



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

Notes:

- This guide is used to rate the condition of culverts, where the pipe (or installations of more than one pipe) is less than 10 feet wide as measured along the centerline of roadway, or any storm drainage system features.
- The worst defect found in a feature determines its condition rating. (Refer to condition rating criteria on pages 13 to 20).
- Drainage features are rated on structural integrity and ability to perform their functions. Need for cleaning is NOT part of the Overall Condition rating.
- Phone in unsafe road problems to Maintenance Area Supervisor immediately.

MnDOT Bridge - Hydraulics Phone: 651/366-4470

Send questions to bonnie.peterson@state.mn.us

Internal Webpage: <http://ihub/bridge/hydraulics/hydinfra/index.html>

External Webpage <http://www.dot.state.mn.us/bridge/hydraulics/hydinfra/inspector.html>



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Find data formatting information at:

HydInfra Inspector webpage <http://www.dot.state.mn.us/bridge/hydraulics/inspector.html> – .hif format from Trimble Terrasync GPS inspection

HydInfra Data Formatting webpage <http://www.dot.state.mn.us/bridge/hydraulics/data.html> – HydInfra Published Format

HydInfra Inspection Manual

Culvert and Storm Drainage Systems

HydInfra Features

HydInfra Feature	GPS hif Record Name	Description	Type
Pipe	T_PipeandInsp ExPipeandInsp	Culverts and storm drains of various shapes with sizes less than 10 foot span. Deep Tunnels may be any size.	Physical asset
Structure	ExStrucandInsp T_StrucandInsp	Catch Basin, Manholes, Drop Inlet	Physical asset
Special Structure	ExSpStrucandInsp T_SpStrucandInsp	Aprons, most commonly, but this catch-all feature also includes Slotted Drain, Headwalls, Wingwalls, open Flumes, Weirs, Expanders, Reducers, Floodgates, Energy Dissipaters, Bends	Physical asset
Pond	ExPondInsp T_PondandInsp	Basin holds water temporarily or long-term	Physical asset
SPCDs (Structural Pollution Control Devices)	ExSPCDInsp T_SPCDandInsp	Water quality device including swirling settler, skimmer, filter or other hardware	Physical asset
Ditch	T_DitchandInsp	Open channel along a roadway or an off-take drainage way	Physical asset
Outfall (Discharge Point)	T_ExOutfall_Infall	Associated with a feature –Outfall or Infall or Other flow, and where it goes to or from	Add-on to asset
Illicit Discharge	T_Illicit_Discharge	Track water quality offenses	Inspection record
Environmental Inspection	T_Environmental	Record soil chemistry – pH, conductivity, resistivity data at a location and associate it with a feature	Inspection record
Culvert Group	(N.A.)	Group multiple pipe, structures, special structures using ArcGIS tool.	Grouping of assets
Pond Group	(N.A.)	Group multiple pipe, structures, special structures, ponds, spcds & ditches using ArcGIS tool	Grouping of assets

- Note: 1) Field Record Names are record types in the HydInfra data dictionary.
 2) A record type that starts with “T_“ creates a new feature with a new ID when uploaded in HydInfra.
 3) Use the “Ex_” record types to re-inspect an existing feature – with its HydInfra ID.

HydInfra Inspection Manual

Culvert and Storm Drainage Systems

Inspection Flags and Measures

		Images
<u>Condition Indicators</u>	<ul style="list-style-type: none"> • Needs Repair? • Repair under Road • Piping • Cracks • Holes • Deformation • Misalignment • Spalling/Flaking • Pitting/Rusting • Joints Separated* • Maximum Joint Separation • Number of Separated Joints • Separated Apron 	Needs Repair Repair Under Road Piping Cracks Holes Deformation Misalignment Spalling/Flaking Pitting Rusting Joints Separated Max Joint Sep # Joints to Fix Apron Separated
<u>Roadway Indicators</u>	<ul style="list-style-type: none"> • Void in Road • Road Distress • Inslope Cavity • Erosion/Scour 	Road Void Road Distress Inslope Cavity Erosion
<u>Not in Condition Rating</u>	<ul style="list-style-type: none"> • Needs Clean? • Plugged • Silt • Standing Water* • Typical Water Flow 	Needs Clean Plugged Silt Water Typical Water Flow

* Not collected in field inspections as of 2013.

Notes:

- 1) Flags are yes/no fields that indicate specific problems.
- 2) Measures are inspection fields with menus or lists of attributes to describe the hydraulic feature.

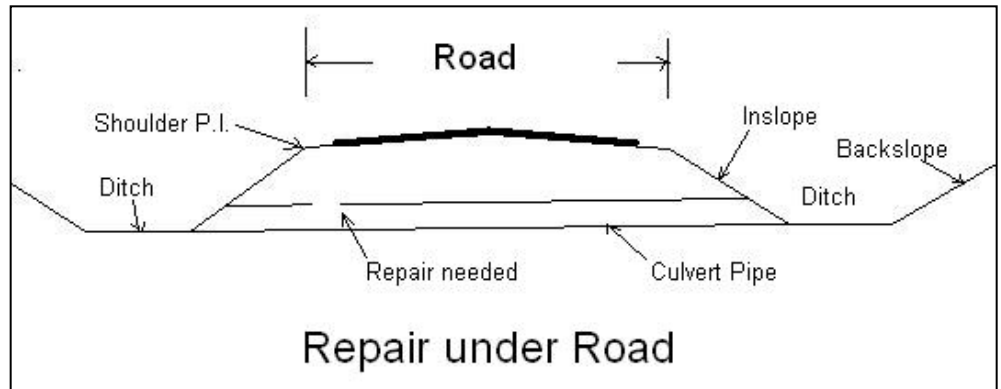
Definitions – HYDINFRA Flags and Measures

Condition Indicators

■ **Needs Repair?** – Does this feature need to be repaired?

■ **Repair under Road** –

If a repair is needed, the needed repair is located between the two shoulder P.I.'s (point of intersection where the road surface intersects with the inslope). The Repair flag must be marked yes for Repair under Road to be valid.



■ **Pitting/Rusting** – Small pits are visible in the surface of the pipe, or if metal, rusted but still solid.

■ **Spalling/Flaking** – Flat chips of concrete are lost from feature's surface or if metal, flakes of rust are falling away.

■ **Cracks** – Visible crack.

■ **Holes** – Hole goes completely through the feature's material.

■ **Joints Separated** – The joints between two pipe sections are separated (lengthwise) and may be allowing soil to filter through. (This flag is not collected in field inspections as of 2013).

■ **Max Joint Separation** – Estimate or measure the largest separation between pipe sections (interior of pipe).

■ **# Joints to Fix** – Count the number of joints that are separated by 1 inch or more, or have evidence of soil infiltrating the joints.

■ **Separated Apron** – Describe which end(s) of pipe has a separated apron, where the joints between the apron and first pipe section may be allowing soil to filter through, causing an Inslope Cavity.

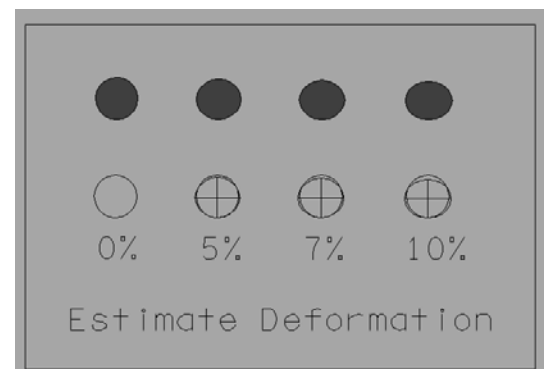
■ **Misalignment** - The pipe sections are offset and alignment is bad.

■ **Deformation** – Feature's shape is distorted, flattened or ovaled.

■ **Infiltration** – Evidence that soil or water is seeping into pipe.

■ **Piping** – Water is flowing along the outside of pipe (causes loss of soil in roadbed).

■ **Deter. Ties** (Deteriorated Ties) – [Pipe ties](#) are corroded or broken.



Not in Condition Rating [\[back to summary of Inspection Flags\]](#)

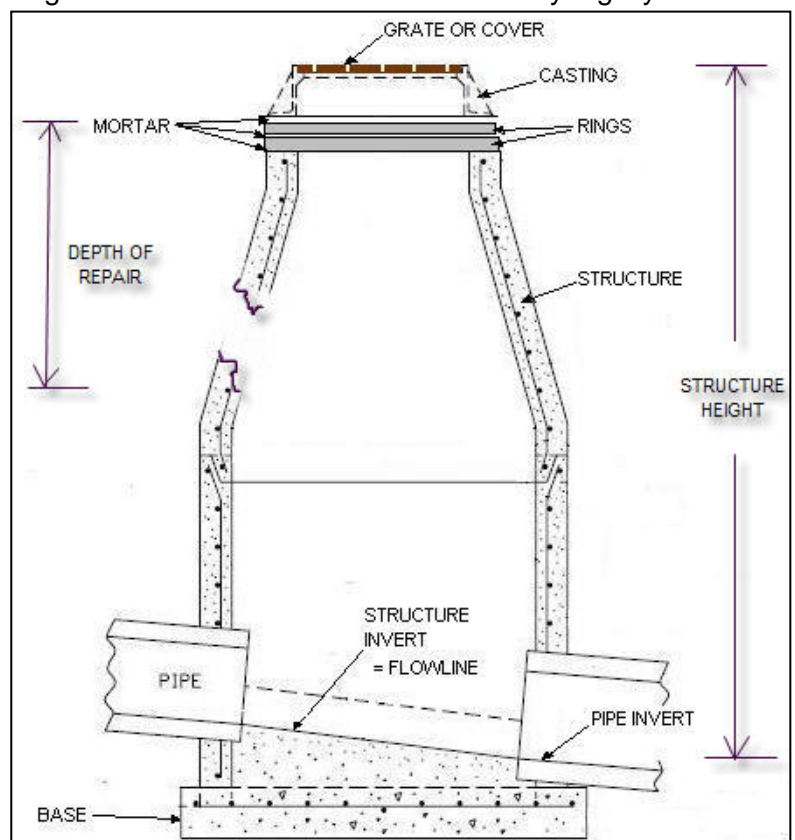
- **Clean?** – Does this feature need to be cleaned? Pipe is 1/3 or more full of sediment. Sediment or Debris will impede drainage. (See also Sediment % Full).
- **Standing Water** – Feature is normally wet – may indicate downstream plug or problem. (No longer collected in 2013).
- **Typical Water Flow** – Describe the typical water situation in the pipe: Dry, Slow, Fast, Standing, or Full
- **Silt** – Sediment buildup or deposit in pipe. The silt may or may not slow water flow, but may restrict the view of feature's condition.
- **Plugged** – Something is in pipe causing water to backup or restrict the water flow.
- **Sediment % Full** – Estimate the depth of sediment, compared to the interior height of apron or pipe. For SPCDs and Ponds, estimate the percentage of the total volume that is filled by sediment.

Roadway Indicator Flags (adjacent to feature) [\[back to summary of Inspection Flags\]](#)

- **Inslope Cavity** – A cavity or hole in the inslope of the roadway above an apron or pipe joint. Usually found in areas where joint separation has occurred.
- **Road Distress** – Pavement problem – Road Bump, Dip, Pavement Patch or Cracks (indicators of possible loss of roadbed through poor condition pipe or structure).
- **Void in Road** – Evidence of a loss of soil from the road around or near the pipe or other feature.
- **Erosion** (formerly Scour) – Erosion or channel degradation has occurred as evidenced by a gully or loss of vegetation, caused by water flows.

Structure Terms

- **Structure Height** – Measure from top of grate to bottom of invert
- **Repair Depth** – Measure from bottom of casting to bottom of the needed repair
- **Connected Pipes** – number of pipes attached to the structure
- **Sump** – a basin below the outgoing pipe that is deeper than 1 foot
- **Deteriorated Rings** – The adjusting rings (= layers below the iron casting assembly) are broken or cracked. Rings may also have missing mortar.
- **Structure Type:**
 - [Manhole - MH](#)
 - [Catchbasin - CB](#)
 - [Drop Inlet - DI](#)

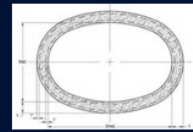


Pipe Shape

- Round



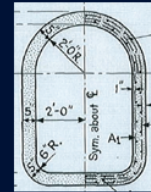
- Elliptical



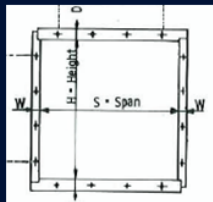
- Arch



- CattlePass

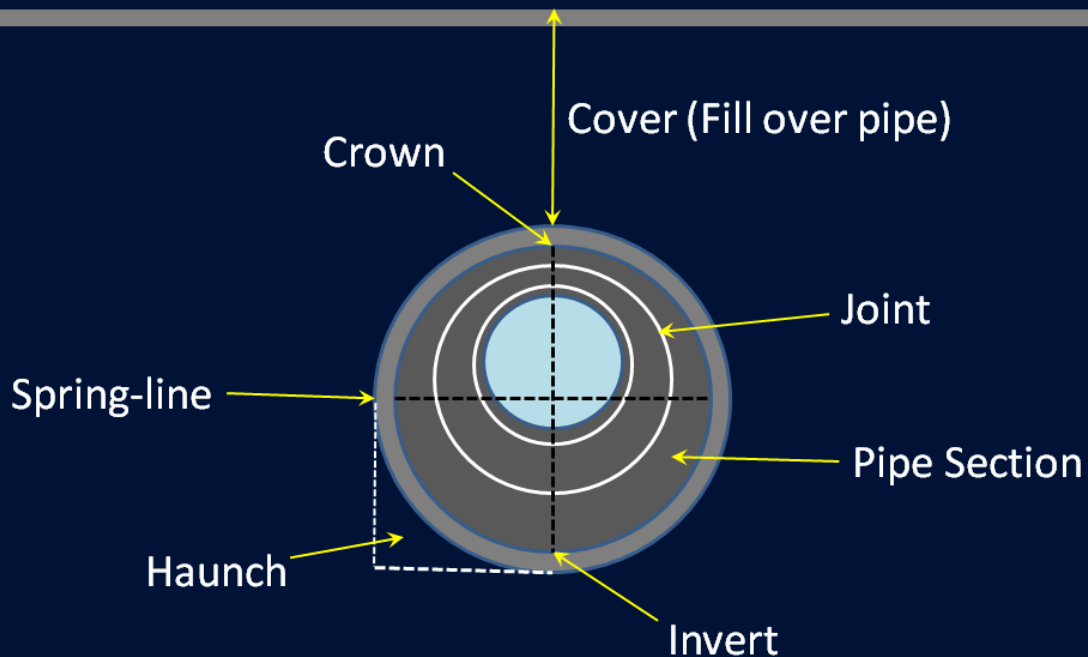


- Box



- Other HydInfra “Shapes”
 - Slot Drain
 - Other
 - Open Flume
 - Tunnel

Names for parts of a pipe



Pipe Function

Function defines the category or use of the pipe.

This is a new field in 2013.

Culverts vs Storm Drain definition:

1. If the primary purpose is to carry stormwater across the road, then it's a culvert.

- A culvert can have up to 2 catchbasin structures (carrying pavement drainage) as long as the pipe mostly conveys water from ditch to ditch.
- A culvert can have another pipe that connects into the culvert pipe that brings in ditch drainage (like tee structures shown in Standard Plates Design PC or PM).
- A culvert can have bends.
- A culvert can have a drop inlet. For example, a pipe that collects water from the ditch and conveys it under the roadway is a culvert, even if it has a structure on the upstream end.
- A cattle pass is a culvert whether it carries water or not.

2. If the primary purpose is to carry stormwater off the road surface, it's a storm drain.

- Storm drains have one or more pipes but at least one inlet must directly collect pavement runoff.
- A system with a network of pipes is typically a storm drain.
- Storm drains can outlet into a culvert. This can occur when a multi-pipe storm drain system discharges into a large centerline culvert that carries water through the roadway embankment (so part is named "Storm Drain" and part is named "Culvert").

3. If you can't define it, call it "Unknown"

- Unknown Function pipes will be included as Culverts in the Performance Measures.

Function categories:

Culverts
Storm Drain
Drain Tile
Tunnels
Surge Chambers
Other
Unknown
Bridges*

* (Bridges are Pipes > 10 span that should not be included but have been.)

Activity and Status

The **Activity** field captures activities done to the feature, whereas the **Status** field indicates whether the feature is Inplace, Proposed (created from plan data) or is no longer used. If the Inspector chooses “Removed”, “Abandoned” or “Duplicate” for the Activity, then Bon will update the Status to take it out of the set of active features and put it in the archives. If Activity is “Install”, “Clean”, “Repair” or “Clean/Repair” then the pipe can be included on a Pipe Maintenance Report.

- Discover for first location of features in HydInfra
- Install for brand new features (not liners)
- Verify for re-inspection of existing
- Extension for pipes that have been extended
- Duplicate to get rid of excess features
- Removed if feature was taken out
- Abandoned if plugged and left in the ground

- Liner
- Clean
- Repair
- Clean/Repair
- Video
- Other

*Activities by
Maintenance
or Contractor*

GPS Import Files and Zombies

Import files are Terrasync GPS files with HydInfra feature data that Inspectors can edit. Instructions to use import files are on the HydInfra Inspector webpage:

<http://www.dot.state.mn.us/bridge/hydraulics/hydrainfra/inspector.html>

[Hydrainfra Inspection using GPS Import files \(PDF\)](#)



Zombies are not real. Zombies are included in the import file, or in a separate background file, as markers for former Pipes that had been Inplace sometime during the last couple years, but the Status has now been changed to “Removed”, “Abandoned” or is “Bridge”.



Inspectors will look for Zombies on the ground to find and inventory the new feature that replaced the former feature. A Bridge Zombie should be ignored.



Accurate pipe material identification is essential to tracking material performance

Pipe Materials &

MATERIAL TYPE

■ Concrete

CONCRETE

■ Corg. Steel (CSP)

■ Structural Plate

■ Polymeric-Coated

■ Bituminous-Coated

STEEL

■ Aluminized Steel

■ Corg. Aluminum (CAP)

ALUMINUM

■ Timber

■ Other

OTHER

■ Corg. Plastic (HDPE)

■ PVC

■ Perforated Plastic

PLASTIC

“Liner” materials describe a lined pipe:

■ Liner HDPE

■ Liner PVC

■ Liner Cured in Place

■ Liner Metal

■ Liner Other

LINER

New Plastic Materials in 2015:

- SRPE
- Polypropylene

Notes:

- 1) If pipe is lined, choose material “Liner”+ material name.
- 2) Specific pipe material identification is essential to tracking material performance over time. View the [HydInfra Materials PowerPoint](#) to see examples of pipe materials.
- 3) Other materials are available in the data dictionary to describe structures, SPCDs and other features.

Roadway Types Describe the Feature's Location

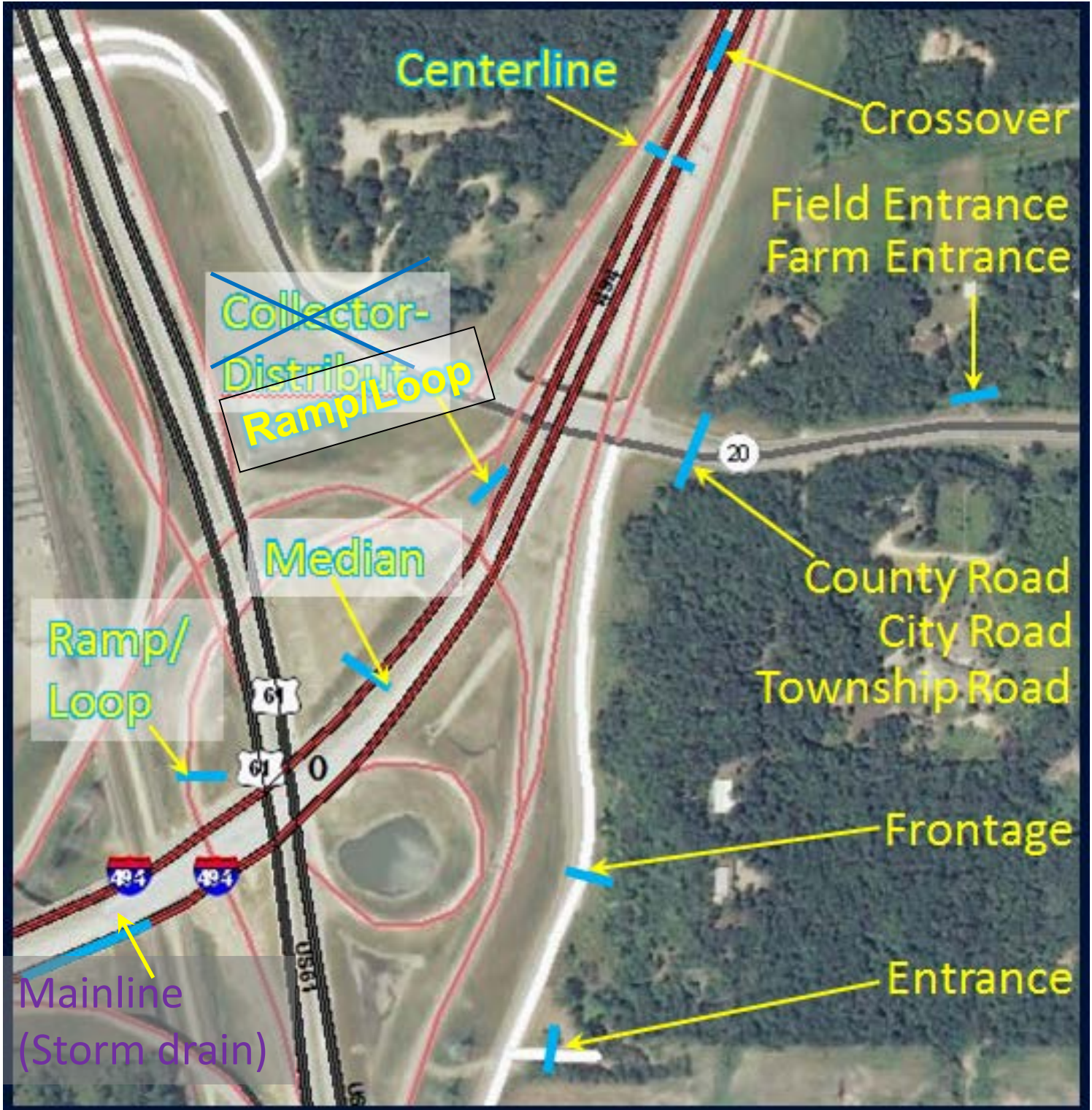
Highway Culverts

Side Culverts

Not Culvert

“Highway Culverts” include:

- Centerline – drainage crosses the entire highway
- Median – feature drains the median ditch
- Ramp/Loop – feature is on a ramp or loop
- Use Ramp-Loop instead of Collector-Distribut (from 2016 on)
- (Mainline should describe storm drain pipes not culverts)



Inspection Cycle for Drainage Performance Measure

Recommended Inspection Frequency for Highway Culverts*		
Overall Condition	Recommended Inspection Frequency Years	Comments
4 Very Poor	2	Pipes where problem is not under the road
	1	Pipes where problem requires a repair under the road
3 Poor	4	Most condition 3 pipes
	2	Condition 3 Pipes with Piping or Road Void **
1 & 2 Like New and Fair	6	
0 Can't be Rated	2	
Pipes with no inspections		Goal to inspect Highway Culverts within 6 years of Date Discovered***
Overall Target: 80% of Highway Pipes meet Recommended Inspection Frequency		

The Drainage Performance Measure recommended inspection frequency applies to “Highway Culverts”.

***Highway Culverts**, included in the Drainage Performance Measure, are HydInfra pipes where:

- Roadway Type is Centerline, Collector/Distribut, Mainline, Median, Ramp/Loop
- Pipe shape is Round, Arch, Box, Elliptical, CattlePass or Other
- Function is Culvert, Unknown or blank
- Maintenance Responsibility is not City, County or Private
- (Status is Inplace or Proposed)

Pipes that are not under State highway traffic lanes are not included in the performance measure. Pipes not included are “Side Pipes” with Roadway Types of Crossover, County, City, Township, Frontage, Entrance Pipes (Entrance, Field Entrance, Farm Entrance) or others (Trail, Railroad, Bridge, Ditch Block or Other). Pipes that are not culverts are also not included in the Performance Measure. Pipes with Functions of Storm Drain, Drain Tile, Tunnel or Other are not counted as culverts.

**Condition 3 pipes with piping or road void have a 2-year inspection cycle because these serious conditions could lead to road problems.

***For pipes with no inspections and the Date Discovered is prior to 2013, a target inspection date of 2019 was assigned.

HydInfra Ratings Guide

Roadway Indicators

Factors: Integrity of road fill material related to drainage features	Flags and Images
<p>Good or Fair Condition</p> <ul style="list-style-type: none"> ▪ No road settlement ▪ No pavement patching ▪ Road surface not affected 	
<p>Poor Condition</p> <ul style="list-style-type: none"> ▪ Pavement cracking above pipe (road distress) ▪ Holes in inslope (inslope cavity) 	<p>Road Distress Inslope Cavity</p>
<p>Severe Condition</p> <ul style="list-style-type: none"> ▪ Indications of voids around pipe or loss of road fill including piping ▪ Settlement of road surface (void in road) ▪ Holes in road surface caused by pipe or structure condition (void in road) ▪ Evidence of repeated pavement patching 	<p>Piping Road Void Road Void Road Distress</p>

Notes:

The general conditions of the roadway and adjacent area are used as clues to help determine the condition rating for each hydraulic feature that is inspected. These general conditions may be indicators of concealed structural problems.



11/7/2001

Road surface may indicate condition of pipe

MN 95 near MP 89, near Marine on the St. Croix



11/7/2001

HydInfra Ratings Guide

Structure (MH, CB & DI)

Factors: Structural integrity, Integrity of surrounding material	Flags and Images
<p>1 Excellent Condition</p> <ul style="list-style-type: none"> ▪ Very minor defects in concrete rings ▪ None to hairline cracks evident ▪ None to slight spalling or scaling 	
<p>2 Fair Condition</p> <ul style="list-style-type: none"> ▪ Some mortar missing at concrete rings ▪ Pitting of pre-cast concrete ▪ Aggregate is visible ▪ Spalling or scaling to 1/4 inch depth ▪ Cracks less than 1/8 inch ▪ Evidence of infiltration of water or soil 	
<p>3 Poor Condition</p> <ul style="list-style-type: none"> ▪ Concrete rings broken, or mortar missing – gaps 1/2” to 1” ▪ Settlement of pavement or soil adjacent to structure ▪ Reinforcement shows ▪ Blocks/bricks flaking/crumbling ▪ Cracking evident with widths 1/8 - 1/4 inch ▪ Spalling or scaling > 1/4 inch depth 	
<p>4 Severe Condition</p> <ul style="list-style-type: none"> ▪ Concrete rings broken or mortar missing – gaps >1” ▪ Voids in soil or depressed pavement adjacent to structure, caused by infiltration ▪ Structure settlement that affects structure stability or function ▪ Extensive exposure of reinforcement ▪ Cracks that show movement (misaligned pieces) ▪ Blocks/bricks missing ▪ Holes through the structure 	

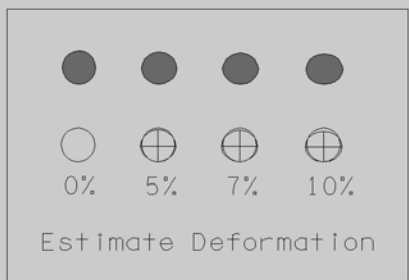
Notes:

Attributes such as crack width and spalling depth won't be measured in most cases – inspectors must estimate defects based on what they see from the pipe end.

Need for cleaning is NOT part of the Overall Condition rating but is noted with a separate “Clean” flag (Clean? = Y) and a “Sediment % Full” value.

HydInfra Ratings Guide

Plastic Pipe or Liners – HDPE or PVC or CIPP

Factors: Structural integrity, Integrity of surrounding material	Flags and Images
<p>1 Excellent Condition</p> <ul style="list-style-type: none"> • Pipe is straight • Joint separation less than 1" • Deformation less than 5% of original inside diameter 	
<p>2 Fair Condition</p> <ul style="list-style-type: none"> • Deformation of pipe 5% to 7% of original inside diameter • For dual wall HDPE pipe, liner buckling in 2 or fewer areas • Joint separation less than 3" with no soil infiltration through joints • For dual wall HDPE pipe, circumferential cracking in PE liner only, above flow line and less than 1/4 of circumference, (if crack is below flow line, freeze/thaw may increase damage, use Condition 3) • Minor misalignment and settlement throughout pipe 	<p>Deformation</p> <p>Joint Separation</p> <p>Cracks</p> <p>Misalignment</p>
<p>3 Poor Condition</p> <ul style="list-style-type: none"> • Significant ponding of water due to sagging or vertical misalignment • Deformation of pipe 7% to 10% of original inside diameter • For dual wall HDPE pipe, liner buckling in more than 2 areas • Joint separation more than 3 inches, but not detached • Evidence of soil infiltration in pipe • Pipe condition is causing soil loss in road shoulder • Any crack in PVC pipe outside of road surface area • For dual wall HDPE pipe, circumferential cracking in HDPE liner only, in upper or lower portion of pipe, less than 1/2 of pipe circumference, with no soil infiltration through joints • Erosion has undermined apron or pipe • Apron is separated from pipe • Repair is needed but is not under road 	<p>Misalignment</p> <p>Deformation</p> <p>Joint Separation</p> <p>Infiltration</p> <p>Inslope Cavity</p> <p>Cracks</p> <p>Cracks HDPE</p> <p>CIPP delamination</p> <p>Separated Apron</p>
<p>4 Severe Condition</p> <ul style="list-style-type: none"> • Floated – top of pipe is at or above ground surface • Joint separation allowing major soil infiltration • Deformation greater than 10% of original inside diameter • Hole through pipe material • Pipe condition is causing soil loss beneath road surface • Any crack in PVC pipe under road surface area • For dual wall PE pipe, circumferential cracking greater than 1/2 of pipe circumference, in the liner only • For dual wall PE pipe, buckling of liner and exterior shell • Burnt (there is no inspection flag for burnt pipe, use spalling/flaking or holes) 	<p>Misalignment –Float</p> <p>Joint Separation</p> <p>Deformation</p> <p>Holes</p> <p>Road Void, Piping</p> <p>Cracks</p> <p>Cracks</p> <p>Deformation</p> <p>Burnt HDPE</p>

HydInfra Ratings Guide

Metal Pipe and Special Structure

Factors: Structural integrity, Integrity of surrounding material	Flags and Images
<p>1 Excellent Condition</p> <ul style="list-style-type: none"> ▪ Discoloration of surface ▪ Galvanizing intact ▪ No rust or pitting 	<p>Condition 1 Steel</p>
<p>2 Fair Condition</p> <ul style="list-style-type: none"> ▪ Galvanizing gone ▪ Pitting, superficial rust or tight rust flakes 	<p>Pitting/Rusting</p>
<p>3 Poor Condition</p> <ul style="list-style-type: none"> ▪ Flaking rust evident, with some loss of wall thickness ▪ A hole, less than 1 inch in size ▪ Deformation, deflection or distortion visible, up to 10% of diameter ▪ Can poke a hole in pipe with a sharp point ▪ Inslope Cavity – Infiltration of soil into the pipe from road inslope (embankment) ▪ Infiltration of soil into pipe <u>may</u> be causing loss of fill beneath road surface ▪ Erosion has undermined apron or pipe ▪ Apron is separated from pipe ▪ Repair is needed but is not under road 	<p>Spalling/Flaking Holes Deformation Spalling/Flaking Inslope Cavity Road Distress Erosion Separated Apron</p>
<p>4 Severe Condition</p> <ul style="list-style-type: none"> ▪ Hole 1 inch or greater, or many small holes, or bottom gone ▪ Cracks or tears ▪ Severe deformation greater than 10% of diameter ▪ Joints separated ▪ Misalignment ▪ Can poke a hole in pipe with a blunt rod ▪ Piping or Road Void -- Pipe condition is causing soil loss beneath road surface 	<p>Holes Cracks Deformation Joint Separation Misaligned Spalling/Flaking Piping or Road Void</p>

Notes:

Special Structures is the catch-all feature that includes [Aprons](#), [Headwalls](#), [Headwall Wingwalls](#), [Weirs](#), Expander/Reducers, [Bends](#), [Floodgates](#), [Energy Dissipaters](#) and other items that are not Pipes, Structures, SPCDs (Structural Pollution Control Devices), Ponds or Ditches.

Need for cleaning is NOT part of the Overall Condition rating but is noted with a separate “Clean” flag (Clean? = Y) and a “Sediment % Full” value.

Attributes, such as hole size or deformation %, won’t be measured in most cases – inspectors estimate defects based on what they see from the pipe end.

HydInfra Ratings Guide

Concrete Pipe & Special Structure

Factors: Structural integrity, Integrity of surrounding material

<p>1 Excellent Condition</p> <ul style="list-style-type: none"> ▪ Minor chipping at joints/openings ▪ Hairline cracks ▪ Insignificant spalling or scaling 	<p>Condition 1 Concrete Hairline cracks</p>
<p>2 Fair Condition</p> <ul style="list-style-type: none"> ▪ Joints broken or pulled apart up to 1" (anywhere along joint) ▪ Aggregate exposed (pitting) ▪ Cracks evident with widths up to 1/8 inch ▪ Spalling or scaling to 1/4 inch depth 	<p>Joint Separation Pitting/Rusting Cracks Spalling/Flaking</p>
<p>3 Poor Condition</p> <ul style="list-style-type: none"> ▪ Joints broken or pulled apart 1"-3" (anywhere along the joint) ▪ Cracking evident with widths 1/8 - 1/4 inch ▪ Spalling or scaling > 1/4 inch depth ▪ Reinforcement beginning to show ▪ Ends misaligned or shifted ▪ Infiltration of soil into pipe under inslope causing soil loss in road shoulder ▪ Pipe <u>may</u> be causing soil loss beneath road surface ▪ Erosion has undermined apron or pipe ▪ Apron is separated from pipe ▪ Repair is needed but is not under road 	<p>Joint Separation Cracks Spalling/Flaking Misaligned Infiltration Inslope Cavity Road Distress Erosion Separated Apron</p>
<p>4 Severe Condition</p> <ul style="list-style-type: none"> ▪ Joints pulled apart or broken more than 3" at any point along joint (unless only at apron – see condition 3) ▪ Cracking evident with widths > 1/4 inch or cracks showing movement – pipe pieces have shifted ▪ Reinforcement fully exposed in places ▪ Holes through concrete or bottom gone ▪ Deformation – pipe is misshapen (look also for cracks and spalling or slabbing) ▪ Piles of soil at joints, or any indication that soil infiltrates into pipe under roadway 	<p>Joint Separation Cracks Spalling/Flaking Holes Deformation Road Void Infiltration & Piping</p>

Notes:

Special Structures is the catch-all feature that includes [Aprons](#), [Headwalls](#), [Headwall Wingwalls](#), [Weirs](#), Expander/Reducers, [Bends](#), [Floodgates](#), [Energy Dissipaters](#) and other items that are not Pipes, Structures, SPCDs (Structural Pollution Control Devices), Ponds or Ditches.

Need for cleaning is NOT part of the Overall Condition rating but is noted with a separate "Clean" flag (Clean? = Y) and a "Sediment % Full" value.

Attributes such as crack width and spalling depth won't be measured in most cases – inspectors must estimate sizes based on what they see.

HydInfra Ratings Guide

Other Materials or SPCD (Structural Pollution Control Device)

Factors: Structural integrity, Water Quality Functions, Clogging, Integrity of surrounding material	Flags and Images
1 Excellent Condition <ul style="list-style-type: none"> ▪ Materials are intact. 	
2 Fair Condition <ul style="list-style-type: none"> ▪ Materials have minor defects but the feature is structurally sound. ▪ The feature is functioning properly. 	
3 Poor Condition <ul style="list-style-type: none"> ▪ Materials have defects that may affect function or structural integrity of the feature ▪ Repair is needed but is not under road 	
4 Severe Condition <ul style="list-style-type: none"> ▪ Components are broken or not working ▪ Outflow is non-functional ▪ Piles of soil inside feature at the joints, or any indication that soil infiltrates into feature from under roadway ▪ Materials have severe defects and need repair soon. 	

Notes:

Need for cleaning is NOT part of the Overall Condition rating but is noted with a separate “Clean” flag (Clean? = Y) and a “Sediment % Full” value.

SPCD (Structural Pollution Control Device) is a feature built to improve water quality. Examples of SPCDs include “Grit Chambers” (like baffled box), swirling “Separators” (like Vortech, CDS, Stormceptor, Baysaver, Downstream Defender and other makes) “Skimmers” and “Filters”.

“Other Materials” may be any that is not described in Plastic (pg. 15) Metal (pg.16) or Concrete (pg.17) rating criteria.

For detailed concrete rating criteria, refer to page 14, “Structure – MH &CB – Condition”.

HydInfra Ratings Guide

Pond

Factors: Water Quality Functions, Water containment functions – basin integrity/clogging/overtopping, Vegetation	Flags and Images
<p>1 Excellent Condition</p> <ul style="list-style-type: none"> ▪ Embankment is sound. ▪ Outflow structures are clear of debris and functional ▪ Vegetation is well established, without any noxious weeds (see county list of Noxious Weeds). 	
<p>2 Fair Condition</p> <ul style="list-style-type: none"> ▪ Limited patches of missing vegetation. ▪ Sheet erosion occurring (look for exposed grass roots). ▪ “Healed” (vegetated) rills. 	
<p>3 Poor Condition</p> <ul style="list-style-type: none"> ▪ Evidence of overtopping (flow marks over embankment for example). ▪ Noxious Weeds are present (see county list of Noxious Weeds). ▪ Vegetation missing over 500 sq. ft. or more total area. ▪ Pond or embankment liner material (geotextile, clay liner, etc.) is damaged. ▪ Infiltration pond has dead vegetation where water stands. ▪ Infiltration pond has standing water for more than 3 days in a row. 	
<p>4 Severe Condition</p> <ul style="list-style-type: none"> ▪ Burrows, piping or alternate flow paths through embankment. ▪ Eroded gully or slope failure presents a hazard to vehicles leaving the roadway or threatens road or embankment integrity. ▪ Evidence of pond water backup onto upstream or adjacent properties or onto roadway. ▪ Normal outfall or emergency overflow or is non-functional or is bypassed. 	

Note:

Need for cleaning is NOT part of the Overall Condition rating but is noted with a separate “Clean” flag (Clean? = Y) and a “Sediment % Full” value.

HydInfra Ratings Guide

Ditch

Factors: Vegetation, Erosion (Physical integrity), Flow Capacity or Sediment Deposition	Flags and Images
<p>1 Excellent Condition</p> <ul style="list-style-type: none"> ▪ Vegetation is well established, without noxious weeds (see county list of Noxious Weeds). ▪ No eroded rills ▪ If it is an Infiltration ditch, ditch is infiltrating water. 	
<p>2 Fair Condition</p> <ul style="list-style-type: none"> ▪ Sediment deposition is visible. ▪ Limited patches of missing vegetation. ▪ Sheet erosion occurring (look for exposed grass roots). ▪ “Healed” (vegetated) rills. 	
<p>3 Poor Condition</p> <ul style="list-style-type: none"> ▪ Noxious Weeds are present (see county list of Noxious Weeds). ▪ Ditch liner material (geotextile, clay liner, etc.) is damaged. ▪ Ditch grade headcut (ditch bottom is de-grading from downhill to uphill) is occurring – pipe aprons suspended above eroded ditch bottom may be an indicator. ▪ “Infiltration Ditch” (ditch constructed specifically to infiltrate stormwater) has dead vegetation where water ponds. ▪ “Infiltration Ditch” (ditch constructed specifically to infiltrate stormwater) has standing water for more than 3 days in a row. 	<p>Erosion or Headcut</p>
<p>4 Severe Condition</p> <ul style="list-style-type: none"> ▪ Eroded gully or slope failure presents a hazard to vehicles leaving the roadway or threatens road or embankment integrity. ▪ Sediment <u>in ditch</u> causing water to back up onto upstream or adjacent properties, or onto roadway. (Pipes are most likely the problem – check affected pipes first). 	

Note:

Need for cleaning is NOT part of the Overall Condition rating but is noted with a separate “Clean” flag (Clean? = Y) and a “Sediment % Full” value.

HydInfra Ratings Guide

Illicit Discharge Identification

Illicit Discharge is a discharge or deposit of polluting materials, liquid or solid, that can be transported to natural waterways.

Look for:

- Unexpected pipes coming into the highway storm drain system.
- Pipes flowing when storm drains shouldn't be.
- Suspicious odors, floatables, colors or opaque water. (Don't sniff out an odor – your first impression is sufficient. Some substances are damaging to inhale.)

HYDINFRA can also be used to record deposits of dumped or otherwise deposited polluting materials.

Report suspected Illicit Discharge to your District Contact within 24 hours for follow up:

Accidental spills by trucks, that are reported to Dispatch, forwarded to MPCA Duty Officer and cleaned up by trucking company's contractor are not reported as Illicit Discharge, but are logged by Dispatch.

District	Contact	Phone
Metro District	Metro Dispatch	651-234-7500
District 1	Matt Meyer, Duluth	218-725-2758
District 2	District 2 Hydraulics Engineer, Bemidji	218-755-6500
District 3	Robert Nibbe, Hydraulics Engr, Baxter	218-828-5700
District 4	District 4 Hydraulics Engr, Detroit Lakes	1-800-657-3984
District 6	District 6 Hydraulics Engineer, Rochester	507-286-7692
District 7	Scott Morgan, Hydraulics Engr, Mankato	507-304-6210
District 8	District 8 Hydraulics Engineer, Willmar	1-800-657-3792

Outfall Identification

An MS4 Outfall is a separate and identifiable drainage conveyance where stormwater leaves MnDOT right of way or merges with a natural water (lake, stream, wetland, county ditch, etc.) and is located within an MS4 boundary.

MS4 Outfall does NOT Include:

- Diffuse runoff (sheet flow)
- Natural waters passing through MnDOT Right of Way
- Municipal storm drains passing through MnDOT Right of Way without MnDOT inputs

Pipe Materials &

MATERIAL TYPE

- Concrete
- Aluminized Steel
- Corg. Steel (CSP)
- Structural Plate
- Polymeric-Coated
- Bituminous-Coated
- Corg. Aluminum
- Timber
- Other

- Corg. Plastic (HDPE)
- PVC
- Perforated Plastic
- SRPE - Steel Reinforced Polyethylene
- PP - Polypropylene

“Liner” materials describe a lined pipe:

- Liner HDPE
- Liner PVC
- Liner Cured in Place
- Liner Metal
- Liner Other

Concrete Pipe

Material Type: Concrete



Corg. Steel (CSP)

(galvanized steel pipe)

Material Type: Steel



Structural Plate

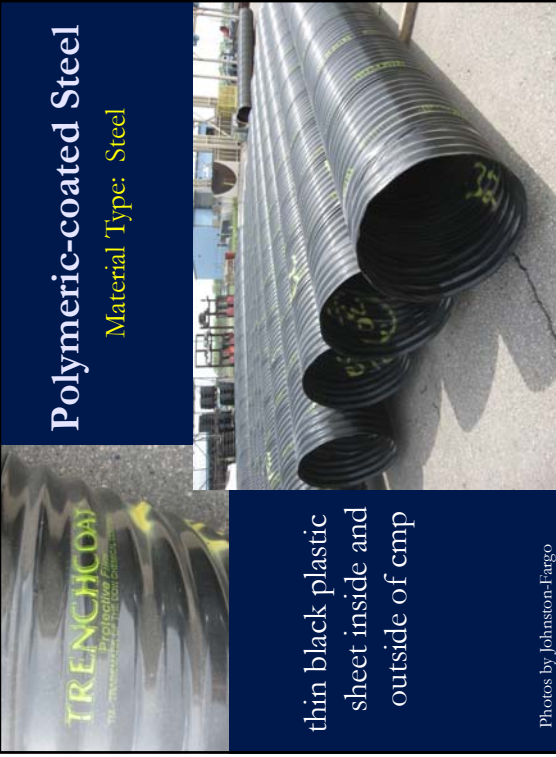
Material Type: Steel



US 61 Silver Bay, r.p. 53,26

Galvanized steel plates are bolted together, was used in larger diameter culverts


Polymeric-coated Steel
Material Type: Steel



thin black plastic sheet inside and outside of cmp

Photos by Johnston-Fargo

Bituminous-Coated Steel
Material Type: Steel




Looks like tar on cmp

May contain asbestos

Labeled in Construction Plans as "AB-Bonded"

Not installed since 1970's but exists in field

Aluminized Steel
Material Type: Steel



Magnetic and has a sheen like the inside of a pop can but edges may be rusty

Photos at right by Johnston-Fargo

Corg. Aluminum (CAP)
Material Type: Aluminum



Photo from <http://www.lockermz.com/>

All aluminum pipe, not steel so no rust, not magnetic, is more bendable

PVC Material Type: Plastic





Photo PVC pipe from <http://www.pvcinc.com/>


White or green, more brittle than HDPE, especially in cold

Corg. Plastic (HDPE) Material Type: Plastic




HDPE = High Density Polyethylene has smooth inside and corrugated outside. HDPE is always black

Corg. Plastic (HDPE) Material Type: Plastic



Add a comment because single wall corrugated HDPE should not be used as highway culverts or storm drain.

SRPE - Steel-Reinforced PolyEthylene
Material Type: Plastic



Blue line shows it's SRPE
Exterior flanges are steel, coated with HDPE

Photos of Durmaxx pipe by Comtech

Polypropylene

Material Type: Plastic



PP = Polypropylene Pipe is grey and stiffer than HDPE

Perforated Plastic

Material Type: Plastic

used in pond underdrains
to filter stormwater

Material Type: Other

- Vitreous Clay
- Timber
- Any other material

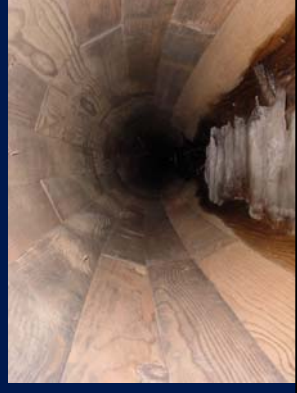


Wooden cattle pass
in D6 on MN 60
r.p. 185.91

Timber

Material Type: Other
also used in wet box culverts

Wooden Pipe on Grand Ave,
MN 23 in Duluth



Vitrified Clay (VCP)

Material Type: Other



Red fired clay tile exists in some old small town storm drains and old farm drain tile.

HIVE Inspection Rob Coughlin, D6

Other Material

(add a comment to describe it)

Material Type: Other



From HIVE Inspection

Excavated 20 inch box "pipe" carved from limestone provides outlet for old VCP storm drain -- D6 Hwy 56 Kenyon

Material Type: Liner

- Liner HDPE
- Liner PVC
- Liner Cured in Place
- Liner Metal
- Liner Other
- Liner SRPE ??
- Liner PP ??

Liner

Materials:

Liner HDPE

Material Type: Liner



Like Snap-Lite or butt-fused HDPE liner has grout between original pipe and liner.

Liner PVC **Material Type: Liner**





Photo of PVC liner from Caltrans <http://www.dot.ca.gov/hq/oppd/dib/dib83.pdf>

Liner Cured in Place **Material Type: Liner**



CIPP Liner is resin-filled fabric, inflated and cured with hot water or steam or UV light till it's rigid

Liner Metal **Material Type: Liner**




Photo: Johnston-Fargo

Steel flat-seamed pipe is sometimes used as liner

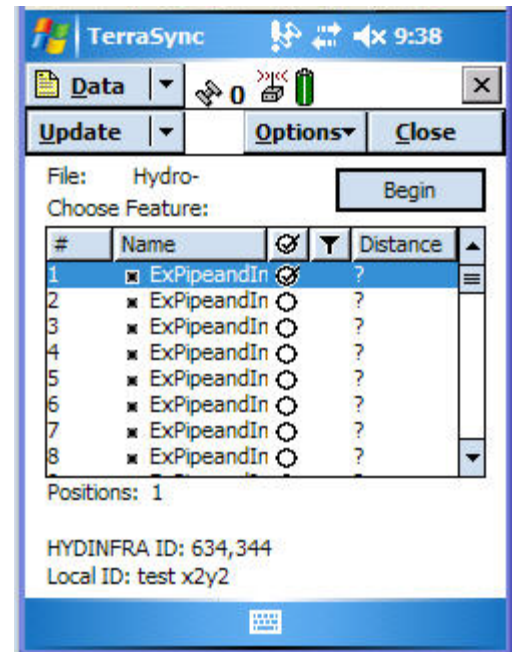
Liner Other **Material Type: Liner**

Use Comments to describe this.

For example, "Sprayed on concrete liner"

HYDINFRA INSPECTION USING IMPORT (.IMP) FILES WITH TERRASYNC AND TRIMBLE GPS

1. Transfer the .imp (import) data file onto the GPS unit. The Import file has data for existing HydInfra pipes, structures and special structures. After 7 days, Trimble data files won't allow edits, so transfer data to PC and download a copy of the import file once a week.
2. Transfer the most current HydInfra data dictionary onto the GPS unit.
3. Click Start button.
4. Choose TerraSync (wait a few seconds while it opens).
5. In TerraSync, click Status button and choose Data.
6. Click on the New button and choose Existing from the menu.
7. Choose the .imp file that you transferred and click Open. (Confirm the antenna height if asked).
8. The list of existing pipes comes up.
9. Click on Distance, to sort by the nearest pipe to the farthest. (Change Units to feet in the Setup menu if needed, find Setup under Data button).
10. **Open Map** by clicking the Data button.

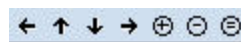



11. Click Options button and choose Auto Pan to GPS Position.




12. Choose **Zoom In** from top left menu to click and drag a box to zoom to the pipes you will inspect.

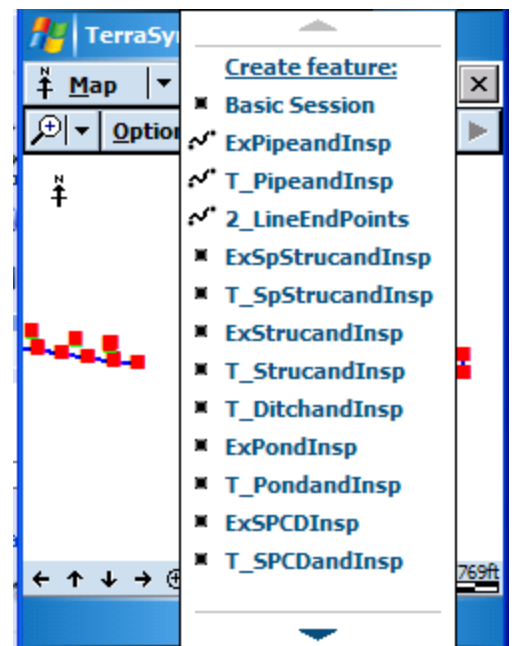
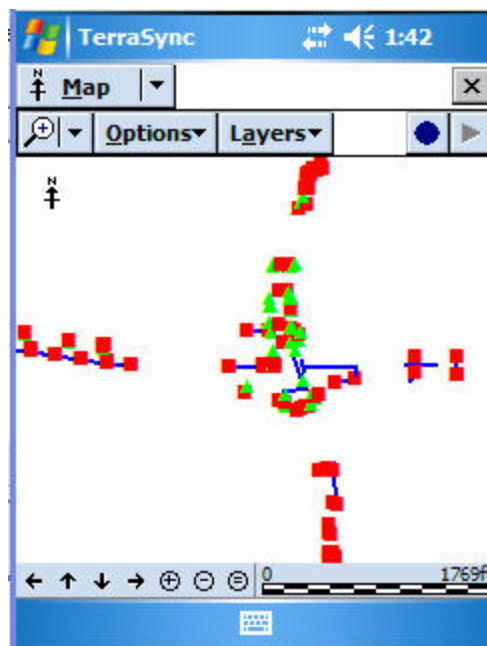
13. Zoom tools at bottom of screen are similar but different.



14. **Click the big dot button**  and choose **Basic Session** to start your data file (Basic Session is only needed once, at the beginning of the file. It adds information to each of the following features).

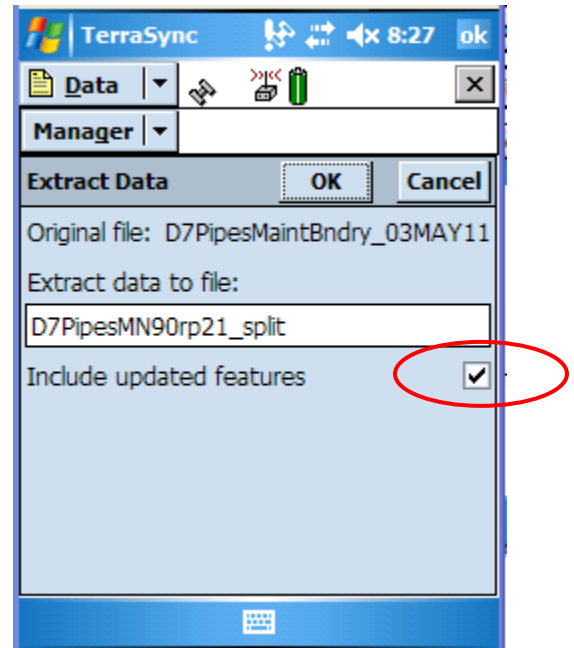
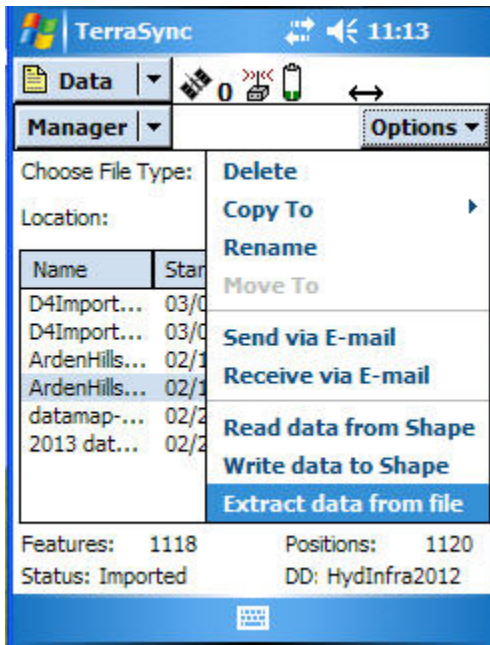
15. Click Data button again and watch the distance as you go to the nearest pipe. When you are on it, click on the listed pipe and click Begin button.
16. MAKE SURE YOU HAVE THE RIGHT PIPE.
17. The ExPipeandInsp record opens, with the Pipe ID and previous inspection data loaded. Change the data to reflect current pipe conditions. Enter data in the blank fields. Use the Inspection Comment to describe oddities.
18. Scroll to the top and check that "Mark as Updated" has a check mark next to it. Only the checked pipes will get updated in HydInfra.
19. Click OK to save and close the updated feature.
20. Add a New Feature from

Map view – click dot  to open features types menu (new features begin with "T_")



21. Instructions to Extract the edited and new features from the import file –

- a. Close the Import file.
- b. Go to Data and File Manager and highlight the Import file
 - o Click on Options button and choose “Extract data from file”.
 - o Name the _split file by Hwy number and reference point. Keep the “_split” in the name.
 - o Check **“Include updated features”**
 - o Click OK (this will take a few minutes if original file includes all District pipes).
- c. The **extracted pipes will be removed** from the original import file and saved in the “_split” file.
- d. Always RENAME the _Split file if you extract a second time from the Import file, or **you will overwrite your data!**



22. **Transfer the file to your PC and process it like a normal field file.** Sometimes the extracted file won't transfer or won't open. If this happens, go back to File Manager on the GPS unit and extract from the **previously extracted** _split file to get a split_split file. Don't use the original Import file. Be careful – see 21 d. above. (Thanks to Patti Wallin-Johnson D3 for coming up with this solution).

23. Pathfinder Office **hif ASCII export setup** must have this setting on the Data tab: “Export New and Updated Features” (otherwise every uninspected feature will be exported).

