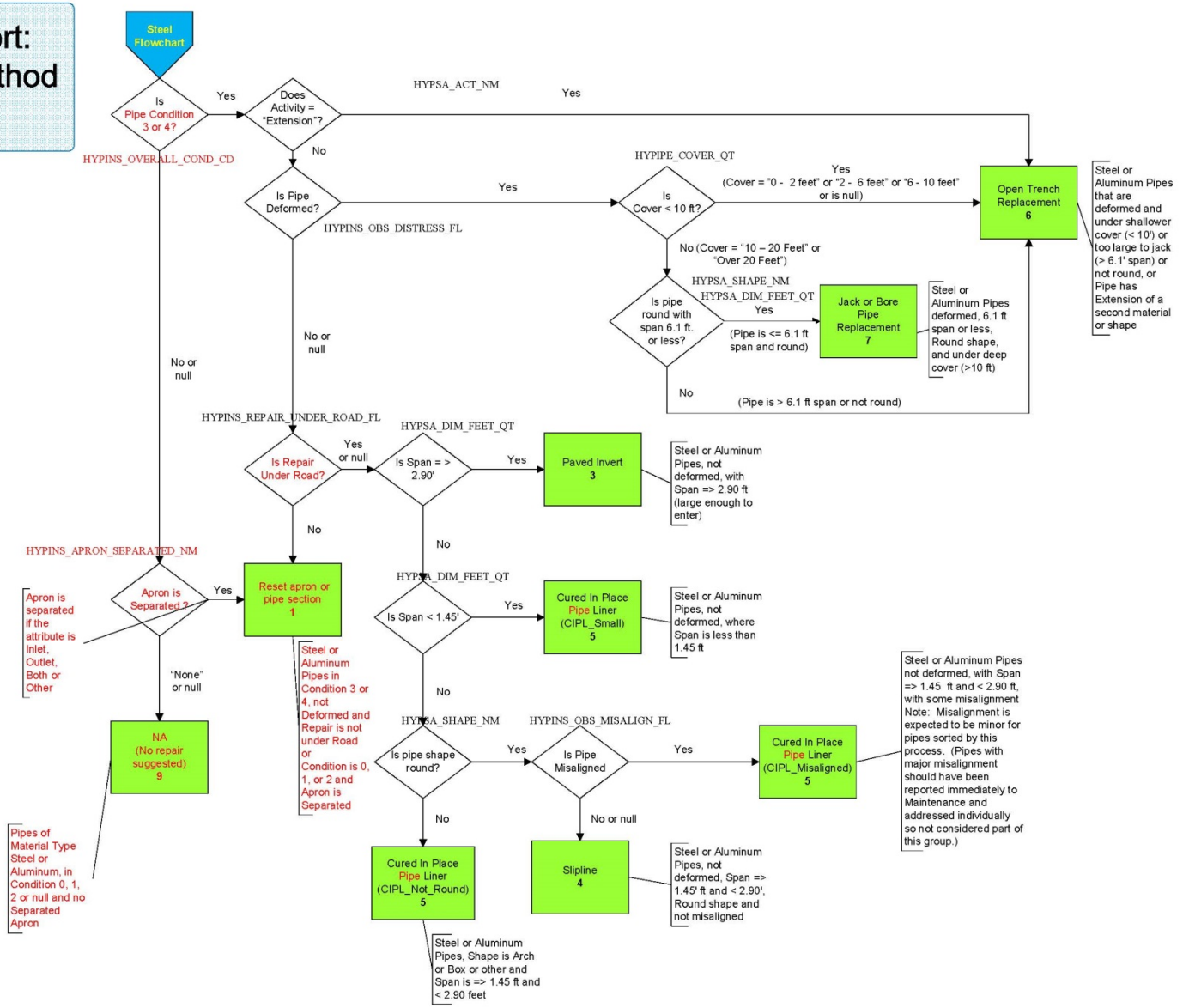
Concrete pipe Suggested Repair sorting process covers the most common Concrete pipe problems

TAMS-HydInfra
Pipe Flowchart Repair
Concrete Pipes



Suggested Repair for Corrugated Steel or Aluminum Culverts differs from Concrete

Flowchart of HydInfra Report: Pipe Suggested Repair Method Steel or Aluminum Pipes



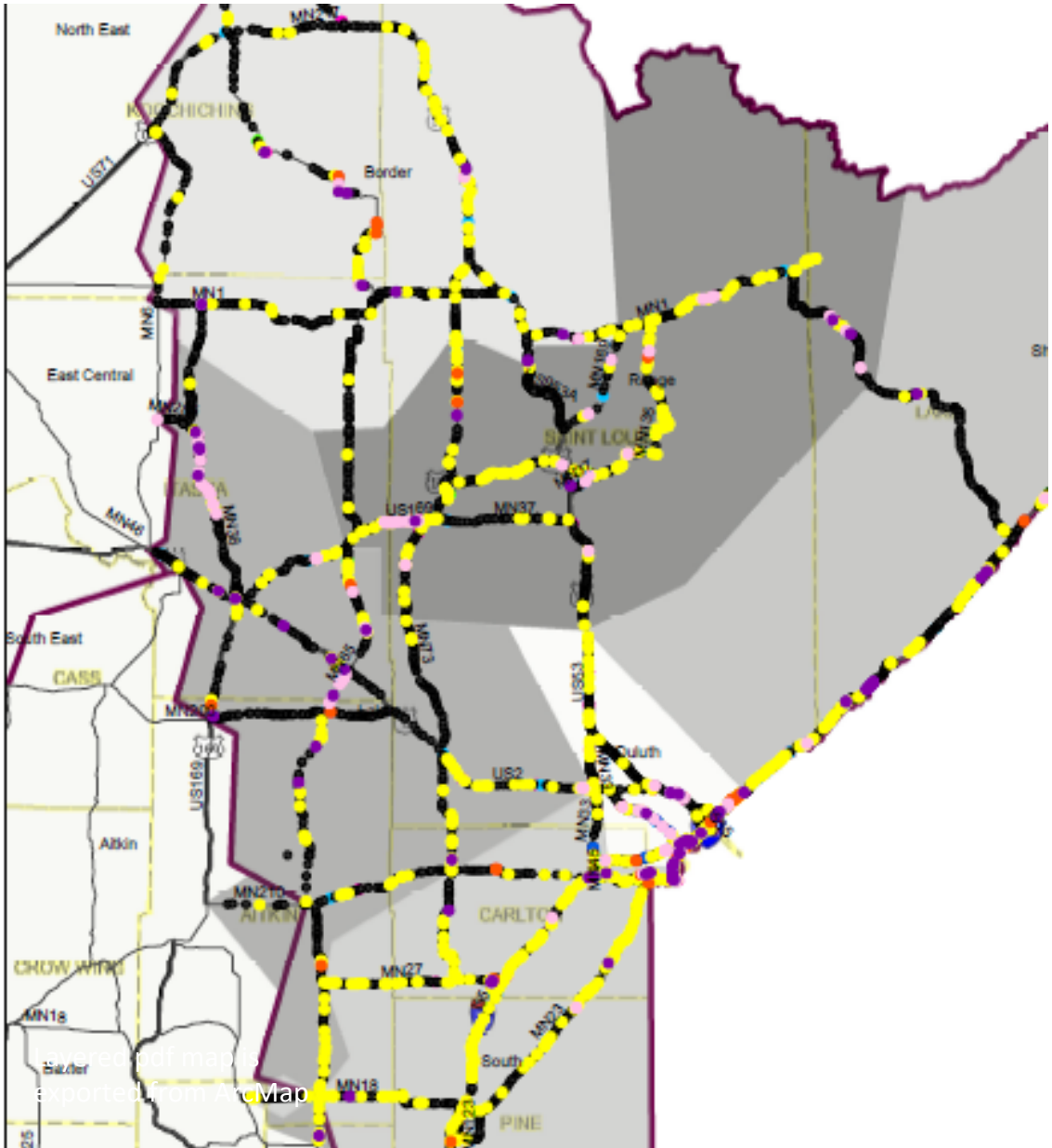
MnDOT Maintenance captured Culvert Repair Costs that can be applied to Suggested Repairs. See 2014-2015 Summary

Average Estimated Maintenance Cost of Culvert Repair			
Repair Category	**Culvert Categories**	**Number of Repairs**	**Average Repair Cost**
Trench New Pipe	All	314	$ 8,430
	Highway [1]		$32,170
	Side [2]		$ 9,610
	Entrance [3]		$ 5,160
Slipline		47	$12,570
Reset Apron and Pipe		66	$ 3,000
Replace Apron and Pipe		52	$ 3,000
Joint Repair		33	$ 2,710
Pipe Extension		15	$ 4,060
Hole Repair		4	$ 2,000
Fill Void		6	$ 1,020
Other		13	$11,270
All Culvert Repairs		550	

[1] Highway culverts include: centerline, mainline, median, CD and ramp-loop
[2] Side culverts include: city, county, township, frontage, cross-over
[3] Entrances culverts include: entrance, farm entrance and field entrance

Culvert Repair Category is described in Repair Made Examples with photos

Separated Aprons are common in Concrete culverts. Suggested Repair is Reset, about $3000 each*



- Trench_New_Pipe
- Slipline
- Review_for_Repair
- Reset
- Paved_Invert
- NA No_Repair_Indicated
- Joint_Repair
- Jack
- Cured_in_Place_Pipe
- Construction District

"Reset" suggested repairs are shown as yellow dots.

*Cost per reset is from 2014 - 2015 Drainage Maintenance Data Summary (PDF)

Big short-coming:

We don’t have simple costs available for culvert repairs or installations done by construction contract.

TAMS still needs construction costs to automate repair cost estimates.