

UV-CURED GLASS REINFORCED PIPE (UVGRP)



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ABOUT TUNNEL VISION

- 40 years in business
- 25 years in trenchless
- Goal:
 - “Be the highest-quality, best-technology trenchless contractor in the Midwest”
(read: ***NOT*** necessarily the biggest).
- Prefer working with knowledgeable long-term partners and keep high employee retention.



VOCABULARY: PIPE REHAB

SIPP

- Spray-in-place pipe “coating”. ***CAN BE VERTICAL***

Slip-lining

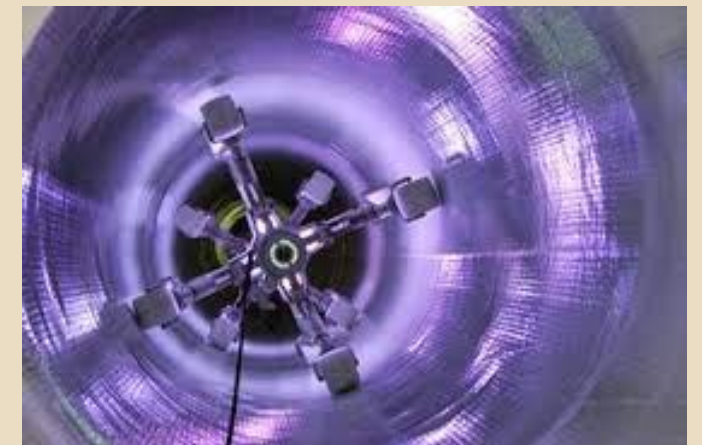
- Inserting smaller-diameter pipe and grouting the annular space

Traditional CIPP

- Inversion
 - Water cure
 - Steam cure

UV-Cured Glass Reinforced Pipe (UVCIPP / UVGRP)

- Pulled-in-place
- Reinforced with woven fiberglass
- Controlled and documented full-length cure with UV-light initiated resins



THE UV LINING PROCESS - VIDEO



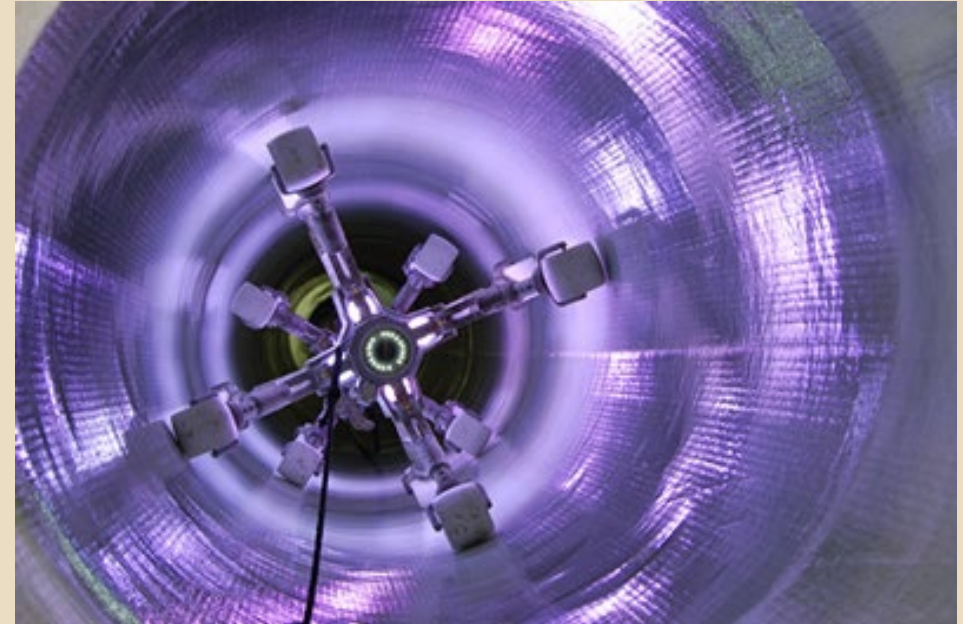
LINING AS MANUFACTURING

- The original pipe is manufactured in a controlled environment with full QA/QC.
- All liners are capital expenses just like the original asset – should be held to same standard.



BRIEF HISTORY OF UVGRP

- Ultra-Violet Light Cured Glass Reinforced Plastic Pipe (UVGRP)
- 1988 – developed in Scandinavia
- 1991 – introduced in Germany
- 2005 – introduced in North America by Reline America
- UVGRP accounts for >85% of CIPP in Europe



THE UV LINING PROCESS

Manufacturing

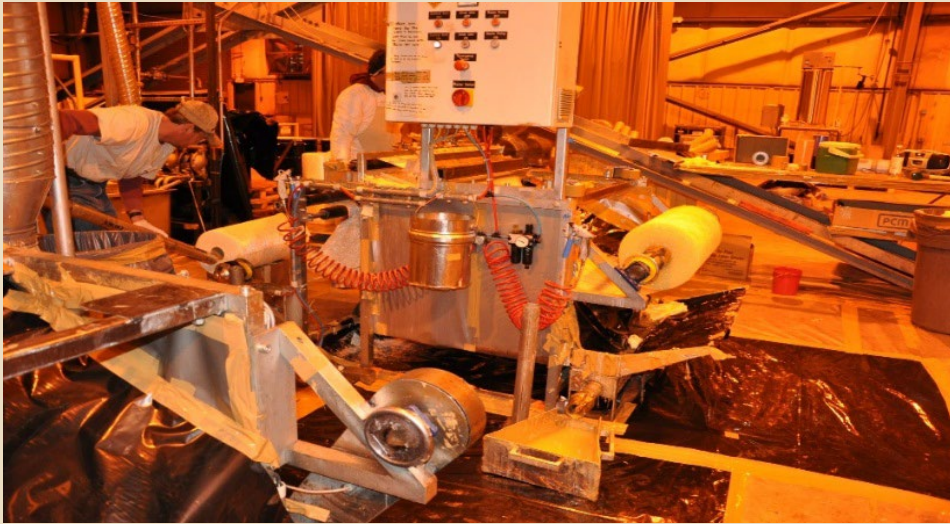
1. Raw resins arrive at factory
 - tested
2. Additives are mixed with resin
 - tested



THE UV LINING PROCESS

Manufacturing cont'd

3. Glass mat is wound and wet out in immersion bath
 - tested
4. Liner assembled and loaded in shipping crates
 - Liner barcoded and samples retained



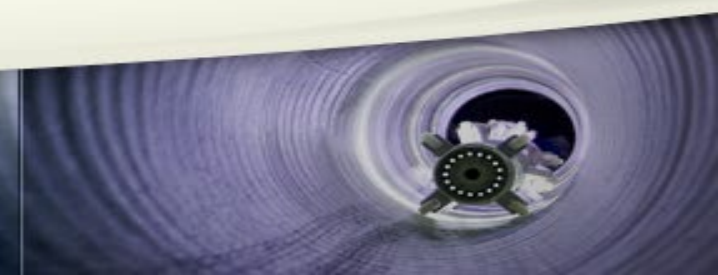
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UV GRP CIPP

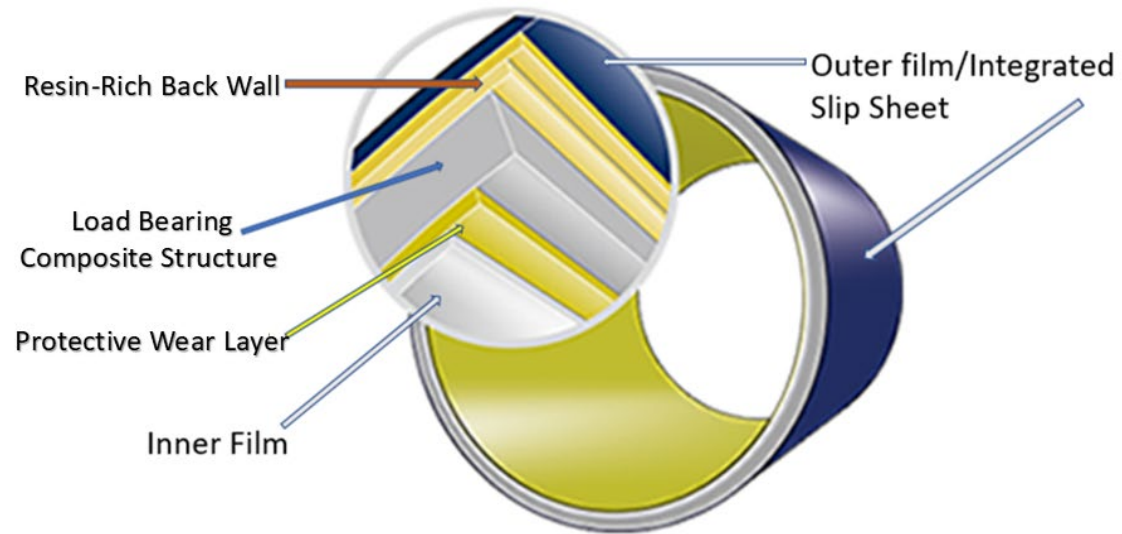
Presented by: Drew Lewis
Senior Business Development Manager
Reline America, Saltville, VA

FOR BETTER INFRASTRUCTURE...
IT'S TIME TO SEE THE LIGHT



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ALPHALINER DIAGRAM



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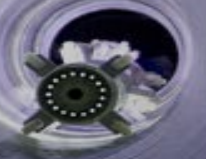


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INDUSTRY STANDARDS

- ASTM F2019-20 (Installation of UV GRP Liner)
- ASTM D5813 (CIPP Resin Chemical Resistance Strength Test)
- ASTM D2990 (Long Term Properties “Creep Test”)
- ASTM D790 (Flexural Properties Testing “3 Point Load”)
- ISO 9001: 2015 (Quality Management System)
- APS Standard (Porosity Test)
- DIN 19523 (jetting resistance test)
- DARMSTADT Tipping Trough (abrasion resistance)
- *Greenbook Certification for 2021

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Installation Term: Slip Sheet



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Installation Term: Pulling Liner in Place



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Installation Term: Cure Truck and Cure Log



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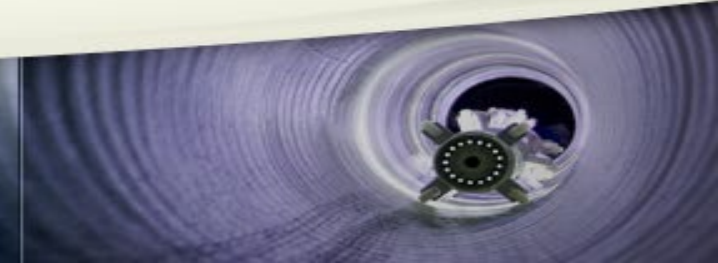


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Installation Term: Light Train



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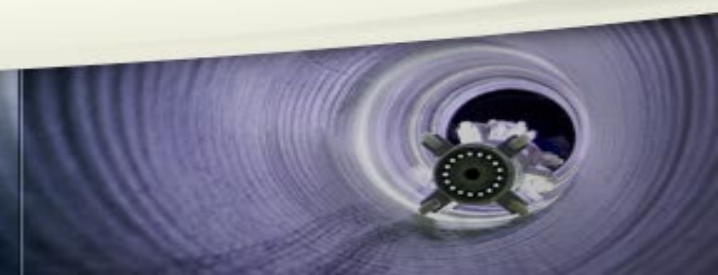


What is UV GRP



Highly engineered, proprietary designs allow UV GRP to be:

- The Strongest CIPP option available
- Highest Creep Retention Value
- Least Impactful option to the Environment



Advantages of UV GRP

- No Styrene/VOC released during installation or Liner Cure
- Quality Assurance built into installation
 - Pre-Cure Inspection
 - Live Data Monitoring Bulbs & Temp
- Quality Tracker System
 - Tamper Proof Cure Log
- Start Stop Anytime
- Rehab Pipes of any material and shape from 6" to 72" and in excess of 1,000ft



Advantages of UV GRP



- Minimal shrink rate (smaller annular space thanks to glass reinforcement)
- No Refrigeration Needed
- Consistent and Uniform Cure
- Quality Assurance
- Brought to the US in 2006 by Reline America (That's US!!)



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About Reline America



FOR BETTER INFRASTRUCTURE...
IT'S TIME TO SEE THE LIGHT



About Reline America

- **Reline America is the only UV GRP Supplier that manufactures both Equipment and Liner creating the most durable and reliable installation process (one stop shop)**
- **ISO 9001:2015 certified quality management system**
- **Installation Integration between Installer, Equipment and Material**

RELINER AMERICA™



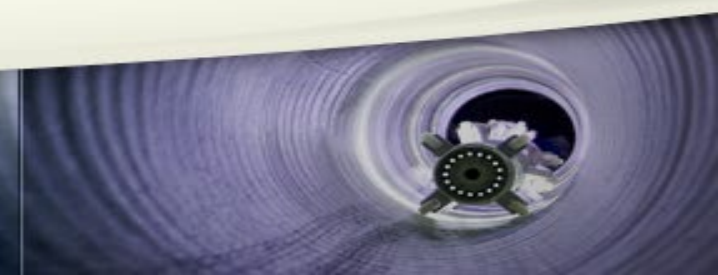
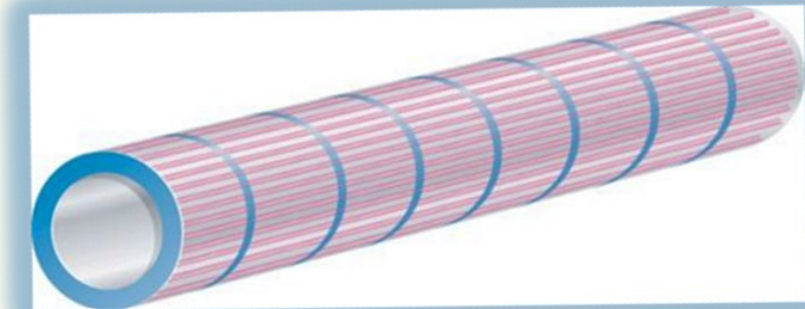
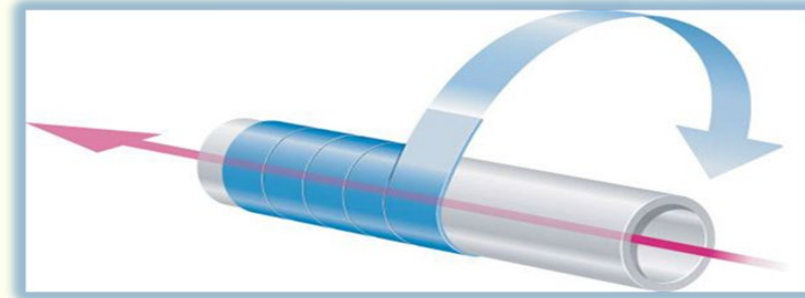
- **Reline America manufactures all our liners under the trade name “Alphaliner”**
- **Proprietary Testing Process for all raw material (incoming goods inspection)**
- **Complete Batch and Lot Traceability for every foot of liner we have manufactured**
- **Tamper Proof Cure Logs**
- **Consistency in manufacturing is consistency in final product**

FOR BETTER INFRASTRUCTURE...
IT'S TIME TO SEE THE LIGHT



Why Alphaliner?

- **Significant amount of Highly Engineered Proprietary technology in both liners and Equipment**
- **Result: Highest Quality most Reliable and Consistent product on the market**
- **Spirally-wound resin saturated fiberglass creates a more uniform wall thickness**



Key Takeaway's for UV GRP

- Incredibly Strong Liner = Thinner Wall = Minimal Reduction to Hydraulic Capacity + Faster Cure
- 50+ Year Lifespan
- No VOC/Styrene Released
- Negligible Environmental Footprint
- Pre-Cure Inspection
- Quality Tracker System
- Tamper Proof Cure Logs
- Highly Engineered Process = Better Quality CIPP Programs

Conclusion



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THE UV LINING PROCESS

Manufacturing cont'd

5. Fully QAQC checked liner shipped to contractor
6. Liner awaits installation for up to 6 months without refrigeration

Manufacturing doesn't end there.

Installation is the final and most important step of manufacturing.



CURING

- Liner is placed, inflated, and light train inserted.
- CCTV cameras on the light train inspects the inflated (but not yet cured liner) as it is winched down the pipe
- Light train turned on during return to curing truck, gathering **video, pressure, and temperature readings** during entire process.



FINAL STEP OF MANUFACTURING END-TO-END QA/QC! CURE LOG DATA



AutoSave (Off) M11675_78xx79 - Read-Only - Compatibility Mode - Excel

File Home Insert Draw Page Layout Formulas Data Review View ACROBAT Tell me what you want to do

D10 X ✓ fx 'Speed'

	A	B	C	D	E	F	G	H	I	J	K
1	INSTALLATION REPORT										
2	CLIENT	MDOT		PROJECT							
3	STREET	M221		MANUFACTURE							
4	PROJECT NUMBER	M11675		PRODUCTION ID							
5	MANHOLE TO MANHOLE	78xx79		PRODUCTION DATE							
6	PIPE DIAMETER	48		WALL THICKNESS							
7	LENGTH	350		STORAGE TEMPERATURE							
8	SOURCE OF LIGHT	6X2000W		OUTSIDE TEMPERATURE							
9	WEATHER										
10	Date_Time	Length	Speed_SP	Speed	Pressure	Temp_1	Temp_2	Temp_3	Temp_4	L1	L2
11	08/08/2017 14:52:22	91.63	1.00	0.00	0.00	90.10	79.20	81.80	96.50	0.00	0.00
12	08/08/2017 14:52:37	91.63	1.00	0.00	0.00	89.50	80.90	83.50	97.50	0.00	0.00
13	08/08/2017 14:52:53	91.63	1.00	0.00	0.00	90.90	79.70	84.00	96.40	0.00	0.00
14	08/08/2017 14:53:09	91.63	1.00	0.00	0.00	90.80	81.00	83.20	97.60	0.00	0.00
15	08/08/2017 14:53:24	91.63	1.00	0.00	0.00	91.30	81.10	84.80	96.80	0.00	0.00
16	08/08/2017 14:53:40	91.63	0.10	0.00	0.00	91.10	81.10	82.30	98.30	0.00	0.00
17	08/08/2017 14:53:56	91.63	0.10	0.00	0.00	92.40	83.90	86.00	97.00	0.00	0.00
18	08/08/2017 14:54:12	91.63	0.10	0.00	0.00	93.50	83.20	83.60	96.80	0.00	0.00
19	08/08/2017 14:54:27	91.63	0.10	0.00	0.00	91.30	82.70	83.90	98.50	0.00	0.00
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21	08/08/2017 14:54:59	91.63	0.10	0.00	0.00	91.60	86.90	83.70	95.70	0.00	0.00
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26	08/08/2017 14:56:18	91.63	0.10	0.00	0.00	93.90	84.60	86.50	98.60	0.00	0.00
27	08/08/2017 14:56:33	91.63	0.10	0.01	0.00	94.30	85.50	85.60	97.30	0.00	0.00
28	08/08/2017 14:56:49	91.63	0.10	0.01	0.00	95.40	85.10	85.40	97.10	0.00	0.00
29	08/08/2017 14:57:05	91.63	0.10	0.01	0.00	95.40	86.00	85.60	98.50	0.00	0.00
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32	08/08/2017 14:57:51	91.63	0.10	0.00	0.00	97.70	86.80	88.10	97.40	0.00	0.00
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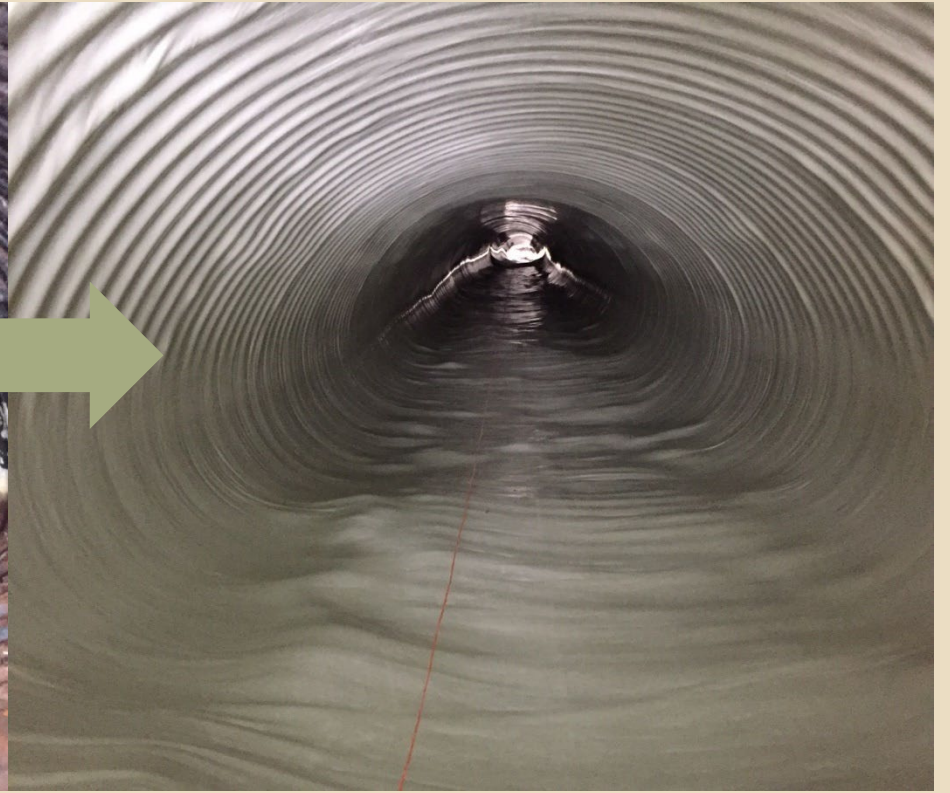
REPORT INFO VOLTAMP

PROJECT PROFILE – BEFORE

- 340' of 57" x 38" low-head arch "squat pipe"
- Invert completely rotted out and turning upwards – very near failure.
- Not a "straight shot" through the pipe.



BEFORE AND AFTER 340' OF 48" ARCH PIPE



MATERIAL PROPERTIES

	Alphaliner 500	Alphaliner 1500	Alphaliner 1800H
Base Material	Glass-fiber reinforced plastic		
Sizes	6" to 72"+		
Shapes			
Modulus of Elasticity (Short Term)	1,487,000 psi	1,956,975 psi	2,555,000 psi
Modulus of Elasticity (Long Term)	1,085,880 psi (27% loss at 50 yrs)	1,374,600 psi (21% loss at 50 yrs)	2,170,000 psi (15% loss at 50 yrs)
Flexural Strength	26,110 psi	30,460 psi	50,000 psi
Design Life	70 years	70 years	70 years

ENVIRONMENTAL IMPACT

Caltrans Study

- Care required with uncured resin!
- Solution:
 - Reduce egress pathways by not introducing water (**dry cure process**).
 - Encapsulate all resin within all sides of the liner.

- **Result:**

No resin washing out

No Thermal shock of hot water

No pathways to human/environmental exposure (steam plumes, runoff)

FINAL REPORT

February 2017

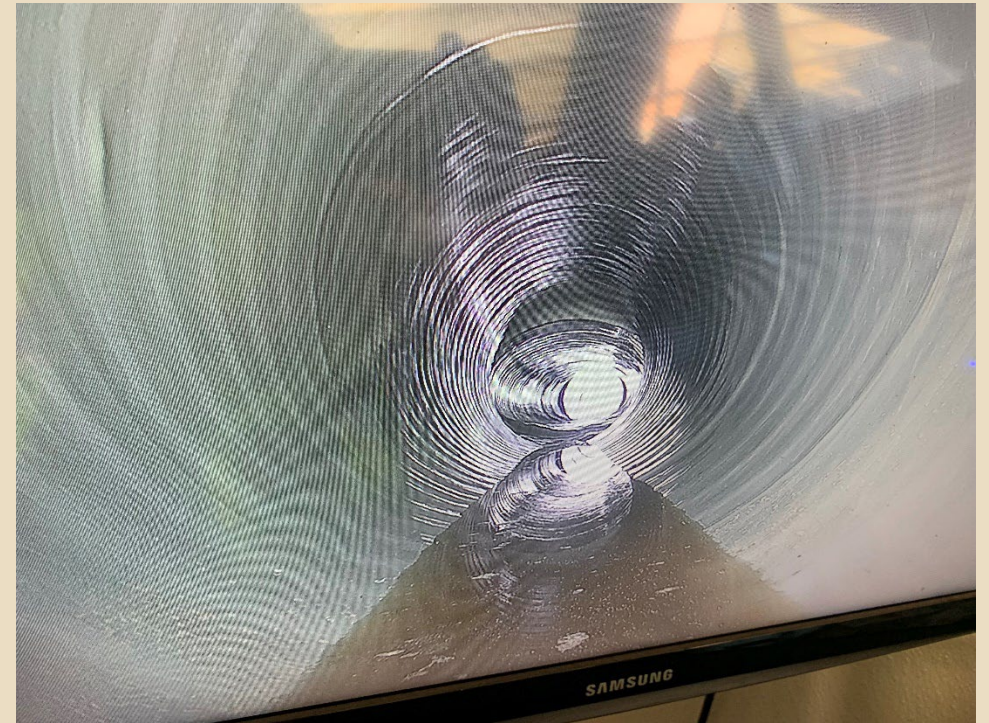
Prepared for
California Department of Transportation

WATER QUALITY OF
FLOW THROUGH
CURED-IN-PLACE
PIPE (CIPP)

Executive Summary:

“The most protective CIPP curing method was UV, where the concentrations of volatile organic compounds in all samples analyzed were below all known environmental thresholds.”

WHAT UV CAN DO



THANK YOU!

Gabriel Kloet
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