TAMS-HydInfra Training

Surveys' Condition Ratings for Pipes and Structures

October 2018

Revised for GV December 2018

Bonnie Peterson

Bridge Hydraulics 2nd floor, Oakdale

651-366-4470

Surveys will assign Condition Rating,
and comment to describe repair needs

so WRE can estimate repairs, linings and
reconstructs for project design

Condition ratings in a nutshell:

HydInfra Inspection Manual

Culvert and Storm Drainage Systems

Condition Rating Codes:

Like new	1	Excellent – like new condition
Still okay	2	Fair – some wear, but structurally sound
Fix in project	3	Poor – deteriorated, consider for repair or replacement
Fix it sooner	4	Severe – serious deterioration
Unknown	0	Not able to rate, not visible

HydInfra Culvert and Storm Drain Inspection Manual

Metro Surveys collects location data like this:

ID	County X	County Y	Z	Asset Code
62160,	147079.905,	559302.703,	903.605,	DI

```
62102,147048.472,559612.050,899.150,BL*RCP153-27 0
62103,147048.472,559612.050,890.150,BL*RCP152-12 0
62110,147110.774,559644.466,905.466,DI-OVERFLOW
62111,147111.019,559645.448,902.777,BL*RCP155-15 0
62112,147110.404,559643.175,902.732,BL*RCP154-15 0
62120,147117.302,559670.351,900.925,EL*RCP154,APR-15 0 SAFETY GRATE
62130,147104.237,559628.607,910.256,STMH
62131,147104.237,559628.607,902.556,EL*RCP155-15 0
62132,147104.237,559628.607,902.556,EL*RCP151-15 0
62140,147047.563,559508.220,908.406,STMH
62141,147047.563,559508.220,899.206,EL*RCP153-27 0
62142,147047.563,559508.220,902.406,BL*RCP156-15 0 FROM NORTH
62143,147047.563,559508.220,899.206,BL*RCP157-27 0
62150,147035.243,559364.778,905.616,CB
62151,147035.243,559364.778,901.416,BL*RCP158-15 0
62160,147079.905,559302.703,903.605,DI
```

Plus HydInfra Rating and “— [comment]”

New Method: comment to describe repair needs

62110,147110.774,559644.466,905.466,DI-OVERFLOW 4 – BAD CRACKS. REPAIR DEPTH 6 FT. REPLACE CASTING AND RINGS. GROUT AT PIPES

Comment has 50 character limit in GPK

Take a Photo of hard-to-explain stuff

1) Get search coordinates from Casey's TAMS Reports.
2) Get PDF map of area from WRE for location survey, or use Georilla3

Download Report CSV and convert Longitude Latitude to County Coordinates.

Download CSV

Rows per page: 100

Location Surveys find Structures

10/5/2018 13:14:12

Hydraulic Structures	Longitude	Latitude	Top of Cast Elev (Ft)	Structure Type	Material Type	Built SP Number	County
2320440	-92.9083244324	45.0352920560		Other	Concrete		Washington
2320451	-92.9786353227	44.9270063045		Other	Concrete		Washington
2320452	-92.9644673487	44.9489947230		SpecFeat - Weir	Concrete		Washington
2321876	-92.7854362800	45.0286275823		Other	Other	8214-114	Washington
2322054	-92.9823638717	45.0345935662	1017.8600	Manhole	Concrete	6227-76	Washington
2322353	-92.9847519609	45.2767165271	.0000	Catch Basin	Concrete		Washington
2322356	-92.9583356746	45.0312614053	.0000	Catch Basin	Concrete		Washington
2322348	-92.8894728375	44.7937970265	.0000	Manhole	Concrete		Washington
2322726	-92.9838827432	45.2864927366	.0000	Drop Inlet	Concrete		Washington
2323515	-92.9809128863	44.9482532893	.0000	Catch Basin	Concrete		Washington
2323516	-92.9783093754	44.9486268579	.0000	Catch Basin	Concrete		Washington
2323517	-92.9796471338	44.9486270142	.0000	Catch Basin	Concrete		Washington
2323518	-92.9809000865	44.9486251601	.0000	Catch Basin	Concrete		Washington
2323519	-92.9821608971	44.9486284247	.0000	Catch Basin	Concrete		Washington
2323838	-93.0093841338	44.8851506017		Catch Basin	Concrete	8285-79	Washington
2323839	-93.0064750375	44.8862866973		Manhole	Concrete	8285-79	Washington

SURVEYS DRAINAGE-RELATED CODES	
BOX	VCG
RCP	DCG
RCPA	SCG
RCCP	Curb
CMP	CIP
CMPA	DIP
SCP	DT
EOSA	PCP
END	PVC
SDRN	CPP
CB	FLU
DI	APR
STMH	HEAD
VCP	STLN
ITEE	OTHER
BCG	DCS

Surveyors Feature Codes

From CG_TABLE.XLS

Note: MnDOT's Asbuilt format Table K has different Feature Codes that don't all work in Geopak.

DRAINAGE	
BOX	Box Culvert
RCP	Reinforced Concrete Pipe
RCPA	Reinforced Conc. Pipe Arch
RCCP	Precast Concrete Pipe
CMP	Corrugated Metal Pipe
CMPA	Corrug. Metal Pipe Arch
SCP	Sectional Concrete Pipe
EOSA	End of Safety Apron
END	Pipe End
SDRN	Slotted Drain Ends
CB	Catch Basin
DI	Drop Inlet
STMH	Storm Manhole
VCP	Vitrified Clay Pipe
ITEE	Inspection Tee
BCG	Type B C&G (Use Com. For Loc.)
VCG	Type V C&G (Use Com. For Loc.)
DCG	Type D C&G (Use Com. For Loc.)
SCG	Type S C&G (Use Com. For Loc.)
Curb	Curb (Stand Alone)
CIP	Cast Iron Pipe
DIP	Ductile Iron Pipe
DT	Drain Tile
PCP	Perforated Concrete Pipe
PVC	Polyvinyl Chloride Pipe
CPP	Corrugated Plastic Pipe
FLU	Flume
APR	Apron
HEAD	Head Wall
STLN	Storm Line
OTHER	Point For Drainage
DCS	Drainage Control Stucture

Structure Types in HydInfra

- Catchbasin - CB

- Manhole - STMH

- Drop Inlet - DI

And less common types:

- Buried Manhole
- DCS - Control Structure (flow control)
- Deck Drain (on a bridge)
- Diverter (drains 2 directions)
- ITEE - Inspection Tee

Describe it if there is no code.

Two other TAMS Structure types have no SMD code:

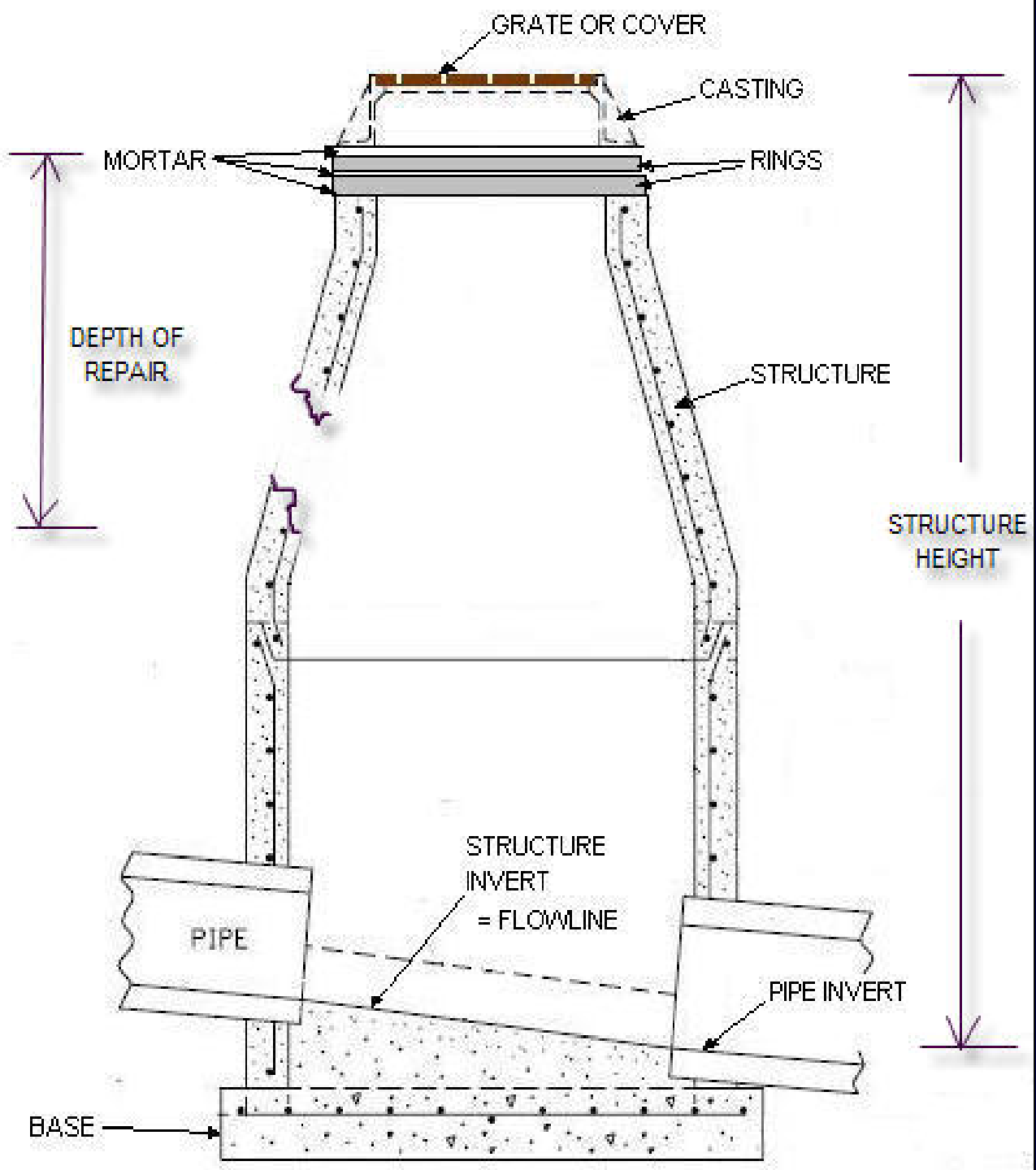
SPCD Structural Pollution Control Device

Special Feature Overflow or Other

Structure Terms

Comment to describe repair needs:

1. Replace casting or grate?
2. Replace Rings?
3. Replace cone?
4. Repair depth for gaps, holes, cracks, missing blocks or bricks?
5. Repair grout around connected pipes?
6. Repair Structure invert?
7. Infiltration of road fill? (Condition 4)



What can you see inside the structure?

Manhole (solid cover) with too many rings

Condition Rating - Is it broken or not?

Rating Criteria in

HydInfra Culvert and Storm Drain Inspection Manual

page 34,
General Inspection Criteria - Other Materials

1 Excellent Condition
- Materials are intact.

2 Fair Condition
- Materials have minor defects but the asset is structurally sound.
- The asset is functioning properly.

3 Poor Condition **Broken**
- Materials have defects that may affect function or structural integrity of the asset but can wait for a repair
- Repair is needed but is not under road

4 Severe Condition **Broken**
- Components are broken or not working
- Outflow is non-functional
- Piles of soil inside asset at the joints, or any indication that soil infiltrates into asset from under roadway
- Materials have severe defects and need repair soon.

Look for gaps and cracks at rings, structure walls, connected pipes and invert.

Imagine water rising at the pipe inlet.

A gap between pipe and structure can cause piping and loss of road fill.

Is soil leaking through structure walls?

Weakened?

Or worn but still okay?

Look for clues to structure condition on the pavement surface.

Then look inside.

Loss of fill outside the structure points to a gap in the structure or rings.

Structures with gaps are Condition 4

- Holes
- Cracks with gaps
- Leaking fill
- Missing blocks

Replace structure or rebuild to “Repair Depth”

Settling in pavement or curb may indicate a road void

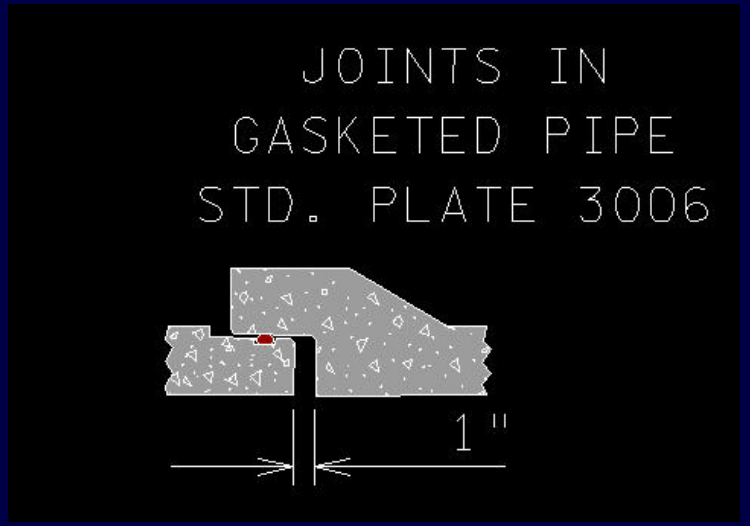
A pile of dirt in the structure indicates a road void

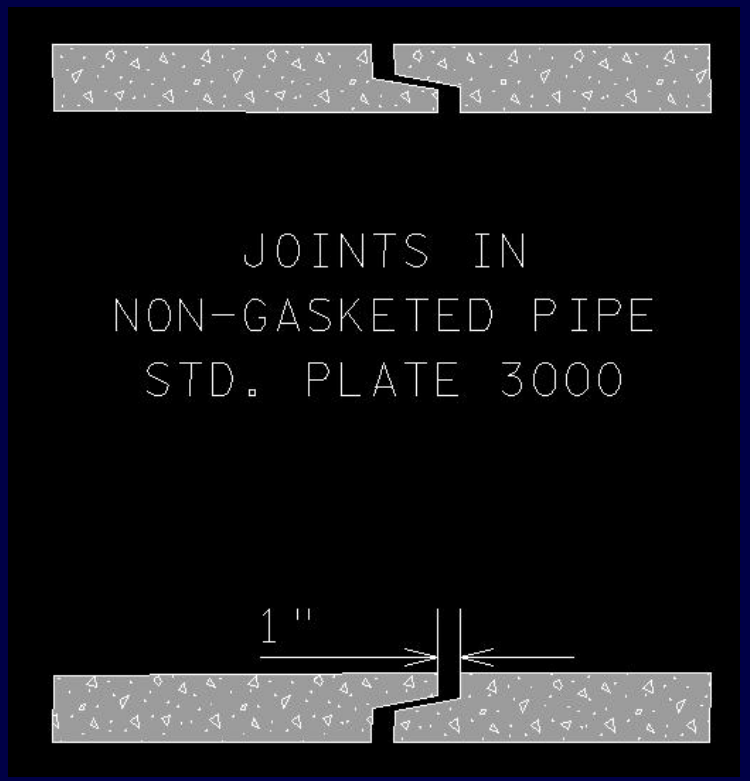
Concrete pipe fails most often when Joint Separation and Piping causes Road Void

HydInfra data shows about 7% of MnDOT's concrete pipes have separated joints

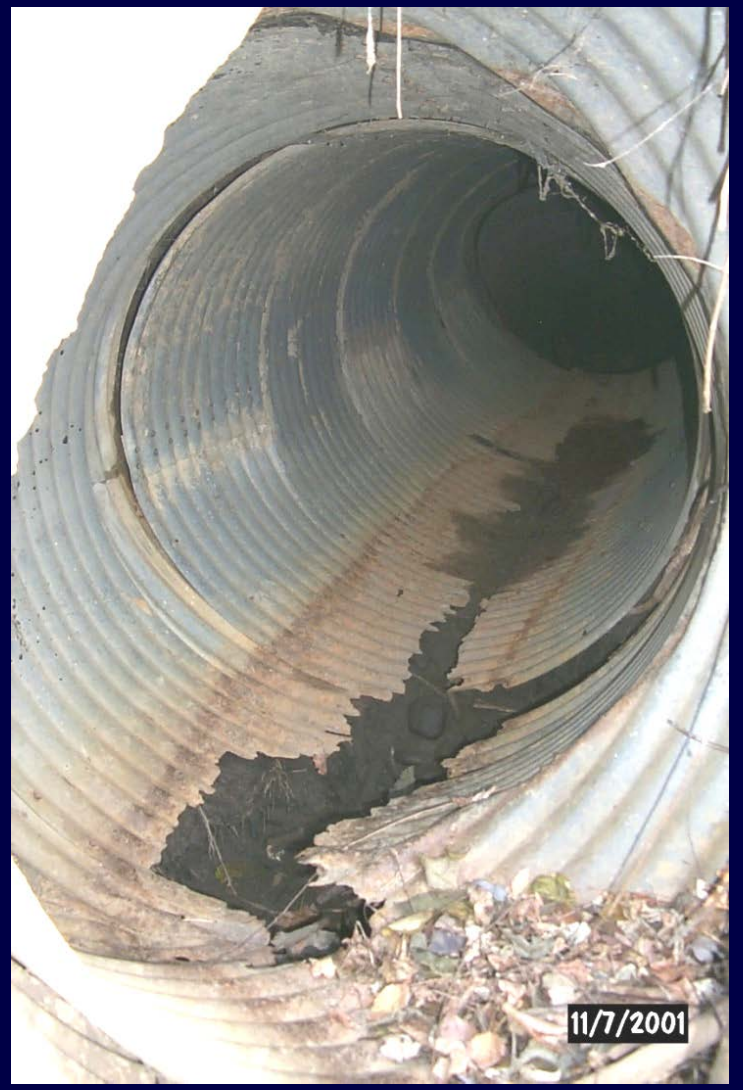
Piping looks like this –

water leaves the pipe at holes or joints and flows along the outside





Loss of road fill is Condition 4



Condition 4 Culvert – Gaps in culvert cause piping and road void

MN95 RP 89

Does the structure have a restricted access because of an odd repair?

Needs a rebuild.

Identify
Materials - Structures and Pipes

Why? -- for Project Design and Lifecycle Cost Analysis in TAMS

Joint Separation and Misalignment is rare in Steel pipe and may indicate a slope failure

Slope failure around a pipe or structure is Condition 4

Horseshoe-shaped slope failure

Chicken or Egg – did the leaking pipe cause the slope failure or did slope failure cause the leaking pipe?

While some steep slopes are prone to failure leaking pipes lubricate the slide

US Highway 8, April 2016 Photos by Kris Rehnberg, MnDOT Oakdale Surveys

Or, the downstream channel is lowering, causing channel sides to fall in

In this case, a headcut in the downstream channel lead to culvert joint separation.

Another horseshoe slope failure downstream is a symptom of the lowering gully.

Erosion - Scour - Channel Degradation – Headcut are terms to describe soil loss downstream of pipe.

Concrete abrasion, acid attack and bad manufacture are far less common

Abrasion from rocks District 1 Duluth

Acidic factory discharge,

I-94 St. Paul

Metro District

Bad concrete mix in alternating pipe sections, District 3 Baxter

Porous weeping patches indicate bad concrete material

D7 MN Highway 22, 2014, Post-construction video

The pipe photo shows water trickling down the inside wall through perforations or honeycombing.

Bad Resin 1996 HDPE pipe shows Deformation, Misaligned and Separated Joints

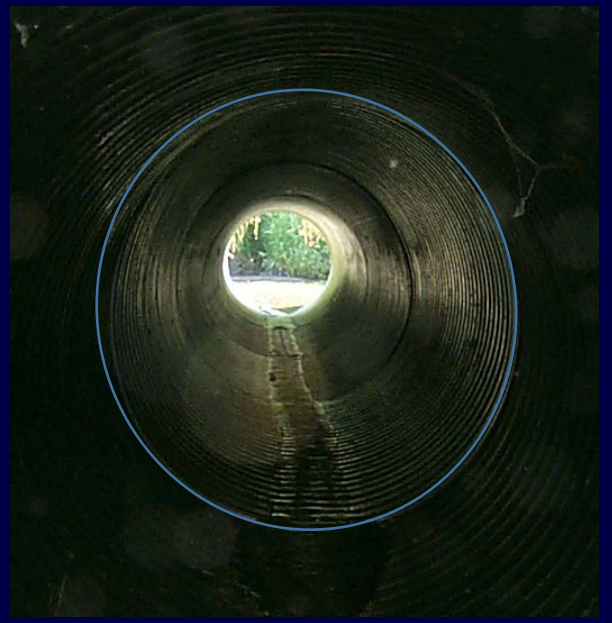
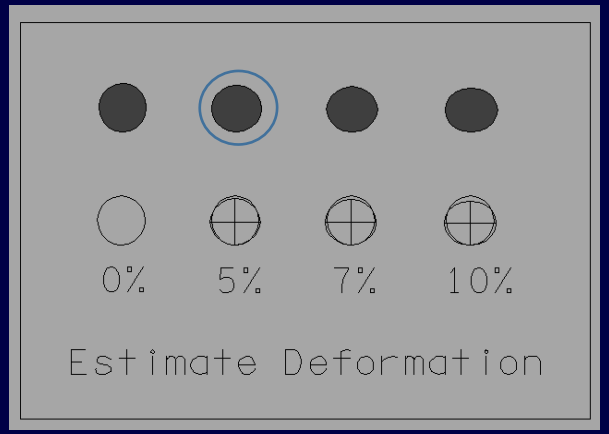


Photo above shows 5% Deformation (rotated)

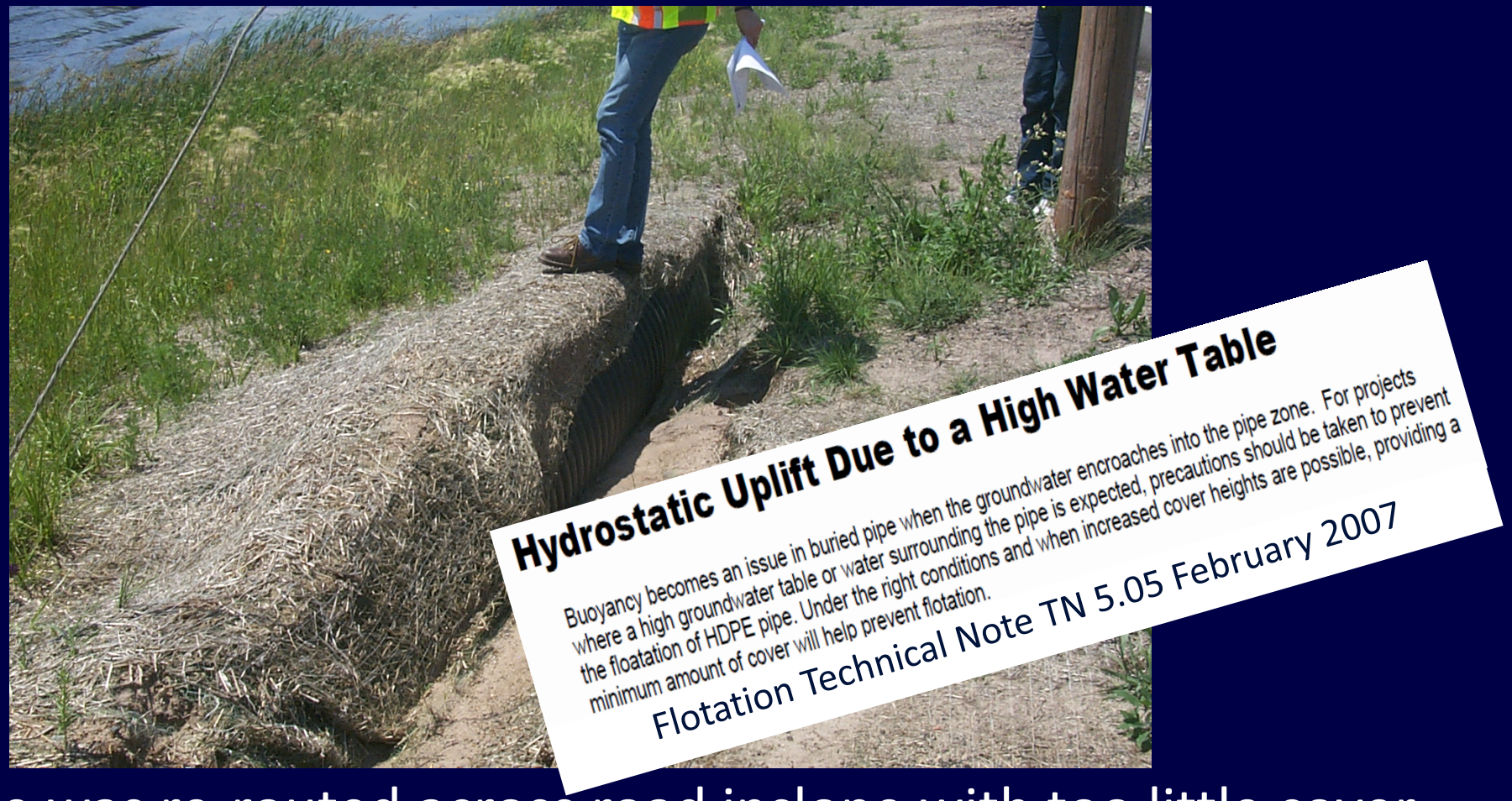


HydInfra ID 36918 has manufacturing defect in pipe material

1996 bad resin HDPE
has patterned surface and cracks in 2006

Resin Specs have been changed since this pipe was manufactured

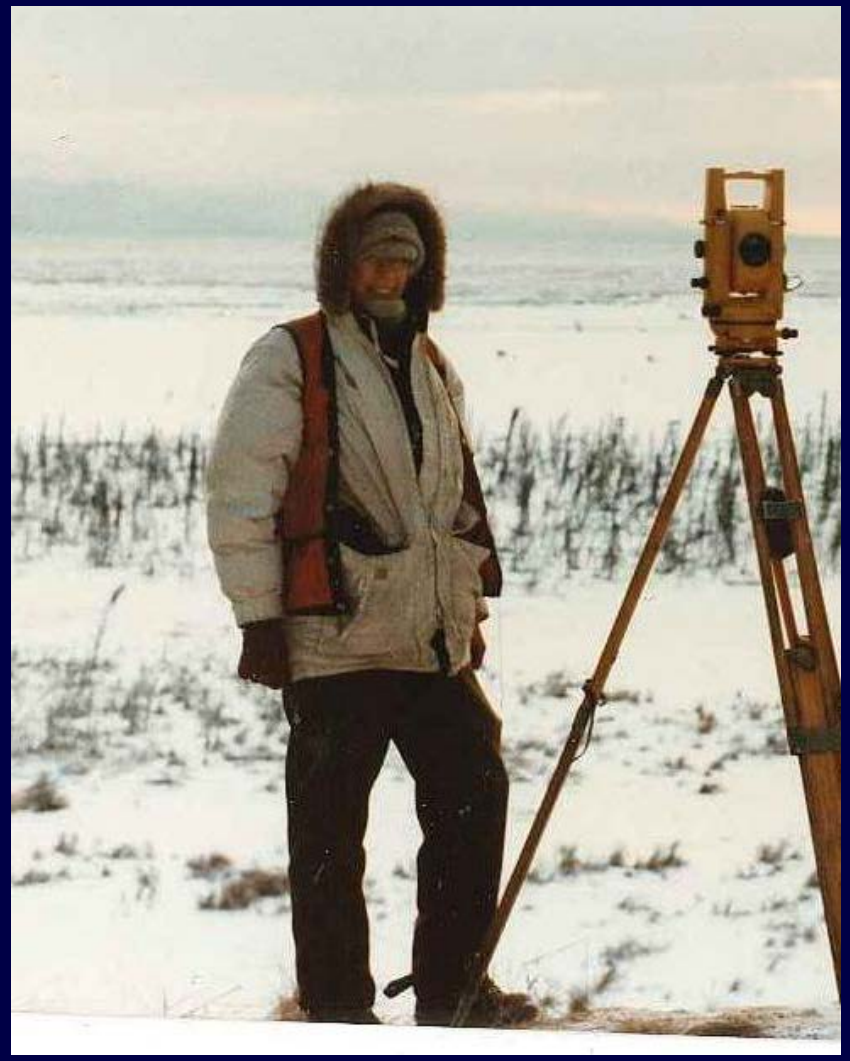
Too little cover –
Construction change caused Floated HDPE



Pipe was re-routed across road inslope with too little cover (about 6 inches). High water or frost heave can cause the pipe to “float”.

Big storm + bad pipe = wrecked road

We could have fixed it cheaper, sooner.



View overlooking Cook Inlet, Anchorage Alaska, January 1983 at -5^0 F
Those are black spruce trees across the middle of photo.

About the Presenter

Bonnie Peterson, MnDOT Bridge Hydraulics -- HydInfra Coordinator, previously surveyed for private companies in Alaska, Texas and Minnesota and works for MnDOT as an Engineering Specialist Senior.

She graduated from Gustavus Adolphus College with a B.A. in Geography, and continued to Dunwoody Institute's Surveying and Civil Technology program to learn how to map from the ground up.

Minnesota Department of Transportation
Bridge Office, Hydraulics Unit