

EXPERIMENTAL PROJECTS CONSTRUCTION REPORT AND ANNUAL EVALUATION

Sprayroq-SprayWall Polyurethane Applied Lining for Culvert Rehabilitation

Location:	Mineral County-Missoula District: Interstate 90, Reference Point (RP) 59; Nemote Creek Crossing
Project Name:	I-90 Nemote Creek Culvert
Project Number:	IM 90-1(205)59 – Work Type 312: Structure Safety
Experimental Project:	MT-13-14
Type of Project:	Culvert Rehabilitation
Principal Investigator:	Craig Abernathy: Experimental Project Manager (ExPM)
Date of Installation:	January-February 2017
Site Inspection:	April 2017/2018, January 2019, March 2020

Description

The project is located at the crossing of Nemote Creek on Interstate 90, at RP 59.0 ±; approximately two miles west/north of the Tarkio Loop Road interchange, and 1.3 miles east/south of the Quartz Flats westbound rest area. The eight (8) gauge steel plate pipe (SPP) culvert is 242 linear feet, and an interior radius of 12 ft.

Bulging and sagging of the steel plated panels located near the east end of the culvert were noted in 2006, and recommended for remedial action in May 2013. Maximum deflection within areas of deformation was roughly estimated to be six inches located in the upper plates of the pipe (refer to page 4). The purpose of the rehabilitation effort is to improve the structural capacity of the pipe to reduce the chance of a culvert failure that would impact the I-90 roadway.

Experimental Design

Due to site constraints and apparent minimal change in the areas of deformation over the past seven years, the Department proposes to use a cure-in-place-pipe (CIPP) process to provide structural enhancement and corrosion resistance.

The selected product is Sprayroq's catalyzed, two-component coatings *SprayWall*.

SprayWall is a procedure using self-priming, spray-applied structural polyurethane coating as the lining medium. The manufacturer states the lining allows return to active service within an hour of application. Product information including technical performance, specifications and ASTM certification can be found at: [SprayWall Polyurethane Lining](#).

Evaluation Procedures

Construction Documentation: The Research Section will document the construction methods and equipment, material placement, weather, and specification conformance etc.,

Post Documentation: Will entail semi-annual site visits/inspections of the culvert, for visual documentation of the applied liner; in addition to include any maintenance or other Department inspection information associated with the culvert treatment.

Evaluation Schedule

Research will monitor and report on performance for a minimum period of five years annually, with every year up to *ten years (informally). This is in accordance with the Department's "Experimental Project Procedures". Delivery of a construction/installation report, interim, annual or semi-annual reports is required as well as a final project report (responsibility of Research). A web page will be dedicated to display all reporting from the project.

2017:	Installation/Construction Report
2017-2021:	Semi-Annual Inspections/ Annual Evaluation Reports
2022:	Final Evaluation/Final Report

*If considered the extra data collection and analysis will add value to the overall results of the project.

Process

The purpose of an experimental features report is to document the phases and events of any given project to gain the reader an understanding of the general activities required to install or incorporate the research element into an active construction or maintenance project. This report also establishes a baseline for defining performance for any given feature under actual service conditions to determine its relative merits.

The extent of the treatment will encompass the culvert inlet to approximately 30 ft. down flow into the culvert with a 360° SprayWall application. Areas of the apparent deformation will receive a thicker application of SprayWall. Average applied thickness of the polyurethane was at a range of ½"– ¾".

Normally a culvert rehabilitation application such as this would occur during the time of year with the least amount of stream flow to allow the contractor to dam the stream and channel

the flow either around the culvert or with a suspended pipe within the culvert.

The contractor elected to perform the work during the coldest month of winter when the stream was fully frozen. With the intent to remove the ice, then to dry the culvert with high heat to allow the preparation work (shot blasting and cleaning) required prior to the SprayWall application.

Once the culvert was properly prepped the SprayWall was applied per manufacturers recommendations. The period of culvert preparation and polyurethane application was from January to March. Although there were construction problems encountered due to the time of year this project took place, other than the concern of potential seepage; no issues were reported after completion that may affect the long-term performance of the SprayWall application.

Research will inspect and visually document the site annually for performance criteria.

April 2017 Site Inspection

The SprayWall treatment appeared intact with no visual evidence of separation or cracking (page 13).

During this inspection it was noted that areas of the steel plate seams and bolt connections received an additional (apparently hand-applied) application of SprayWall.

Information from District staff states the issue of moisture seepage (a condition evident in the culvert preparation phase; page 9), was observed after the initial SprayWall application was completed and required spot patching to eliminate the migration of moisture. Although the contractor attempted to check the leaks through the use of expanding sealants; 100% containment was not possible.

April 2018 Site Inspection

No issues to report (page 15).

January 2019 Site Inspection

This inspection did reveal some irregular visual aspect of the lining such as the lower 1/4th of the culvert has developed a sandpaper texture and a small area of the liner has reflective cracking through the SprayWall. (see supplemental pages 16, & 19-21). Discoloration of the SprayWall is apparent.

March 2020 Site Inspection

Visually the interior of the culvert has the same appearance as noted on the 2019 site evaluation. One noted event was active icicles forming at the bolt plate connections. The area of plate deflection did have some ice forming at the bolt connections as well. See page 17.

Nemote Creek Culvert Pre-Installation Site Visit - 2014



← Representative image of the observed sagging in the top panels of the steel plate arch culvert. Deflection estimated at six (6) inches as inspected in 2014 (red arrow).

Corrosion also apparent at the base of the culvert (yellow arrow).



← Interior view of extent of steel plate deflection.



← Upstream culvert inlet view, (east end).

Ice Removal Phase- January 2017



← ↓ Representative images of the process of removing ice from the culvert.

Jackhammers, shovels and picks were used to break up the nearly two feet thick ice.





← ↓ More images of ice removal.



← Ice removal complete and culvert is now ready for preparation phase.

The red arrows show placement of tarp with sandbags past the area of rehabilitation to block air flow and meltwater from entering the cleaned-out section of pipe.

Culvert Preparation Phase



← Surface prep is the key to any successful polymer application. For maximum adhesion of the SprayWall liner, the interior surface of the culvert needs to be (as possible,) free of debris, rust, scale, moisture, etc.

As seen here areas of the pipe (mostly at seam connections), that needed grinding to remove deleterious material were spray painted orange (yellow arrow).



← ↓ To prevent oxidation and/or moisture seepage, Flex Seal aerosol (liquid rubber sealant), is applied to all plate seams and bolts.

In areas where moisture still permeated the sealant, a product called Speed Dry was also used to minimize moisture infiltration.





← ↓ The base of the culvert where active corrosion took place is sand blasted (Kleen Blast Abrasives) to bare metal and vacuumed clean.



← Completed sand blasting.



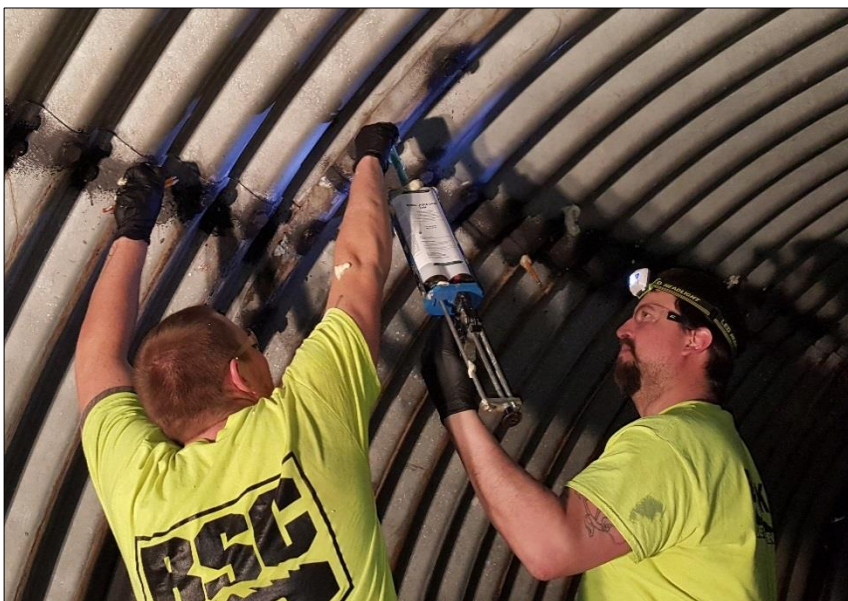
← Warm air is circulated within the prepared section of culvert.

Ambient air and surface temperature must be high enough (60°F / 16°C minimum) for adequate adhesion of the polyurethane coating.



← ↓ Although the application of the rubber sealant did mitigate moisture intrusion, due to the internal heating of the culvert moisture that was inherently frozen around the pipe, began to melt and seep through at various plate joint connections.

In an effort to mitigate the water seepage the contractor would drill near the seam and inject a two-part hydroscopic polyurethane, (Dural Aqua-Dam 200F) which expands to create a waterproof seal.





← Once the Aqua-Dam is injected, pencils (conventional No. 2 Staples brand), were used to plug the holes to prevent seepage and allow curing.

Once the cure set the pencils are cut flush to surface, and excess sealant removed prior to the SprayWall application.

MDT inspectors stated the applied sealants was not 100% effective in mitigating the moisture intrusion.

Sprayroq/SprayWall Application Phase



← Wearing protective clothing a worker applies the SprayWall to the bottom third of the culvert and allowed the material to cure.



← As the spray coating proceeded up the walls of the culvert, boards were propped at the side (cured portion) to be used as stand supports for the workers to complete the treatment.



← Sprayroq uses a conventional two-part (components A & B), polymeric elastomers to produce the structural, spray-applied polyurethane.

Pictured is the **Graco Reactor H-VR Variable Ratio Hydraulic Proportioner**:

This unit insures the correct range of volumetric ratio to adjust the A and B pumps to dispense the exact amount of material specified, and the correct blend based on product requirements.

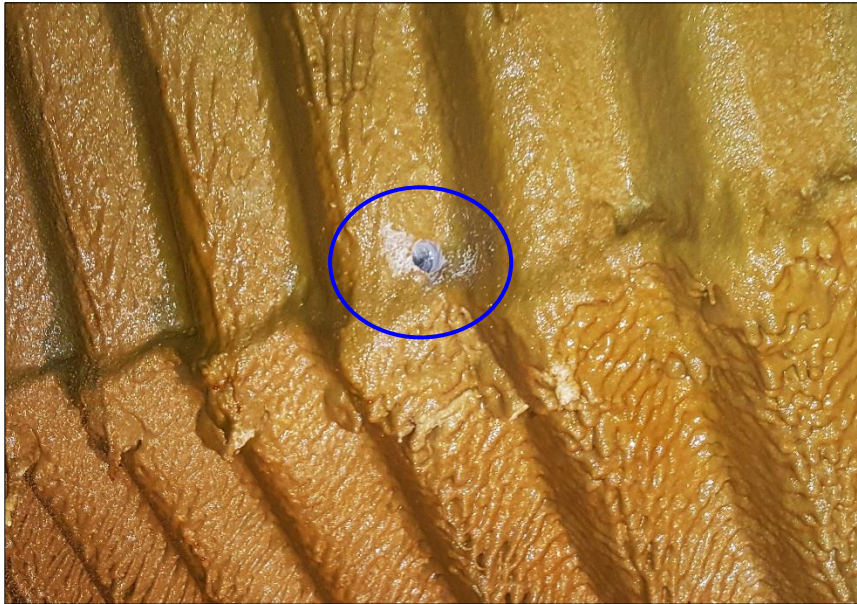


← Close-up of SprayWall texture after full cure.



← View of SprayWall coating near end of rehab section after full cure.

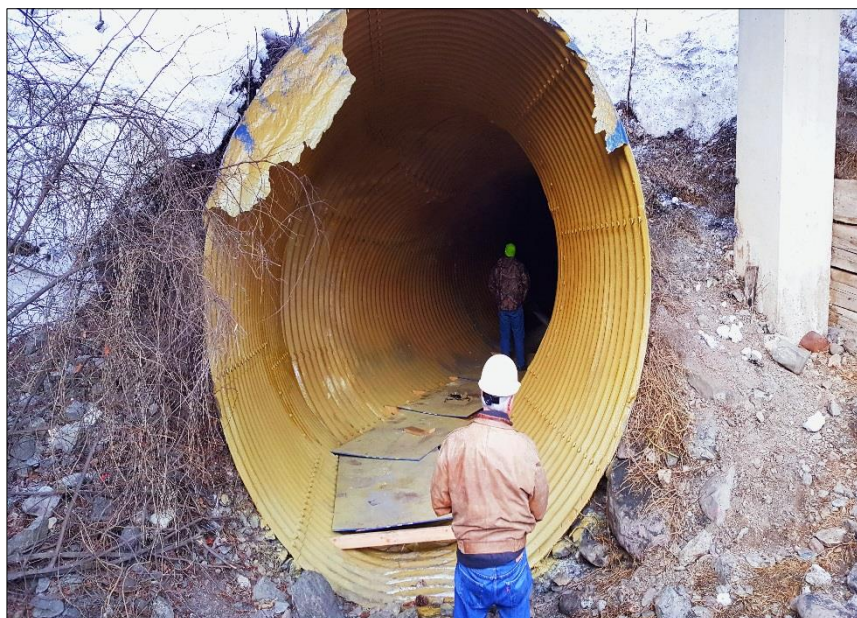
As a rule, SprayWall begins to gel in about 8 seconds, with a tack-free condition after 2 minutes. Within 60 minutes, the initial cure is complete, and the structure can accept flow, while complete curing continues over the next 72 hours based on ambient temperature.



← Several quality controls tests were performed; as seen here, a coring was performed to measure product thickness.

The image below shows a core sample taken near the pipe deflection seam at approximately 7/10th or 3/4".

Other inspections such as pull testing and spark testing were performed with satisfactory results.



← Completed Sprayroq SprayWall installation under final inspection.

April 2017 Site Inspection



↙ During the spring inspection after the culvert lining completion; it was noted that areas of the steel plate seams and bolt connections received an additional (apparently hand-applied) application of SprayWall.

Information from District staff states a minor issue of moisture seepage was observed after the initial SprayWall application.

A spot treatment was applied to those areas which visually showed potential seepage areas.



The red arrows point to some of the areas that received the post-patch.





↑↓ Before culvert section rehabilitation (2016) and (lower image) completed project as seen at the **April 2017** site inspection.



April 2018 Site Inspection



↑ Spring 2018: no visual issues were detected with the SprayWall culvert coating during this inspection.

January 2019 Site Inspection

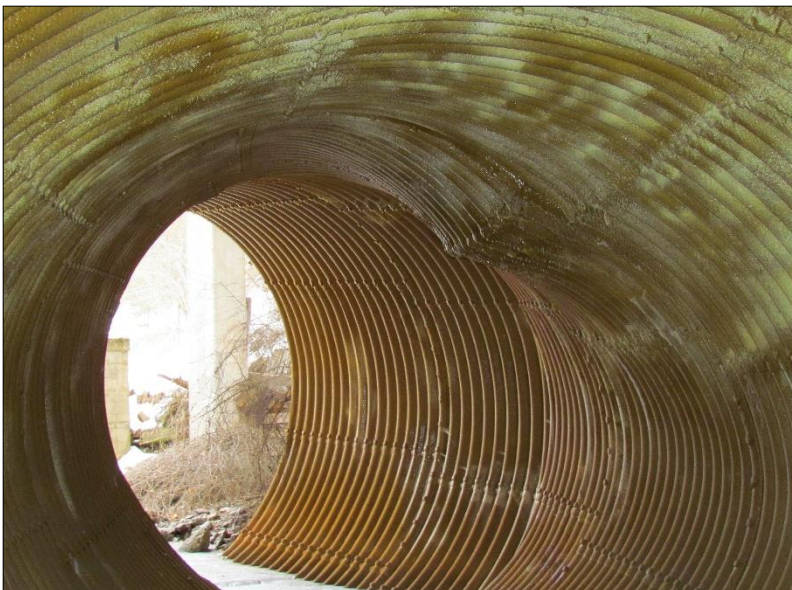


←↓ Representative images of the culvert SprayWall.

Center image is closer view of deflected panel.

Lower image is at the end of the treated culvert looking upstream.

Also refer to the Supplemental section of the report (pages 19-21 for additional information).



March 2020 Site Inspection

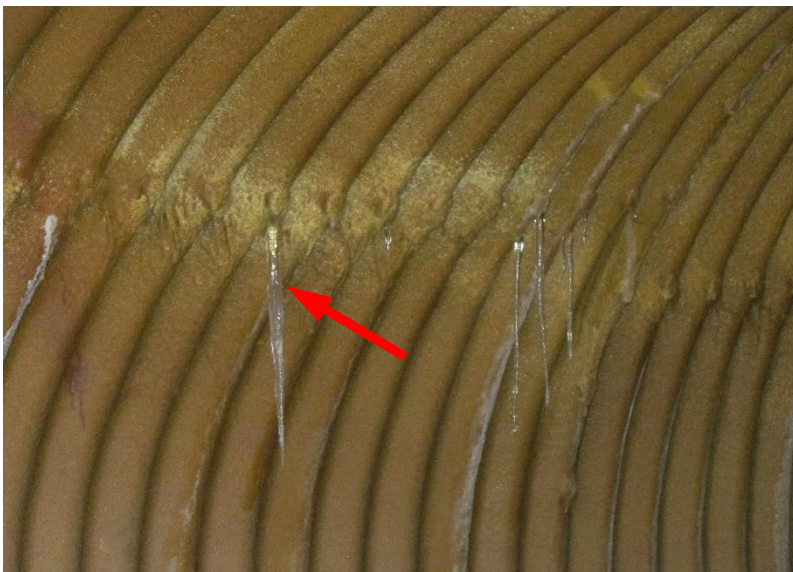


← Overview of culvert inlet.



← Area of culvert deflection.

Although difficult to see in this image, there was some ice coating the culvert plate seams (red arrow).



← This is the steel plate seam just below the area of plate deflection.

Noticeably there are icicles extruding from the plate bolt connections. (example-red arrow).

Supplemental: Varying Surface Texture

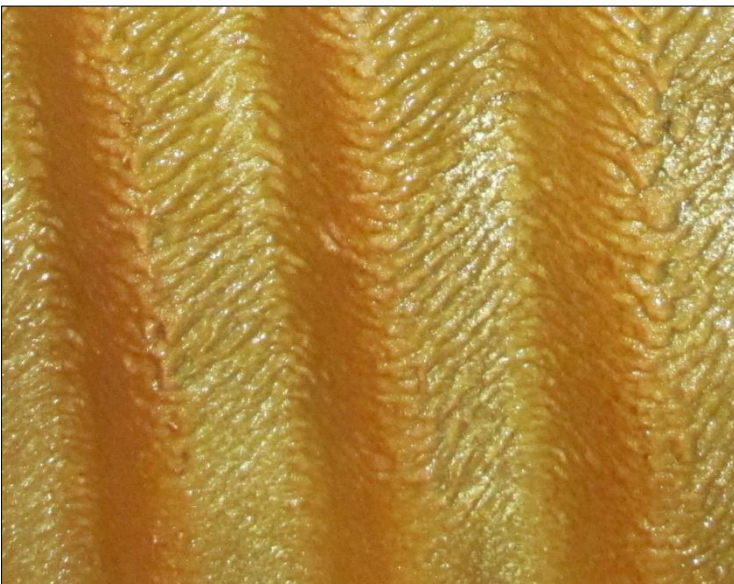


↙ During the **January 2019** site inspection, it was noticed that (approximately) the lower 1/4th diameter section of the culvert had developed a grainy, sandpaper like texture (top and center image). In contrast as compared to the lower image which represents the texture further up the culvert lining.

These images were sent to Mr. Rocky Capehart who was the vendor representative for the project. He in turn has sent the images to the Sprayroq chemical lab for review and opinion.

Sprayroq representative states this may be an issue of overspray during initial application.

If able, Mr. Capehart will visit the site in the spring of 2019 to take core sample for further analysis.



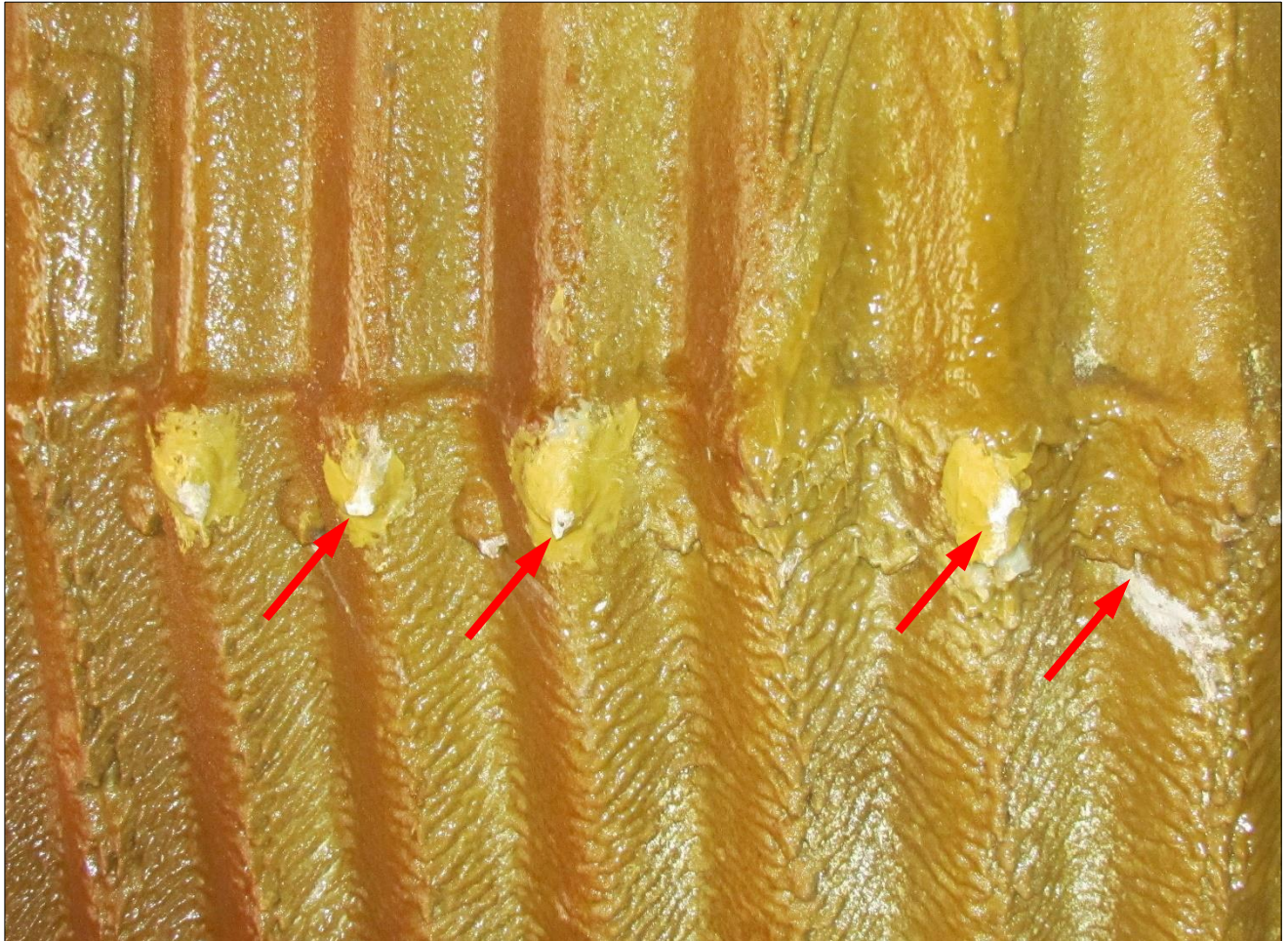
Supplemental: Liner Cracks



↑ Also seen in the January 2019 site inspection was a small section of previously patched liner with cracks reflecting through the SprayWall after patching.

← The red circle denotes the location of liner crack.

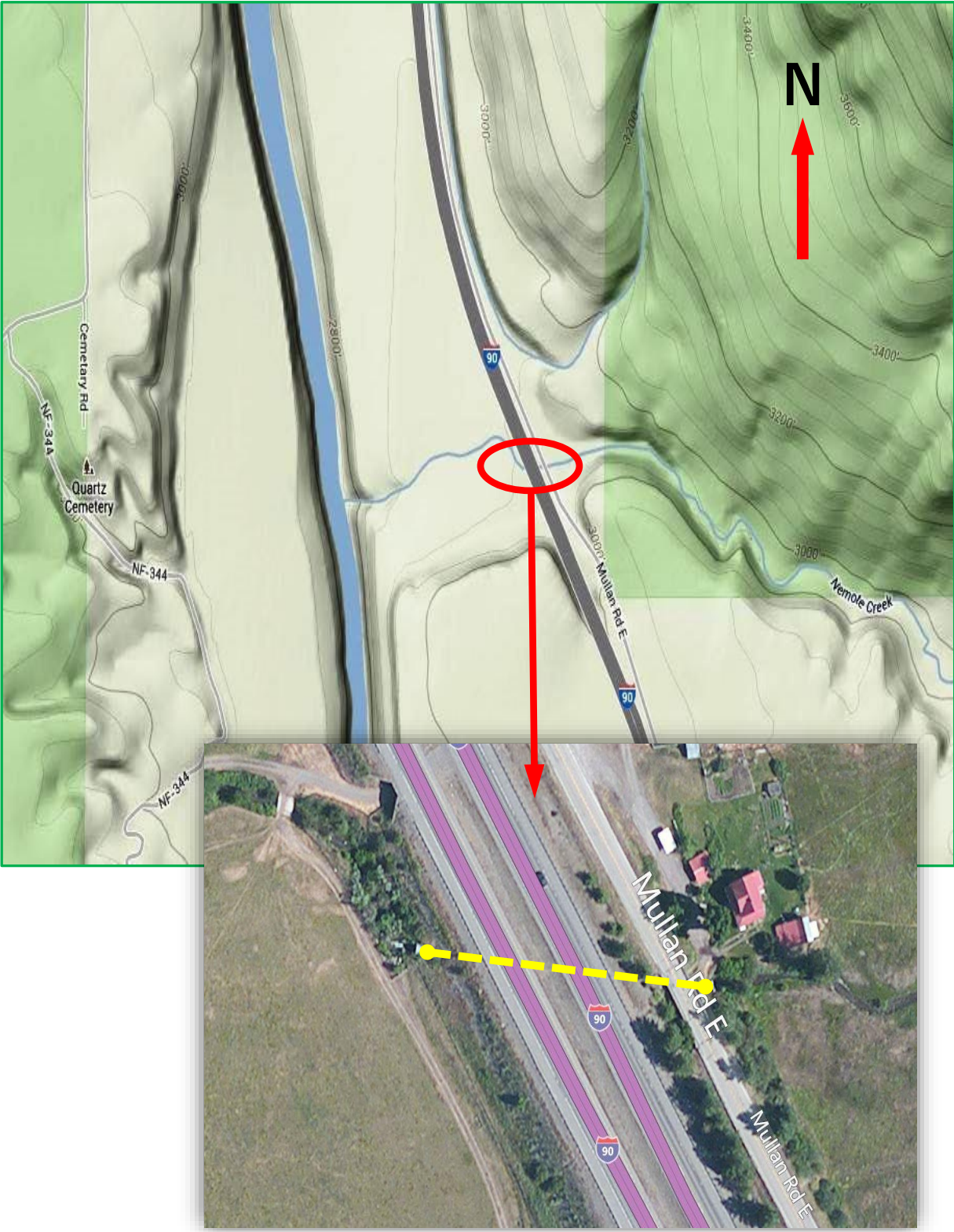
Supplemental: Possible Moisture Leaking at or around Plate Bolt Connections



↑ The above image (as seen in 2019) is the apex of the deflected steel plate panel (refer to page 4). It appears that precipitates (apparently from mineralized water solutions) may be forming through small holes or cracks near the bolt plate connections; some that had been patched after the SprayWall application.

Update: During the 2020 site evaluation icicles had formed at bolt plate connections.

***Project Location:** Nemote Creek Culvert–Interstate 90 & adjacent Mullan Rd. East (Old Highway 12), Reference Point 59: Mineral County-Montana, (yellow line denotes approximate position of the SPP culvert).



*All values approximate

Disclaimer

The use of a product and/or procedure in the course of an in-service evaluation does not constitute an endorsement by the Department nor does it imply a commitment to purchase, recommend, or specify the product in the future.

Data resulting from an evaluation of a submitted product or process is public information and will not be considered privileged. The MDT may, at its discretion, release all information developed during and after the project evaluation.