SOUTH TEXAS WATER AUTHORITY
2302 E. SAGE RD.
KINGSVILLE, TEXAS 78363

MEMORANDUM

TO: South Texas Water Authority Board of Directors
FROM: Jose M Graveley, President
DATE: October 7, 2025
SUBJECT: Meeting Notice and Agenda for the South Texas Water Authority

A Special Meeting of the STWA Board of Directors is scheduled for:

Tuesday, October 14, 2025
12:00 p.m.
South Texas Water Authority
2302 East Sage Road, Kingsville, Texas

The Board will consider and act upon any lawful subject which may come before it, including among others, the following:

Agenda

1. Call to order.
2. Citizen comments. This is an opportunity for citizens to address the Board of Directors concerning an issue of community interest that is not on the agenda. Comments on the agenda items must be made when the agenda item comes before the Board. The President may place a time limit on all comments. The response of the Board to any comment under this heading is limited to making a statement of specific factual information in response to the inquiry, or, reciting existing policy in response to the inquiry. Any deliberation of the issue is limited to a proposal to place it on the agenda for a later meeting.
3. Payment of Bills. (Attachment 1)
4. Request for Proposals: Condition Assessment – 42" Transmission Line. (Attachment 2)
5. Adjournment.

The Board may go into closed session at any time when permitted by Chapter 551, Government Code. Before going into closed session, a quorum of the Board must be assembled in the meeting room, the meeting must be convened as an open meeting pursuant to proper notice, and the presiding officer must announce that a closed session will be held and must identify the sections of Chapter 551, Government Code, authorizing the closed session.

JMG/JM/fdl
Attachments

This meeting notice was posted on STWA's website, www.stwa.org, and on indoor and outdoor bulletin boards at STWA's administrative offices, 2302 East Sage Road, Kingsville, Texas at 445 am/pm on October 7, 2025.
Frances De Leon
Assistant Secretary

(361) 592-9323 Or (361) 692-0337 (C.C. line) Fax: (361) 592-5965

ATTACHMENT 1

Payment of Bills

BILLING STATEMENT

Questions? Please
contact us at
billing@tmlirp.org

Texas Municipal League Intergovernmental Risk Pool
www.tmlirp.org • 512-491-2300
Billing Payment Address:
P.O. Box 388
San Antonio, Texas 78292-0388

South Texas Water Authority
Attn: Jo Ella Wagner
2302 E Sage Rd
Kingsville, Texas 78363

Statement Date	10/01/2025
Due Date	**DUE UPON RECEIPT**
Contract Number	9187

New Charges Detail

10/01/2025	Mobile Equipment	$2,787.00
10/01/2025	Coastal Wind Coverage	$45,500.00
10/01/2025	Workers' Comp	$17,864.00
10/01/2025	Cyber Liability	$1,850.00
10/01/2025	Automobile Liability	$5,145.00
10/01/2025	Errors & Omissions Liability	$1,893.00
10/01/2025	Real & Personal Property	$11,475.00
10/01/2025	Auto Physical Damage	$5,887.00
10/01/2025	General Liability	$2,258.00
Subtotal - Contribution Installment		$94,659.00
Subtotal - Contribution Changes		$0.00
10/01/2025	Pre-Payment Discount/Discount Adj	($1,893.18)
Subtotal - Other Charges / (Credits)		($1,893.18)
Grand Total - New Charges / (Credits)		$92,765.82

Account Recap

Balance from Previous Statement:	$0.00
Total Payments Received:	$0.00
Total New Charges / (Credits):	$92,765.82
Balance:	$92,765.82

RETURN THIS PORTION WITH YOUR PAYMENT

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Submit address/contact changes to:
billing@tmlirp.org

South Texas Water Authority
Jo Ella Wagner
2302 E Sage Rd
Kingsville, Texas78363

Please send your payment to:

TML Intergovernmental Risk Pool
PO Box 388
San Antonio, TX 78292-0388

CHARLES W. ZAHN, JR.
ATTORNEY AT LAW
2106 STATE HIGHWAY 361, SUITE B
P.O. BOX 941
PORT ARANSAS, TEXAS 78373
Telephone: (361) 548-8967 * Fax: (361) 729-2381
Email: cwzjr@centurytel.net
August 10, 2025

South Texas Water Authority
2302 E. Sage Road
Kingsville, Texas 78363
Attn: Mr. John Marez
Executive Director

Re: Bill for services rendered through July 31, 2025

FOR SERVICES RENDERED AS FOLLOWS:

06/02/2025	CWZ Preparation of Third-Party Notice to Seven Seas Water (STWA) USA, LLC of City of Corpus Christi Water Public Information Request	1.00
06/03/2025	CWZ Receipt and review of correspondence from Michael Noone; Telephone conference with Peter Zanoni, Drew Molley and Miles Risley; Preparation of correspondence to Peter Zanoni; Telephone conference with Michael Noone; Telephone conference with Peter Zanoni, Drew Molley and Miles Risley	1.40
06/04/2025	CWZ Telephone conference with John Marez; Telephone conference with Wes Strickland	.60
06/05/2025	CWZ Receipt and review of correspondence from John Marez; Telephone conference with John Marez; Telephone conference with Terry Arnold; Receipt and review of correspondence from Wes Strickland (Water Supply Agreement Amendment)	1.20
06/06/2025	CWZ Preparation of correspondence to Wes Strickland; Receipt and review of correspondence from John Marez; Telephone conference with John Marez	.80
06/09/2025	CWZ Receipt and review of correspondence from John Marez; Telephone conference with John Marez; Receipt and review of correspondence from John Marez; Review of City of Corpus Christi Agenda packet; Telephone conference with John Marez	1.00
06/10/2025	CWZ Preparation of opinion on presentation to the Corpus Christi City Council; Preparation of correspondence to John Marez; Receipt and	

review of correspondence from Lisa Aguilar; Preparation of correspondence to Lisa Aguilar 2.20

06/19/2025 CWZ Conference with Drew Molley, Janet Whitehead, John Marez and Jo Ella Wagner; Receipt and review of correspondence from Janet Whitehead (draft of Memorandum of Understanding); Preparation of correspondence to John Marez 2.00

06/20/2025 CWZ Preparation of correspondence to Wes Strickland and Michael Noone; Receipt and review of correspondence from Michael Noone; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Michael Noone; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Sherry Quisada; Preparation of correspondence to Sherry Quisada; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Wes Strickland to Janet Whirehead; Receipt and review of correspondence from Wes Strickland to Janet Whirehead; Receipt and review of correspondence from Wes Strickland; Preparation of Third-Party Notice to Seven Seas Water (STWA) USA, LLC (City of Corpus Christi Legal); Preparation of correspondence to Michael Noone; Receipt and review of correspondence from Wes Strickland and Michael Noone 3.60

06/21/2025 CWZ Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Janet Whirehead; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Michael Noone; Preparation of correspondence to John Marez; Telephone conference with John Marez; Telephone conference with John Marez; Receipt and review of Public Information Request from Myra Alaniz 3.00

06/22/2025 CWZ Telephone conference with John Marez; Preparation of Memorandum to John Marez; Telephone conference with Janet Whitehead; Telephone conference with Janet Whitehead; Receipt and review of revised Memorandum of Understanding with the City of Corpus Christi; Preparation of correspondence to John Marez; Telephone conference with John Marez; Telephone conference with Janet Whitehead; Preparation of correspondence to John Marez; Receipt and review of correspondence from John Marez 2.40

	Memorandum of Understanding); Receipt and review of correspondence from John Marez;	1.80
07/10/2025 CWZ	Receipt and review of correspondence from John Marez; Receipt and review of Mahita Shankam Public Information Request; Receipt and review of correspondence from John Marez	1.00
07/11/2025 CWZ	Telephone conference with John Marez; Preparation of correspondence to Alan Ozuna	.40
07/14/2025 CWZ	Travel to and attend Kleberg Couty Commissioners Court meeting; Receipt and review of correspondence from Alan Ozuna; Preparation of correspondence to Alan Ozuna	4.40
07/15/2025 CWZ	Telephone conference with Alan Ozuna; Telephone conference with John Marez; Receipt and review of Milton Lorenz Public Information Request; Preparation of Third-Party Notice to Seven Seas Water (STWA) USA, LLC; Preparation of correspondence to Michael Noone and Wes Strickland	2.20
07/16/2025 CWZ	Receipt and review of Reimbursement Agreement; Preparation of Third-Party Notice for Milton Lorenz Public Information Request; Receipt and review of correspondence from Michael Noone; Receipt and review of correspondence from Wes Strickland; Receipt and review of A&M Kingsville study; Receipt and review of correspondence from John Marez; Telephone conference with Michael Noone; Telephone conference with Wes Strickland; Preparation of correspondence to John Marez; Preparation of correspondence to Michael Noone	3.40
07/17/2025 CWZ	Receipt and review of correspondence from Michael Noone; Telephone conference with John Marez; Preparation of correspondence to John Marez; Travel to and attend Corpus Christi City Council meeting; Receipt and review of correspondence from Wes Strickland	3.80
07/18/2025 CWZ	Travel to Kingsville and conference with Alan Ozuna, John Marez, Jo Ella Wagner and Francis De Leon; Conference with Judge Rudy Madrid	4.40

07/29/2025 CWZ	Receipt and review of correspondence from Rachel Clow; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from Wes Strickland; Receipt and review of correspondence from John Marez; Receipt and review of Agenda for the August 5, 2025 Regular Meeting of the Board of Directors; Preparation of correspondence to John Marez; Receipt and review of correspondence from Wes Strickland; Preparation of correspondence to Wes Strickland; Receipt and review of correspondence from Wes Strickland; Review of responsive documents to Perales, Allmon and Rice Public Information Request	4.80
07/30/2025 CWZ	Receipt and review of Rachel Clow response to Seven Seas Water (STWA) USA, LLC request to Texas Attorney General on Rachel Clow Public Information Request; Receipt and review of correspondence from Wes Strickland; Preparation of correspondence to Wes Strickland; Receipt and review of correspondence from John Marez; Preparation of correspondence to John Marez; Review of responsive documents to Perales, Allmon and Rice Public Information Request	2.60
07/31/2025 CWZ	Review of responsive documents to Perales, Allmon and Rice Public Information Request; Preparation of correspondence to John Marez; Preparation of correspondence to Alan Ozuna; Telephone conference with Alan Ozuna; Telephone conference with Wes Strickland; Receipt and review of correspondence from Wes Strickland; Telephone conference with John Marez; Receipt and review of correspondence from John Marez; Telephone conference with Terry Arnold; Receipt and review of Seven Seas Water (STWA) USA, LLC response to Milton Lorenz Public Information Request	4.60

102 hours @ $450.00 per hour = $45,900.00

ATTACHMENT 2

RFP – 42" Waterline Condition Assessment

Memo

To: STWA Board of Directors
From: John Marez, Executive Director
Date: September 19, 2025
Subject: RFP – Condition Assessment – 42" Transmission Line

Background:

The South Texas Water Authority (STWA) owns and operates a 42-inch bar-wrapped transmission main originally installed over four decades ago. This line contains numerous Air Release Valves (ARVs) and large Gate Valves critical to the safe and reliable delivery of water to our service area. A comprehensive condition assessment of these fittings has not been performed in many years. Routine inspections are an industry best practice and support the Authority's long-term asset management and capital planning.

The proposed project will perform a mechanical assessment of 25 ARVs and 5 large Gate Valves to determine their current condition, functionality, and any immediate repair or replacement needs. This work will also provide detailed photographic and video documentation and generate cost estimates for any future corrective actions.

Analysis:

Because the estimated cost of the work will exceed $50,000, Texas Water Code Chapter 49 and Local Government Code Chapter 252 require STWA to procure these services through a formal competitive process. The proposed approach is to issue a Request for Proposals (RFP) that includes the full scope of work — cleaning and preparing access to valves, performing visual and mechanical assessments, safely exercising the five 42-inch Gate Valves under controlled conditions, and delivering a full condition report with recommendations and cost data.

The RFP process provides several key benefits:

- *Transparency and Compliance* – Follows Texas competitive bidding standards and avoids conflicts of interest.
- *Best-Qualified Contractor* – Ensures bidders have proven experience with large-diameter water transmission systems and AWWA C303 pipe.
- *Cost Control* – Unit pricing for each ARV and Gate Valve allows flexibility and fairness if the actual number of fittings differs from current records.
- *Future Planning* – The resulting data will impact long-term capital improvement budgeting and reduce emergency repair risks.

STWA staff will coordinate closely with the selected contractor to ensure safety, avoid service disruptions, and integrate findings into our asset management program.

Staff Recommendation:

Staff recommends proceeding with the issuance of an RFP for the Condition Assessment of the 42-inch Transmission Line as described in the attached scope of work. The RFP will require documentation of relevant experience, safety practices, and technical qualifications, and it will include clear evaluation criteria to select the most qualified and cost-effective proposal.

Board Action:

Authorize the Executive Director to issue an RFP for the 42-inch Transmission Line Mechanical Condition Assessment in accordance with Texas Local Government Code and Texas Water Code requirements and return to the Board for contract award once proposals have been received and evaluated.

Summary:

This action initiates a legally compliant procurement process to inspect, document, and plan for the maintenance of critical pipeline fittings that have not been comprehensively evaluated in decades. It will strengthen system reliability, reduce risk of emergency failures, and provide accurate cost information for upcoming capital projects.

Scope of Work – Mechanical Fitting Assessment

Client: South Texas Water Authority (STWA)
Project: 42" Bar-Wrapped Pipe (AWWA C303) – Mechanical Fitting Condition Assessment

Project Overview

The scope of work includes performing a mechanical assessment of fittings on the STWA 42-inch bar-wrapped pipeline (AWWA C303-78), with specific attention to the condition of Air Release Valves (ARVs) and Gate Valves. The objective is to identify any components requiring repair or replacement. The contractor shall also conduct a controlled operational assessment of five 42-inch Gate Valves to evaluate their functionality. Prior to exercising the valves, the contractor is responsible for performing a visual and mechanical inspection of critical components - including bolts, nuts, and joint connections - to confirm their suitability for operation exercise.

Assessment Coverage

- **25 Air Release Valves (ARVs)**
    - Type 2: Dual-body combination air valves with surge check valves (CSV)
- **5 Gate Valves**
    - 42" Gate Valves directly connected to the main pipeline

Scope of Work

The selected contractor shall provide all labor, equipment, materials, and expertise necessary to perform the following:

Cleaning and Preparation:

- All ARVs, Gate Valves, and associated valve chambers must be cleaned using pressure washing equipment to remove dirt, debris, and obstructions.
- This will ensure safe access and clear visibility for the assessment process.

Visual and Mechanical Condition Assessment

- Each valve and its connection to the pipeline must be inspected for signs of:
    - **Corrosion**
    - **Leakage**
    - **Mechanical wear or damage**
    - **Loose or missing bolts, nuts, and gaskets**
- The inspection should include all accessible parts of the fittings and associated appurtenances.

- Photographs (360-degree angle), videos (360-degree angle), and field notes must be recorded for documentation.

Operational Assessment – Gate Valves

- A controlled exercise (open/close operation) should be conducted on the five 42" Gate Valves.
- Prior to operation, a safety and integrity check must be performed to confirm that each valve is suitable for exercise.
- Valves should be operated using an external manual device with preset torque and pressure settings to avoid damage or overstress.
- Coordination with STWA Operations will be required to ensure proper system integration and avoid service disruptions.
- Coordination with the Engineers of Record is required prior to initiating any valve exercise.
- If there is any indication of potential valve failure, the exercise must be postponed. Final authorization to proceed must be obtained from both the STWA Operations Team and the Engineers of Record.

Data Collection

- A final report must be provided summarizing:
    - Observations and condition of each ARV and Gate Valve
    - **Measurement of metal thickness** for flanges, nuts, and bolts on the ARVs and Gate Valves
    - Identification of valves and fittings requiring **repair** or **replacement**
    - Prioritization of corrective actions
    - Cost estimates for repairs or replacements based on current market rates for each item
    - Pictures must be clearly label to understand the position at which the picture is taken. Also, any deficiencies identified must be clearly noted and labeled in picture

Site Preparation for Future Work

- The site should be left in a condition suitable for follow-up structural inspections or repair work.
- Field supervision must be provided throughout the assessment to ensure quality and support client representatives as needed.

Deliverables

- Full condition assessment report (PDF)
- Photo and video documentation
- Summary table of inspection findings Following should be included

  - **Measurement of metal thickness** for flanges, nuts, and bolts
  - **Nut bolt thread condition**
  - **Material of the nuts and bolts**
  - **Performance results of 42" Valve exercise**
- List of recommended repair/replacement parts with estimated costs

Safety and Coordination

- All work will be conducted in compliance with applicable safety standards.
- Coordination with STWA staff will be required throughout the assessment process, especially during valve operation and system access.

Recommended Bidder Qualifications

Bidders must demonstrate:

- Experience with large-diameter water pipeline systems and AWWA C303 pipes.
- Proven expertise in mechanical inspection of valves and fittings on large water transmission line (42 inches or larger).
- Qualified field inspection team with relevant certifications and experience on water transmission and distribution line projects.
- References from similar water line projects.

Expected Engineering Cost Recommendations

- The assessment scope currently includes **25 Air Release Valves (ARVs)** and **5 Gate Valves,** based on available records (Reference STWA Diamond Map)
- **Note:** A comprehensive inspection of the ARVs has not been conducted in the past 40 years.
- Should the actual number of fittings differ from these quantities, the total project cost will be adjusted accordingly.
- The pricing to be provided **on a per-unit basis** for both ARVs and Gate Valves.
- This unit pricing should then be **multiplied by the confirmed quantity** following inspection, allowing for flexible and transparent cost adjustments.

Attachment for Bidders

To support a clear understanding of the existing system, the following information will be made available to all bidders:

- **ARV Specification Sheet** – Details for dual-body combination air valves with surge check valves (CSV)
- **ARV Construction Drawings** – Design and installation details of existing ARV assemblies
- **Recent Site Photos** – Images of current ARV and gate valve conditions
- **GIS Coordinates** – Precise locations of all ARVs and gate valves
- **Pipeline Construction Drawings** – Available upon request to support further technical review.

Outlook

DRAFT Scope of Work for Valve Assessment

From Ivan Luna <ivan@icengineers.net>
Date Tue 10/7/2025 3:01 PM
To 'John Marez' <jmarez@stwa.org>
Cc Ivan Luna <ivan@icengineers.net>; Jesus Jimenez <jj@icengineers.net>; Ansar Palakkal <ansar@icengineers.net>

1 attachment (180 KB)
Scope of Work - Draft (ICE)_V1.pdf;

John,

Good afternoon, I am sending you the DRAFT Proposed Scope of Work (SOW) for the Valve Assessment. I believe we covered all angles necessary to have a good product so we can determine what needs to be replaced and repair. Please review the SOW and let us know if you want us to make any changes.

V/R

Ivan

Prepared by International Consulting Engineers

10/06/2025

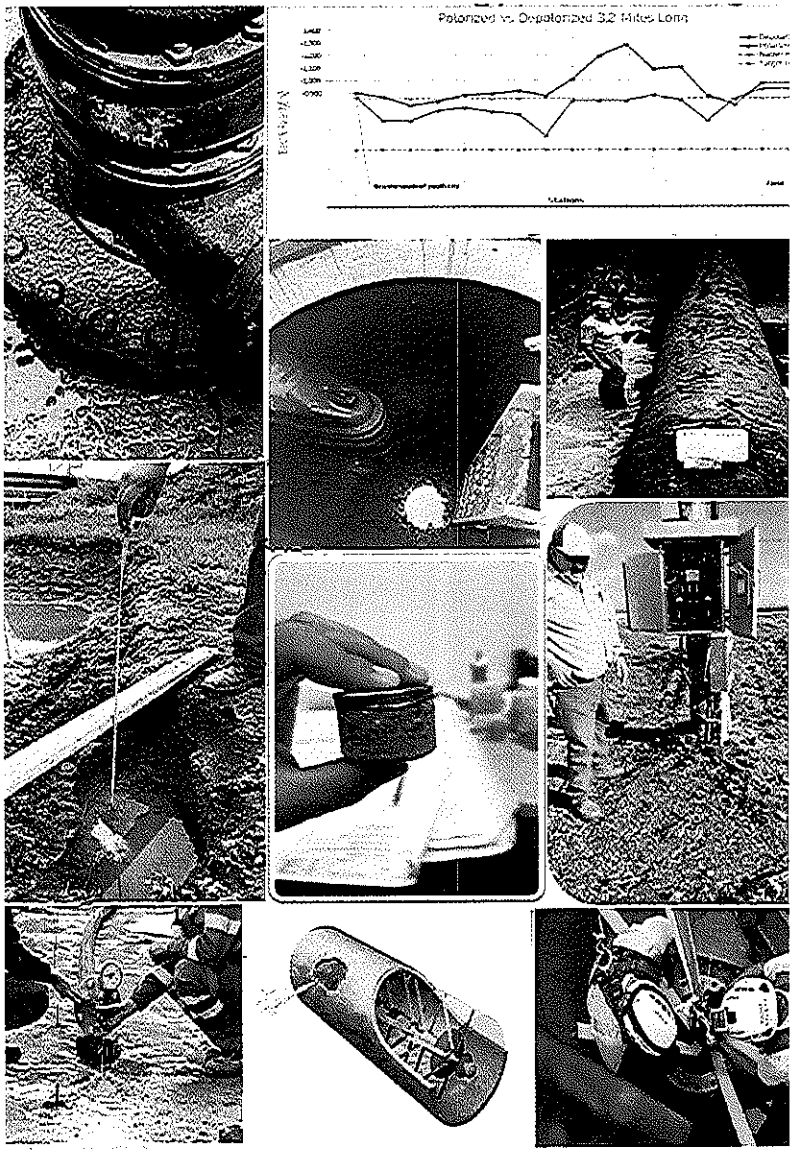
Draft Copy

Compilation of Historical Report and Previous Work on 42" Transmission Line

ICE Desktop Study - Evaluation in Preparation for Upcoming Project Deployment

Index

This study was conducted with a commitment to data integrity and transparency - because **"Quality Information Drives Better Decisions"**



List of Abbreviations

ARV - Air Release Valve
ICCP – Impressed Current Cathodic Protection
MAOP – Maximum Allowable Operating Pressure
AWWA – American Water Work Association
CP – Cathodic Protection
STA – Station

Executive Summary

Objective of the report

This report presents ICE's study for the South Texas Water Authority (STWA), aimed at protecting the 42-inch pipeline from structural damage and enhancing its long-term performance. Using recent site inspections and historical data (1980–2025), key vulnerabilities were identified, prioritized by severity, and addressed with recommended short- and long-term mitigation measures.

The pipeline was built as three separate contract in the early 1980's:

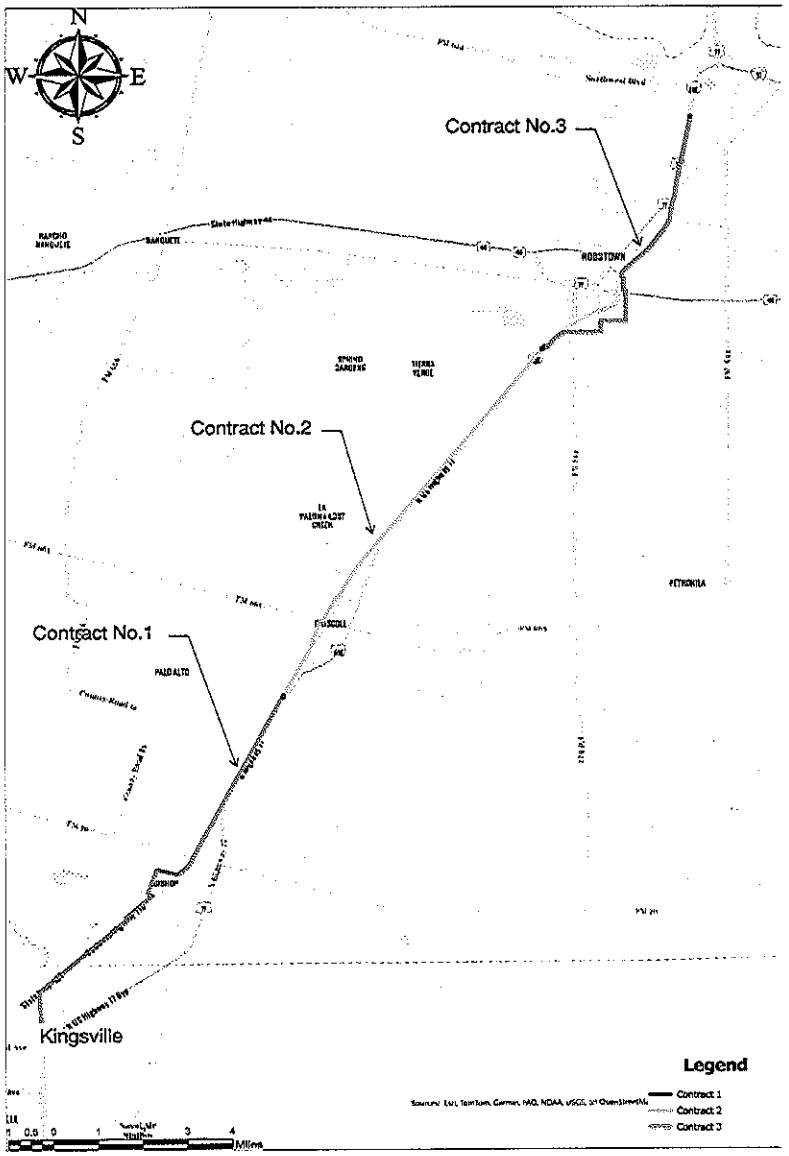
- **Contract No. 1** – Manufactured by Gifford Hill America(GHA), Inc.

  Total Length : 51,272 LF , STA 00+00 to STA 523+00
- **Contract No. 2** – Manufactured by United Concrete pipe division.

  Total Length : 50,992 LF , STA 523+00 to STA 1033+00
- **Contract No. 3** – Manufactured by Gifford Hill America(GHA), Inc.

  Total Length : 47,394 LF , STA 1033+00 to STA 1496+41

In addition, the report outlines several alternative plans to help identify the most effective approach for a complete integrity assessment of the pipeline. Each option combines different strategies to ensure the inspection follows best **engineering practices**, **minimizing risks** and **avoiding cost overruns**. Detailed descriptions of these plans are provided in **Section 2** of this report.



Executive Summary Continuation....

Key risks identified

- **High-Risk Section Along San Fernando Creek**: A 3-mile stretch of pipeline in this area is particularly vulnerable due to aggressive soil conditions and a history of failure in 1994 – **Contract 1**
- **Deteriorated Mechanical Components:** Key elements such as gate valves, ARVs, mechanical bends, and flushing valves lack protective coatings, making them vulnerable to corrosion – **Contract 1, Contract 2 and Contract 3**
- **Impressed Current Cathodic Protection (ICCP):** While some cathodic protection measures have been implemented, the system remains incomplete. Further improvements are needed to ensure full protection - **Contract 1, Contract 2 and Contract 3**

High-level recommendations

Assessment and Repair of Mechanical parts (ARV, Gate Valves..Etc.)

In-line inspection of 42" Line using smart devices

+

Hydro Pressure Test to identify MAOP

Implementation of Proper Cathodic Protection

(ICCP)

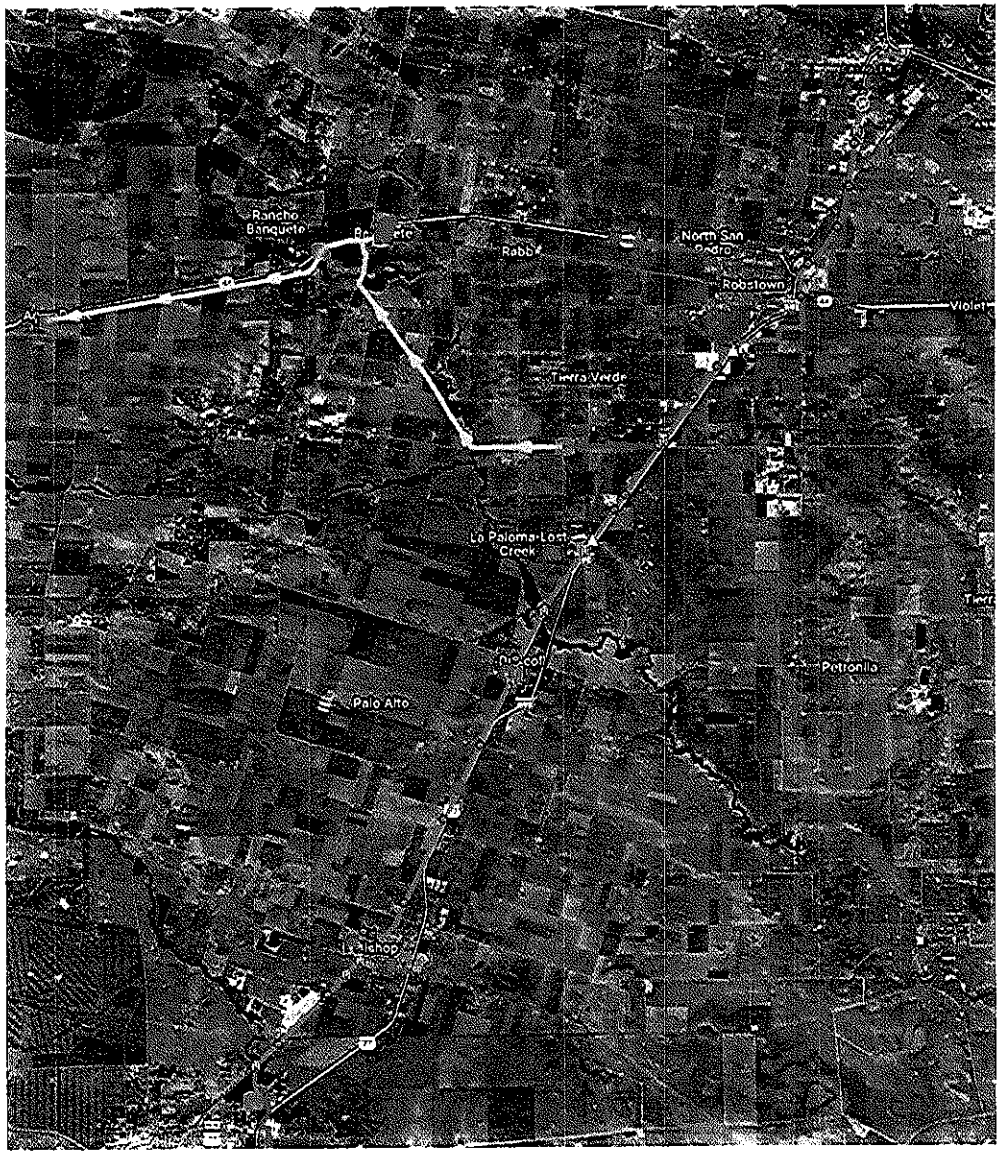
A snapshot form 1994 Pipeline leakage Inspection (Contract -1)

Pipeline Background

General Info

- Built Year: 1980
- Size:42 Inch
- Type: AWWA C303, Bar Wrapped Concrete
- Total Length: 28 miles
- Start and End Points:
  - Start: Kingsville Pump Station (STA 0+00)
  - End: ON Stevens WTP (STA 1496+41)
- Contract 1: Ends at STA 523+00
- Contract 2: Ends at STA 1033+00
- Contract 3: Ends at STA 1460+00
- Single Pipe Length: 32 feet
- Testing Stations: 115
- Active Rectifiers in Line: 4
- ARV's (Air Release Valves): 23
- Gate Vales(42"): 5

Future Pipeline Use: This essential transmission line supplies water to over 14,000 residents and based on the size it is engineered to convey larger volume, making it well-suited to support future major water infrastructure projects in South Texas.



Inspection & Study Timeline

LIST OF REPORT & STUDIES CONDUCTED OVER 40 YEARS

1. **Soil Analysis Report By Ductile Iron Pipe Research Association.**

Key findings: High Sulfate & Chloride Detected

Soil Study

3. **Pipeline Failure Analysis By Corrpro.**

Key findings: Failure was due to aggressive soil

Pipe Failure

5. **42" Line Condition Assessment Report by HDR.**

Key findings: Submitted List of Recommendation.

Desktop Study Report

1982 — 1984 — 1994 — 1995 — 2016 — 2020

Soil Study

2. **Corrosive Soil Investigation By HDR.**

Key findings: High Sulfate Conc. Detected

Potential Survey

4. **Potential Survey and Excavation Report By Harco.**

Key findings: Low Resistive Soil Areas, 11 Selected Excavation.

CP Report

6. **Cathodic Protection Inspection Report By Corrpro.**

Key findings: Surveyed 9 Risk locations, Recommendation made.

Legend, Unresolved issues carried forward : 

Major Assessment Results

Electrical Potential – All Three Contract

Multiple unsafe points found below earth potential

- High chance of Corrosion
- Electrical continuity is not active on the identified points

Soil Reactivity – Contract 1

High sulfur & Chlorine content in topsoil detected

- High chance of external corrosion
- Identified highly corrosive soil between Kingsville and Bishop

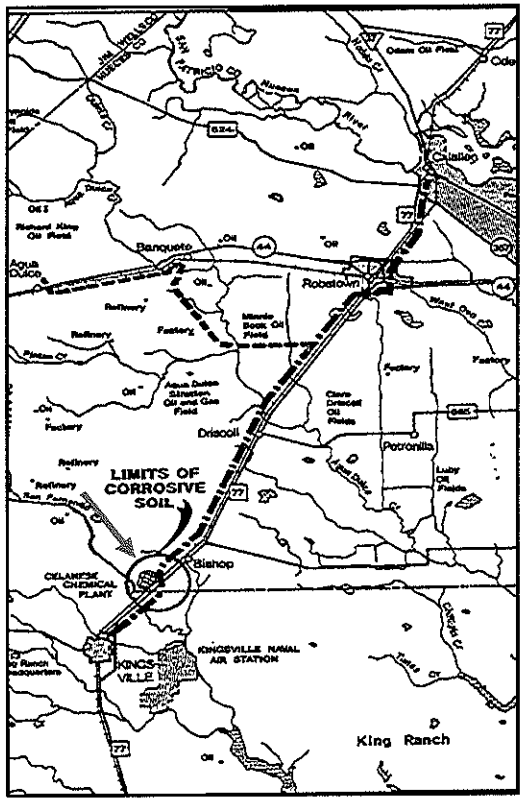
Structural Observations - All Three Contract

Coating degradation

- Possible metal loss and cracking risks on ARV & Gate valves
- Pipeline surface corrosion due to aggressive soil.

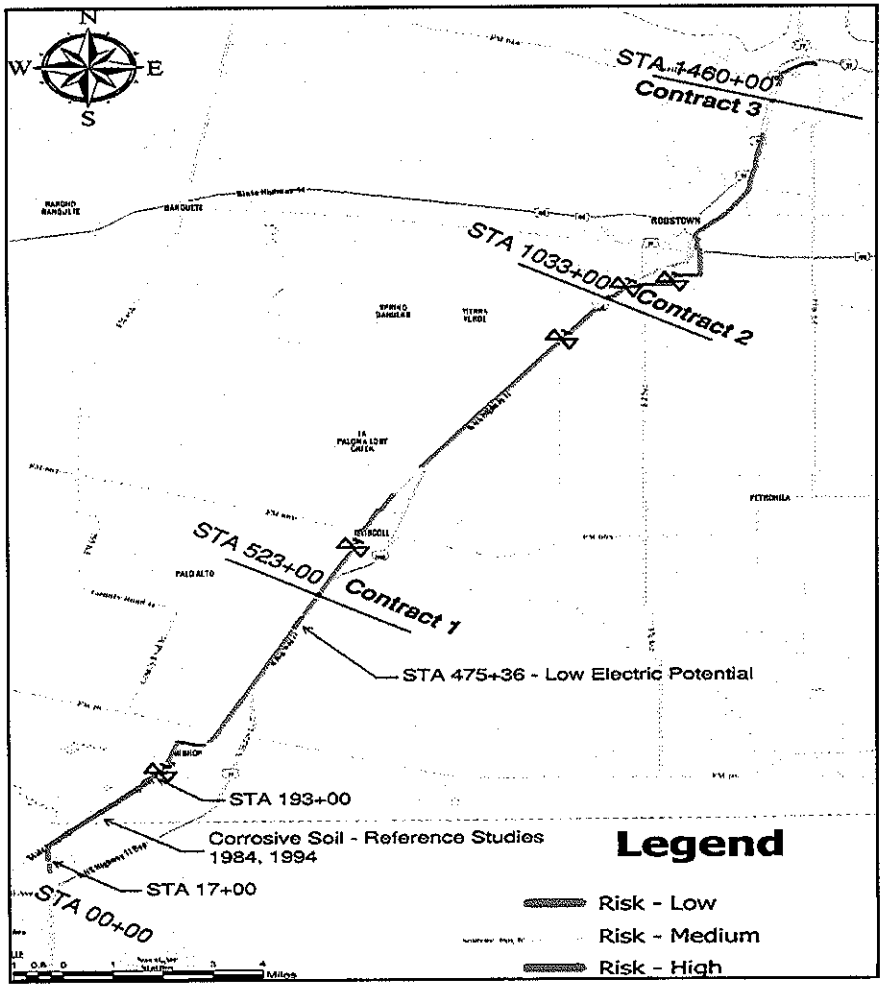
Soil Reactivity on Pipeline- 1994 Excavation

Metal loss on ARV- 2025 Inspection



Identified Corrosive Soil Area by Previous Study - 1984

Visual Insights



SECTION 1: AWWA C303 DESKTOP STUDY- STWA 42 INCH LINE

Previous Studies Major Area of Concern	Identified Year/ Years	Stations	Risk Severity	Further Action Needed
Electrical Discontinuity & High Chlorine (Chlorine: 4131ppm)	1984,1995,2020	STA 71+76 to 93+60	Medium	Yes
Electrical Discontinuity	2020	STA 134+00 (Immediate downstream)	Medium	Yes
Electrical Discontinuity	2020	STA 141+60 (Immediate upstream)	Medium	Yes
Electrical Discontinuity	1995, 2020	Between STA 159+00 to 193+00	High	Yes
Electrical Discontinuity	2020	Between STA 475+36 to STA 486+56	High	Yes
Test Station Electric Bonding	2020	STA 281+90	Medium	Yes
1994 Pipe-line failure	1994	STA 17+00	High	Not required
Corrosive soil	1982,1984,1994	Between STA 17+00 and 160+00	High	Yes
Corrosive soil (6 Oil and gas pipe crossing)	1984	Between STA 981+05 and 1052+00.	Medium	Yes
Area Highly Developed, CP need to be updated	2016	Between STA 1369+07) and 1496+10)	Medium	Yes
Below Earth Electric Potential zone:	1995	STA 543+27	Medium	Yes
Below Earth Electric Potential zone:	1995	STA 681+65 to STA 757+13	Medium	Yes
Below Earth Electric Potential zone:	1995	STA 970+62 to STA 1024+03+13	Medium	Yes

Risk Legends: Low Medium High

Major Findings & Recommendations by Past Studies

Findings:

- Highly corrosive soil has been identified between Bishop and Kingsville – this is also the location of the 1994 failure (Contract 1).
- Excavation during Contract 2 revealed concrete degradation at multiple locations.
- Corrosion current is insufficient for adequate CP at several points along the pipeline (All Three Contract).
- Exposed reinforcing bars and surface pitting were observed on the outer layer of the concrete (Excavation No. 9 , STA 1011+27).
- Electric jumper bonding cables were found in direct contact with soil, increasing the risk of corrosion current loss (Excavation No. 2 , STA 508+30)
- Improper installation of pipe joint mortar was noted (All Three Contract during 1994 Excavation).
- Mechanical components showed signs of corrosion due to missing or deteriorated protective coatings (All Three Contract).

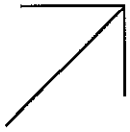
Major Recommendations From Past Studies

Recommendations	Recommended Year	Action Taken by STWA
Annual Soil Testing Program	1984	None
Install more Test Stations (~1500LF Intervals)	1984	None
Establish CP program	2016	None
Install additional Rectifiers	1984, 1995, 2016	On progress, not completed
Pipeline Internal electromagnetic Inspection	2016	None

"Why previous studies failed to resolve issues? "

- Lack of planning
- Lack specialized personnel
- Lack of funding sources
- Technical limitations in approaches
- Pipe age & risk associated with the mitigations.

Root Cause Review



ICE Recommendations – In reference to Past Studies

Recommendation for Corrosion Protection and Pipeline safety Integrity:

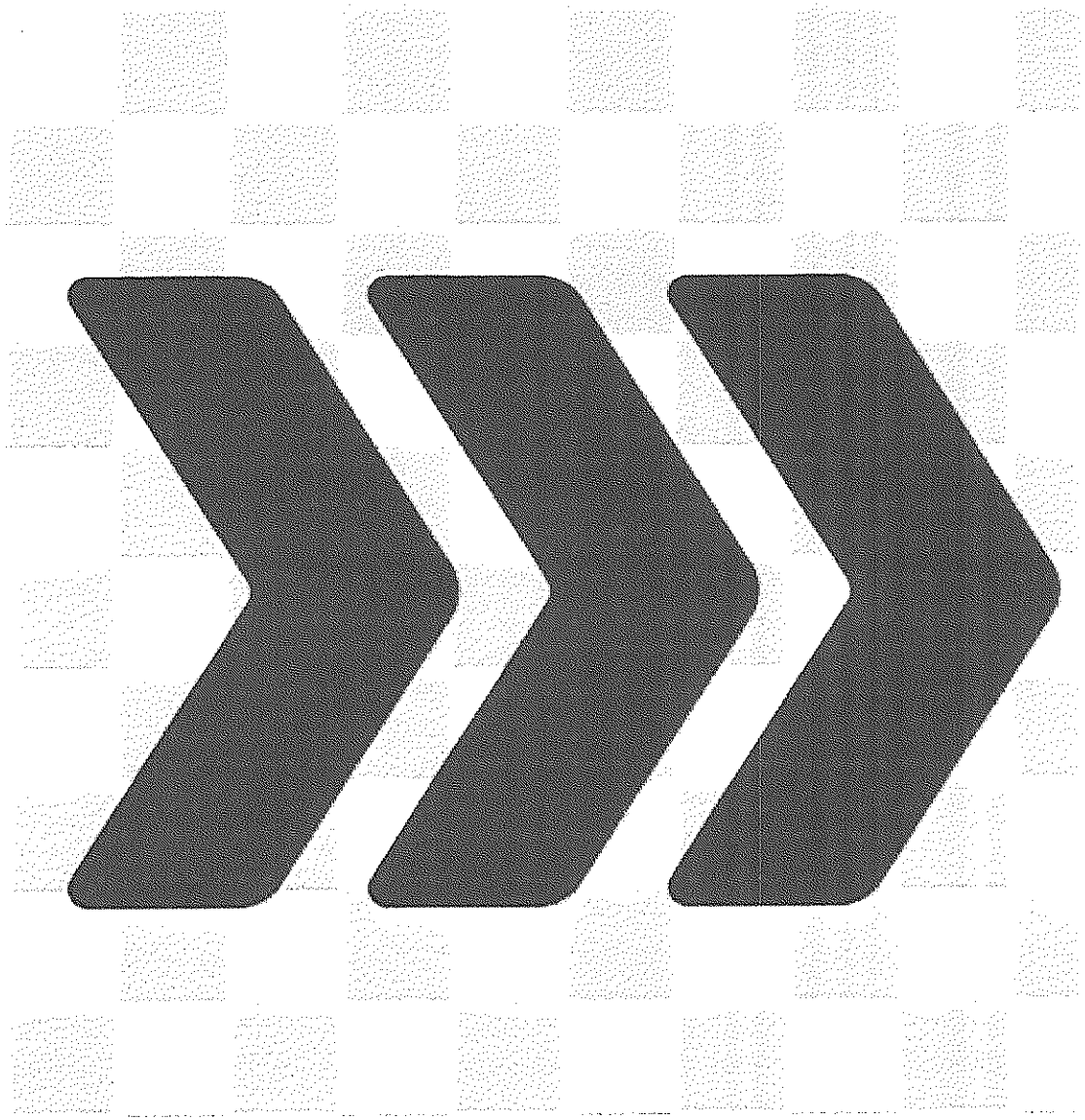
- **Phase 1 – High Priority (Immediate Action)**
  - Focus: 3-mile pipeline section
  - Actions: Mark line, conduct **soil testing**, and inspect pipeline if aggressivity persists
  - Measures: Apply preventive solutions based on actual condition; replace damaged pipe segments using Type V cement coating if required.

- **Phase 2 – Intermediate Priority**
  - Resolve electrical discontinuity identified by Corrpro (2020) before further cathodic protection
  - Expand annual CIS Survey to Contracts 2 & 3 (only Contract 1 was surveyed in 2020)
  - Assess all **mechanical components for repair & coating** failure risk.
  - Plan: Inspect, clean/sandblast, and recoat per standards

- **Phase 3 – Ongoing (Cathodic Protection)**
  - Implement **Impressed Current CP system** for entire pipeline by including additional Rectifiers system
  - Ensure simplified recordkeeping and regular monitoring
  - Note: Critical for sustaining outcomes of **Phases 1 & 2**

To ensure pipeline integrity and readiness for future major water infrastructure projects, either an inline inspection using a **Pipe Diver** tool or a **hydrostatic pressure test** must be conducted.

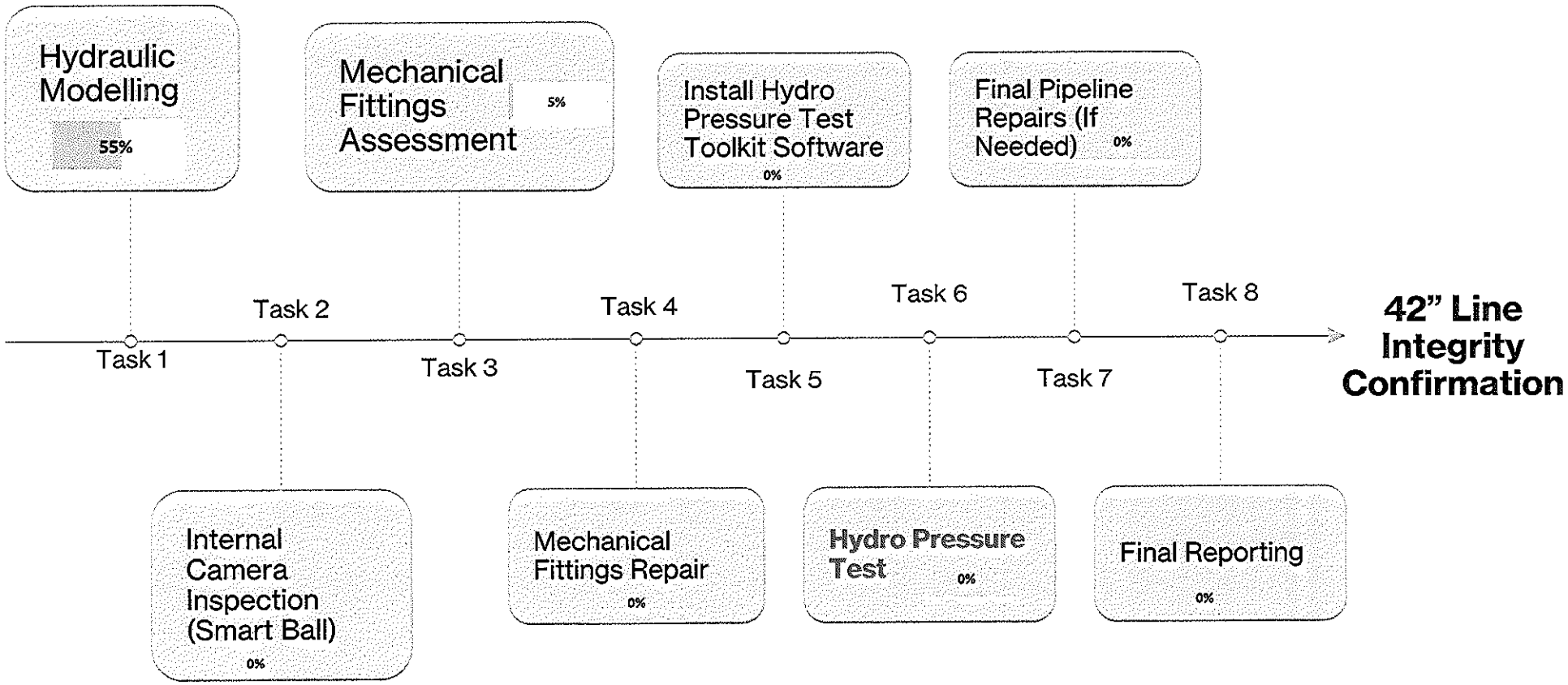
To ensure pipeline integrity and readiness for future major water infrastructure projects..



Section 2-Way Forward

Way Forward – Alternative I

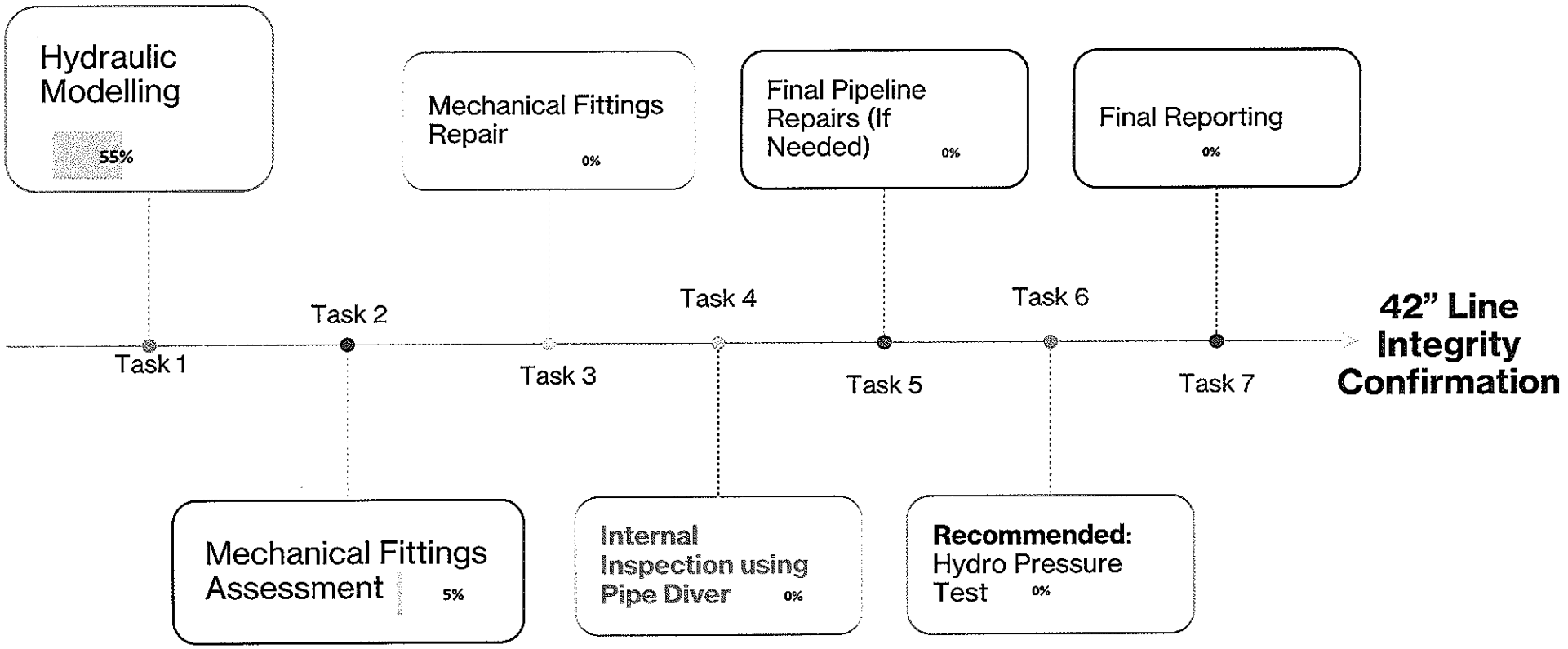
Low Cost – High Risk



Note: Tasks 1 through 3 can be executed simultaneously.

Way Forward – Alternative II

Low Risk – High Cost



Note: Tasks 1 and 2 can be executed simultaneously.

Conclusion

Overall, Integrity Status:

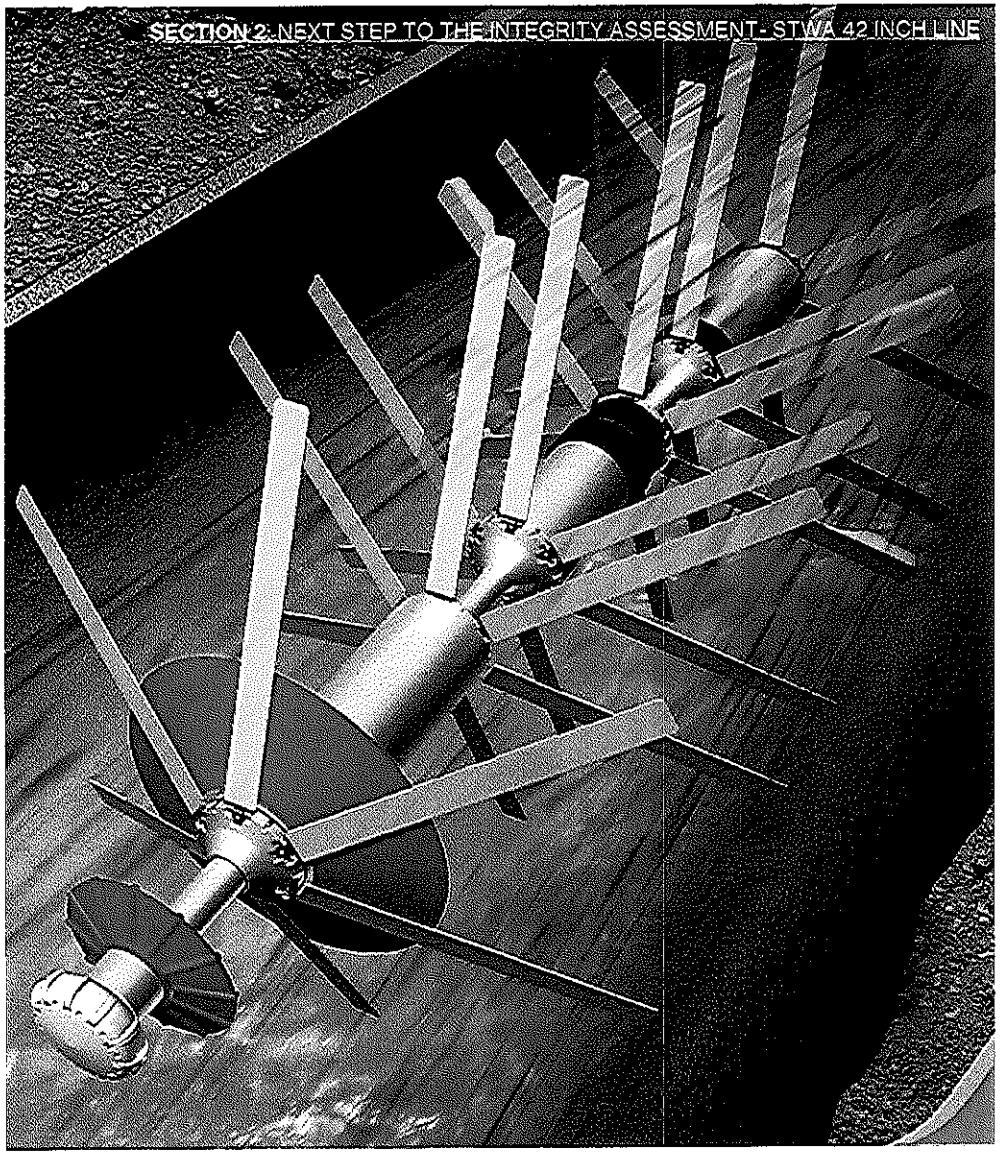
The integrity of the pipeline cannot be confirmed at this moment due to multiple unknown factors. A reliable assessment can only be made after completing the full integrity evaluation process as outlined in the previous slides.

Key Takeaways for Decision-Making:

- Selection between Integrity Plan Alternative 1 or 2 will depend on the **level of risk** and total **implementation cost.**
- A cost-risk analysis will guide the final decision.

Critical Next Steps:

- Inspect and repair gate valves and air release valves (ARVs).
- Following these repairs, proceed with either a hydrostatic test or in-line inspection using a pipe diver, based on the chosen integrity plan.



Final Engineering Recommendations – 42" AWWA C303 Pipeline Integrity

1. Maximum Allowable Pressure: The 42" AWWA C303 pipeline should not be operated at pressures exceeding 50 PSI – the highest pressure recorded over the past three years. This limit must be maintained until thorough internal and external inspections verify that the pipeline's structural integrity is adequate to safely withstand pressures above this threshold.

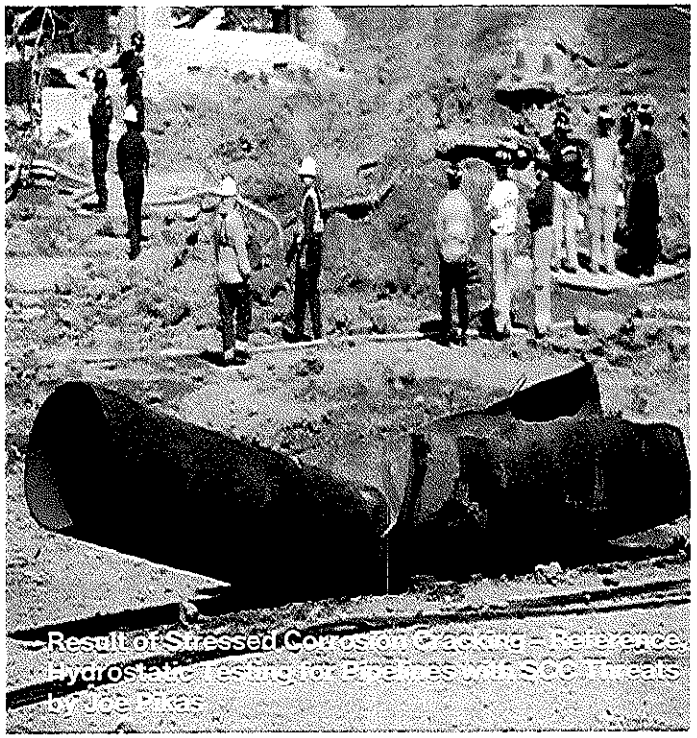
2. Hydrostatic Testing: A hydrostatic pressure test should not be performed until all previously identified risk areas have been thoroughly evaluated and appropriately addressed.

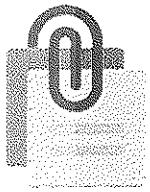
3. Component Evaluation: All ARVs, gate valves, and related mechanical fittings must be individually assessed to determine their current condition and operational reliability.

4. Cost Estimation: A comprehensive Opinion of Probable Construction Cost (OPCC) must be developed prior to executing any inspection activities outlined in Alternatives I or II, to avoid the risk of cost overruns.

5. Remaining Life Assessment: A computer software -based integrity analysis is required to evaluate the remaining service life of the pipeline. This analysis is essential for planning and executing any future projects involving the 42" pipeline system.

6. Engineering Documentation: All tasks related to pipeline integrity assessment must be fully documented. The final engineering report must be signed and sealed by a Texas-registered Professional Engineer (P.E.).



Appendices 

- **Appendix 1** : ICE study data
- **Appendix 2** : Final Report from HDR (1984)
- **Appendix 3** : Technical Memorandum Desktop Study by HDR ,2016
- **Appendix 4** : Moving Electrode Potential Survey by Harco – 1995
- **Appendix 5** : Cathodic Protection Inspection Report by Corrpro, 2020

ICE Desktop Study Supporting Appendixes

Table Of Content

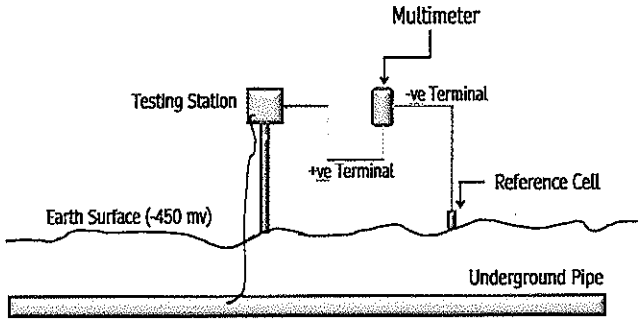
Appendix 1 – ICE study data

TESTING STATION DATA ANALYSIS AND CATHODIC PROTECTION.

- Test stations are used to sense the potential on the pipeline – Multimeter is used to measure the potential in negative milli volt(mv)

Testing Methods:-

1. Earth surface potential (Native Potential) :-0.450 mv
2. By the CP standard the criteria potential : -0.850 mv
3. STWA Target potential: -0.900 mv to -1.000 mv
4. +ve Terminal of multimeter connects test station.
5. -ve Terminal of multimeter connects Earth Surface via a Cu-Cu in liquid form.



Note: Once the pipe potential reach -0.450mv(Native potential) corrosion begins at this point.

Figure 1. Test Station Potential Analysis.

Comparison of Test Station Potential with earth potential and target potential.

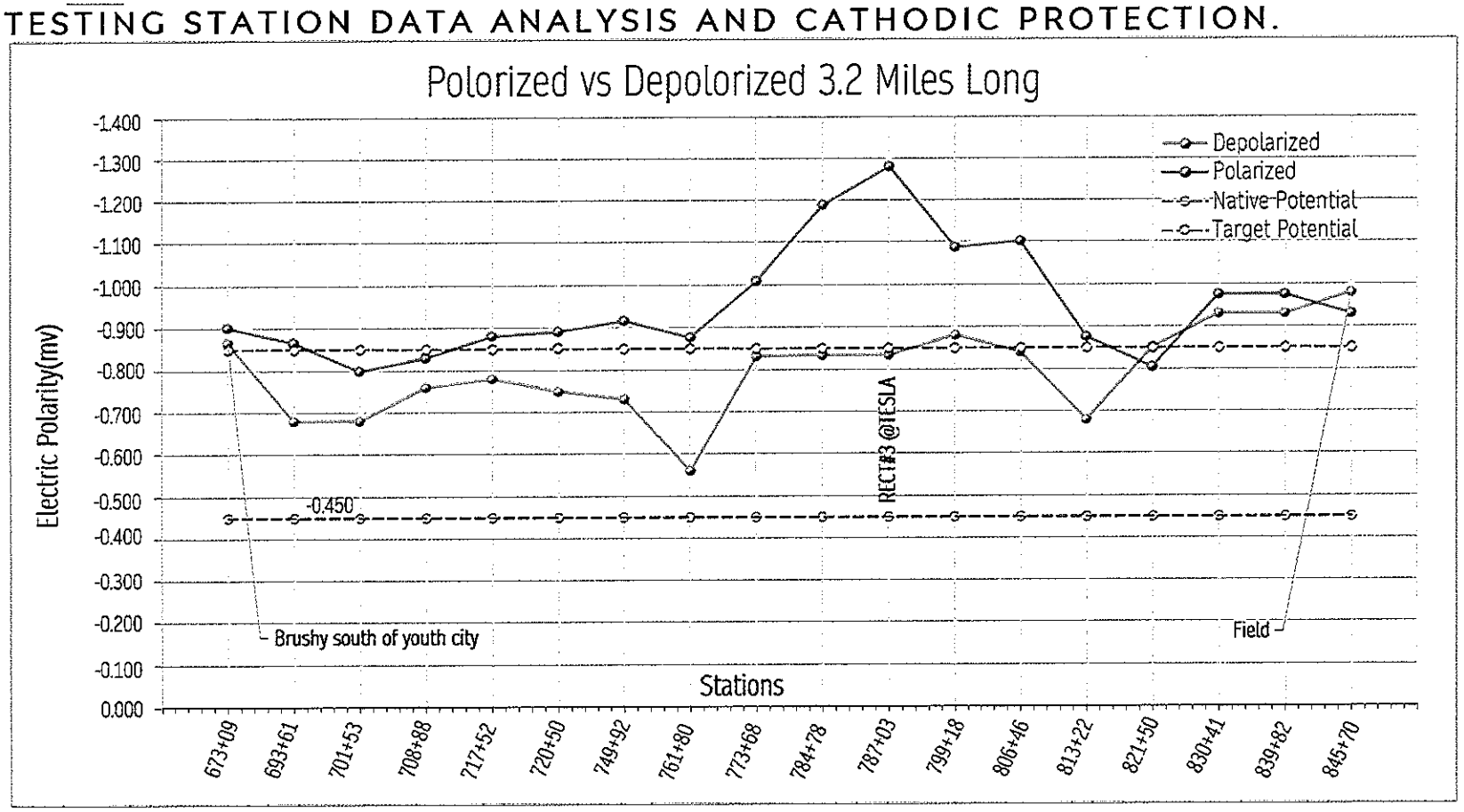


Figure 2. Test Station Results for 3.2 Miles Distance, Results from STWA CP team 2025 Inspection.

STWA Deep Bed Anode Bed – For the Rectifiers

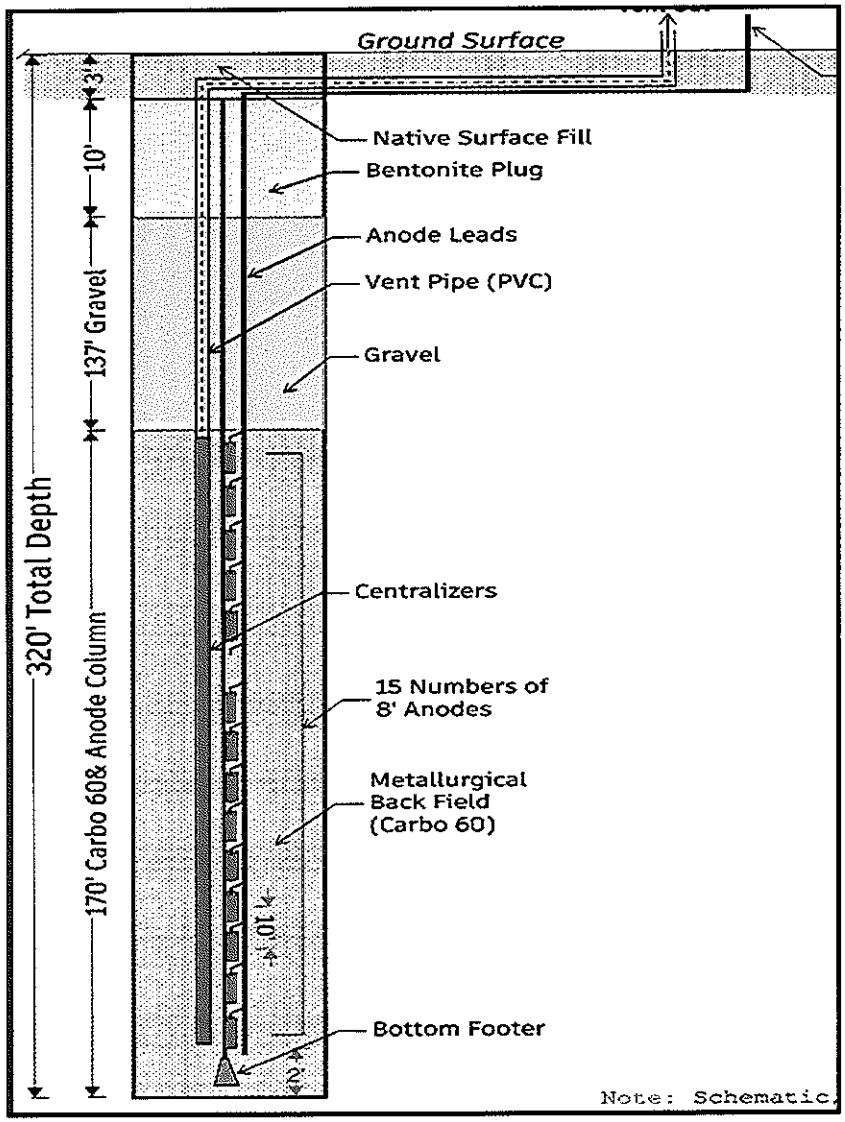


Figure 3.STWA Board members participated in the Cathodic Protection workshop as part of the ongoing CP efforts - Coordinated by ICE, STWA, TAMUK.

SULFUR REACTIVITY ON 42" PIPELINE

1. Sulfur in the soil is usually in the form of sulfate ions (SO_4^{2-})
2. Summary of Chemical Reactions:
   - Sulfate Attack on Concrete:

     $Ca(OH)_2 + SO_4^{2-} \rightarrow CaSO_4 + H_2O$ (Formation of gypsum can cause the concrete to expand and crack)
   - Formation of Sulfuric Acid (via Bacterial Activity):

     $H_2S + 2O_2 + H_2O \rightarrow H_2SO_4$ (Sulfuric Acid accelerates the rusting of steel reinforcement.)
   - Corrosion of Steel Reinforcement:

     $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$ (Iron sulfate formed is soluble and can further degrade the concrete structure.)

Note : 40 years of exposure to sulfur-rich soil, the concrete and steel would have been significantly degraded.

Figure 4. Chemistry behind sulfur reactivity against AWWA C303 Concrete Pipeline.

42" Pipeline Soil Corrosivity History &Line Failure

Ductile Iron Pipe Research Association soil analysis performed in 1982. The data indicated the soil to be severely corrosive with both high sulfate and chloride concentrations along the proposed route of the alignment. The sulfate concentrations ranged from 480 to 12,000 parts per million (ppm) with a mean value of 2,800 ppm. The chloride concentrations ranged from 700 to 4,800 ppm with a mean value of 1,950 ppm.

HDR Engineering conducted a "Corrosive Soil Investigation," and submitted to STWA August, 1984. The report details a near 3-mile long section of the Contract 1 alignment having severely corrosive soils. Gulf Coast Testing Laboratory collected the chemistry of the soil and determined that extremely high concentrations of sulfates ranging from 700 – 32,500 parts per million (ppm) were present in this stretch of the alignment.

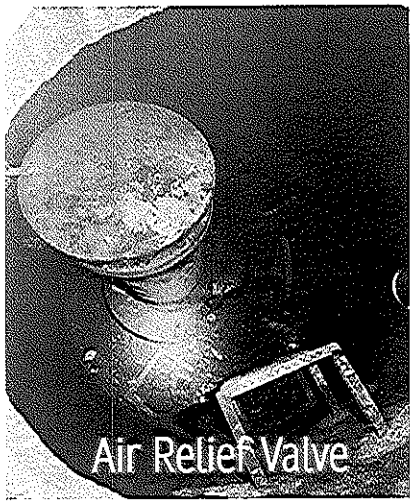
Following the 1994 pipeline failure, Corrpro was contracted to perform a failure analysis investigation, which concluded that the cause of the pipeline failure was due to aggressive soil along the alignment resulting in severe corrosion of the pipeline. Corrpro recommended that two rectifiers be installed to provide an impressed current cathodic protection (ICCP) to mitigate corrosion. Following the installation of the rectifiers it was determined that much of Contract 1 was electrically discontinuous. RCC was contracted to oversee the joint bonding and EC testing of Contract 1. The work allowed for the activation of the two rectifiers.

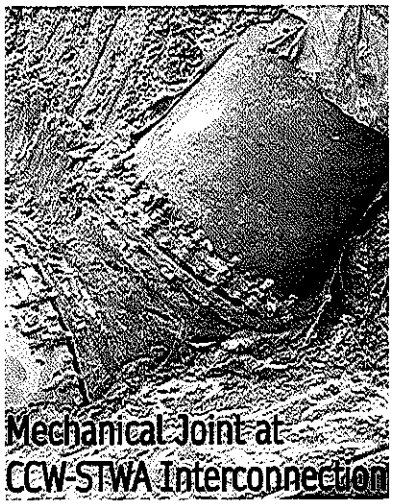
Figure 5. Identified major past studies supported for ICE Desktop Study.

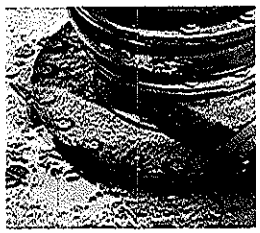
Initially Assessed Mechanical Parts Condition.

EXISTING CONDITION OF ARV AND BLOCK VALVES

- **Above Ground ARV Section:** Over 15 units are in corroded condition.
- **Block Valves:** 5 valves (42")are submerged in water, with corroded joints.
- **Mechanical Joints:** Lack of protective coating, nuts and bolts are corroded condition
- The testing station require servicing and maintenance.

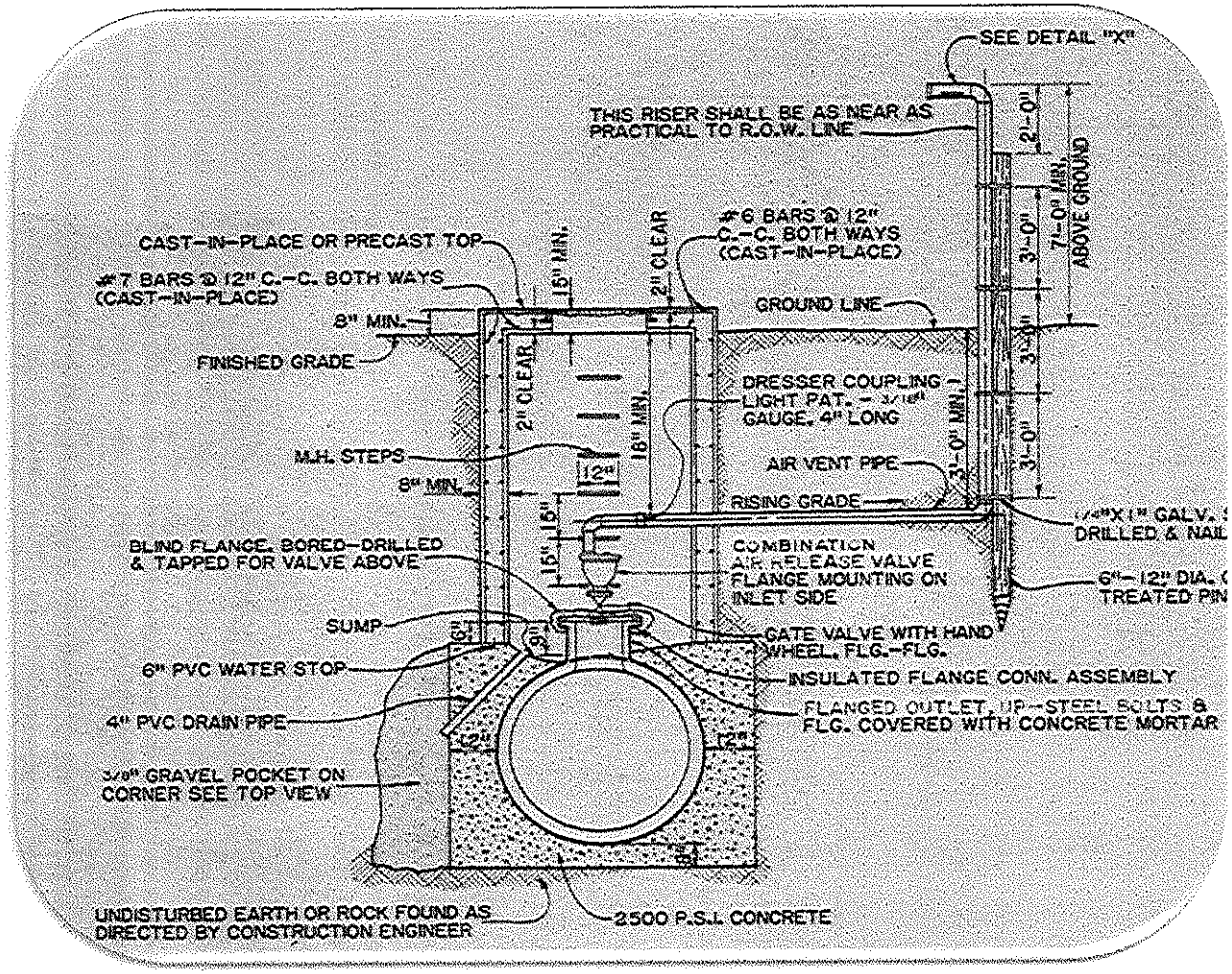






Recent ARV inspection images.

Typical STWA 42" Line Air Release Valve



Important 1994 Excavation Images

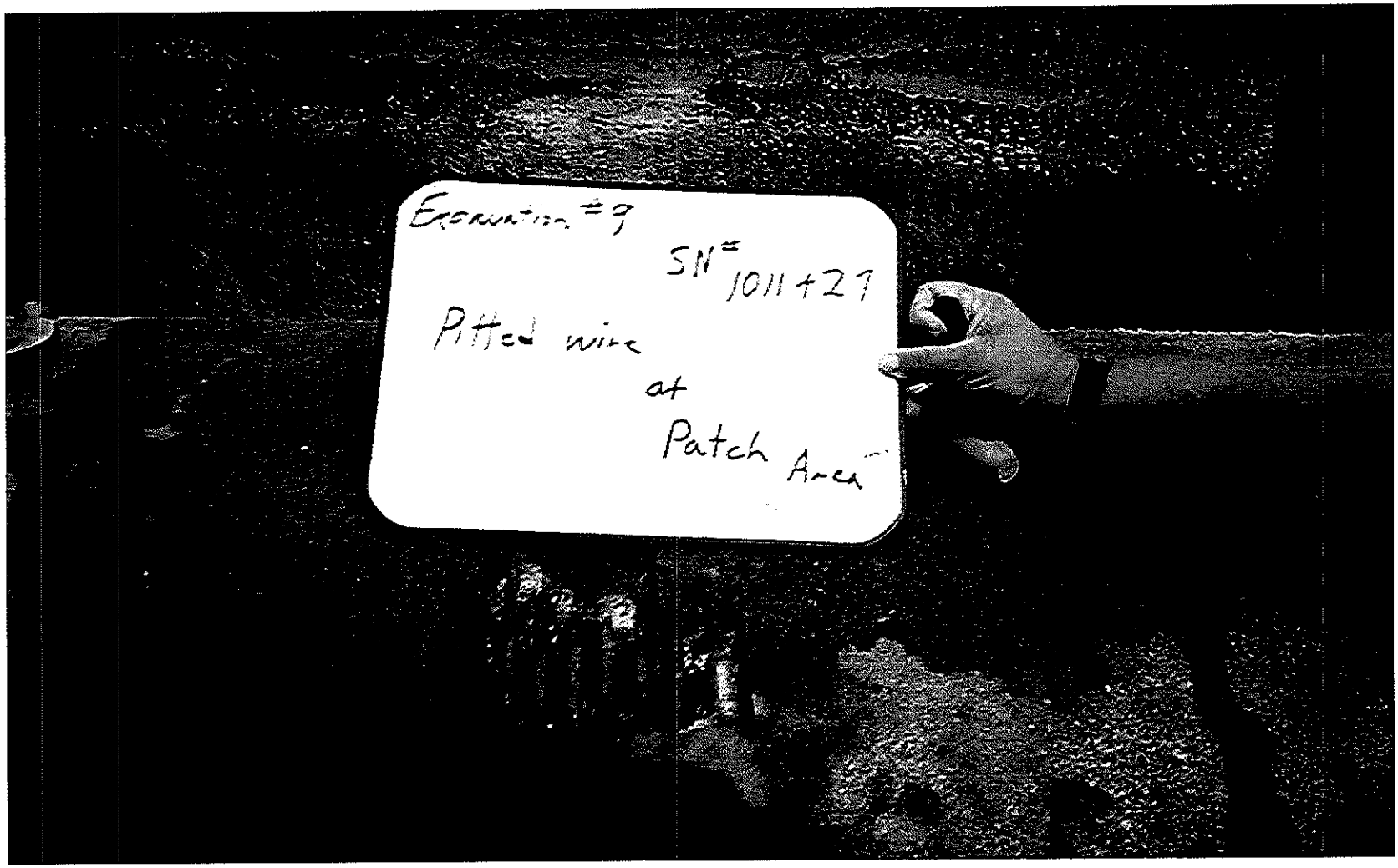


Figure 6. Excavation 9 - Bar wraps Exposed.

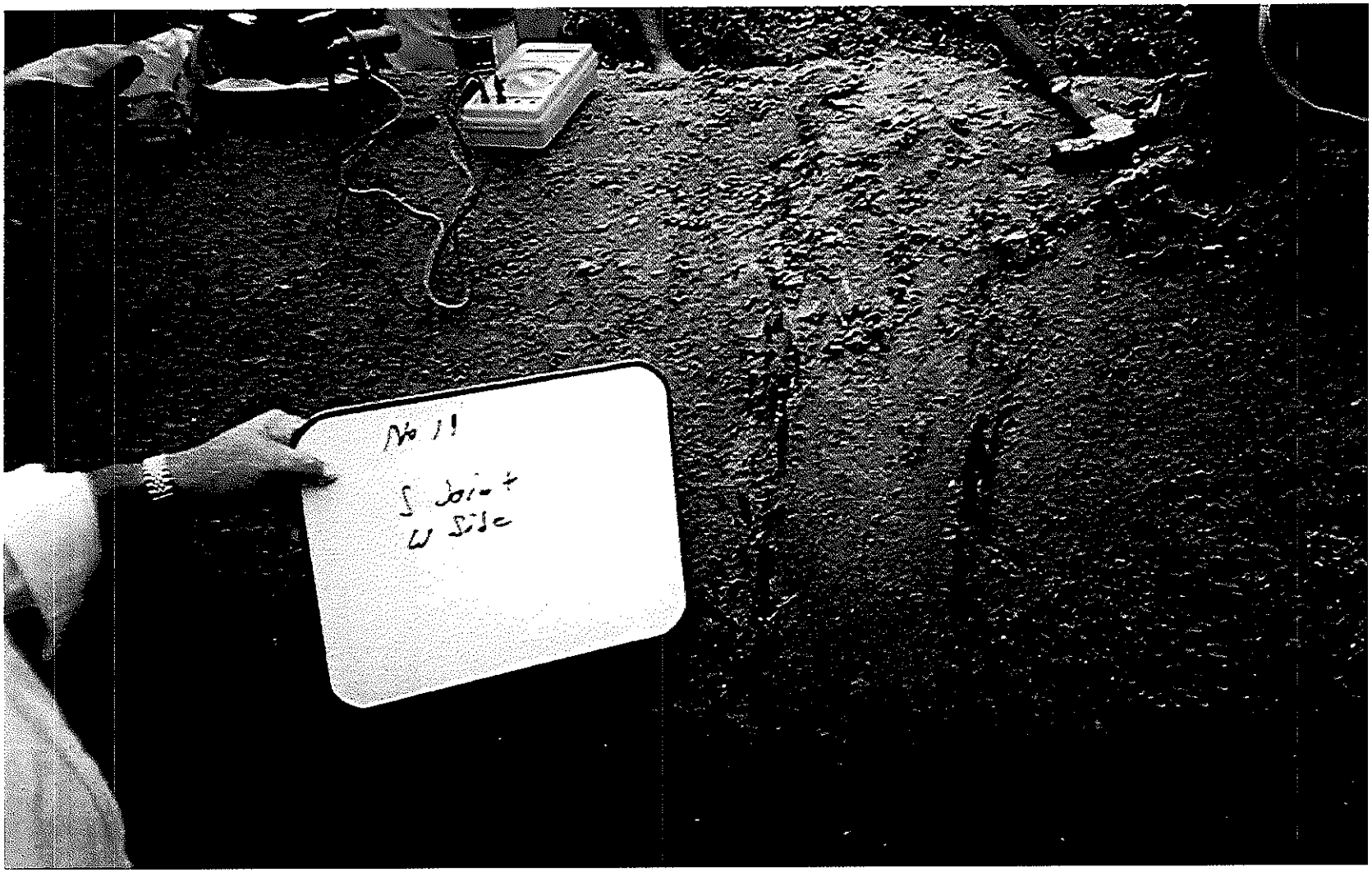


Figure 7. Excavation 10 - Pipe Joint Deteriorated.

Figure 8. Excavation 11 - Pipe Joint Pitting.

Figure 9. Excavation 11 - Joint Pitting.

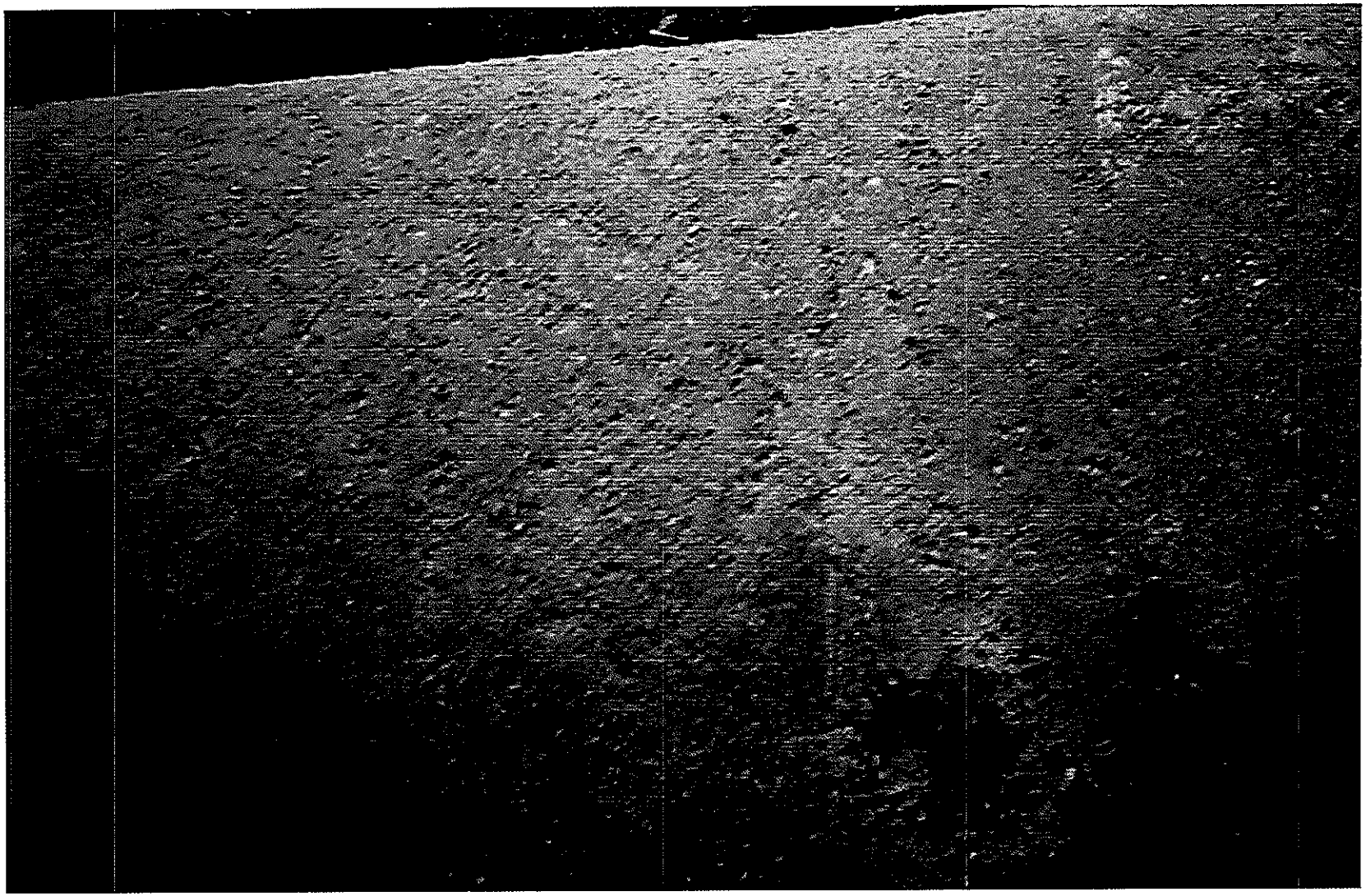


Figure 10. Excavation 5 - Corroded Bar Wrap.

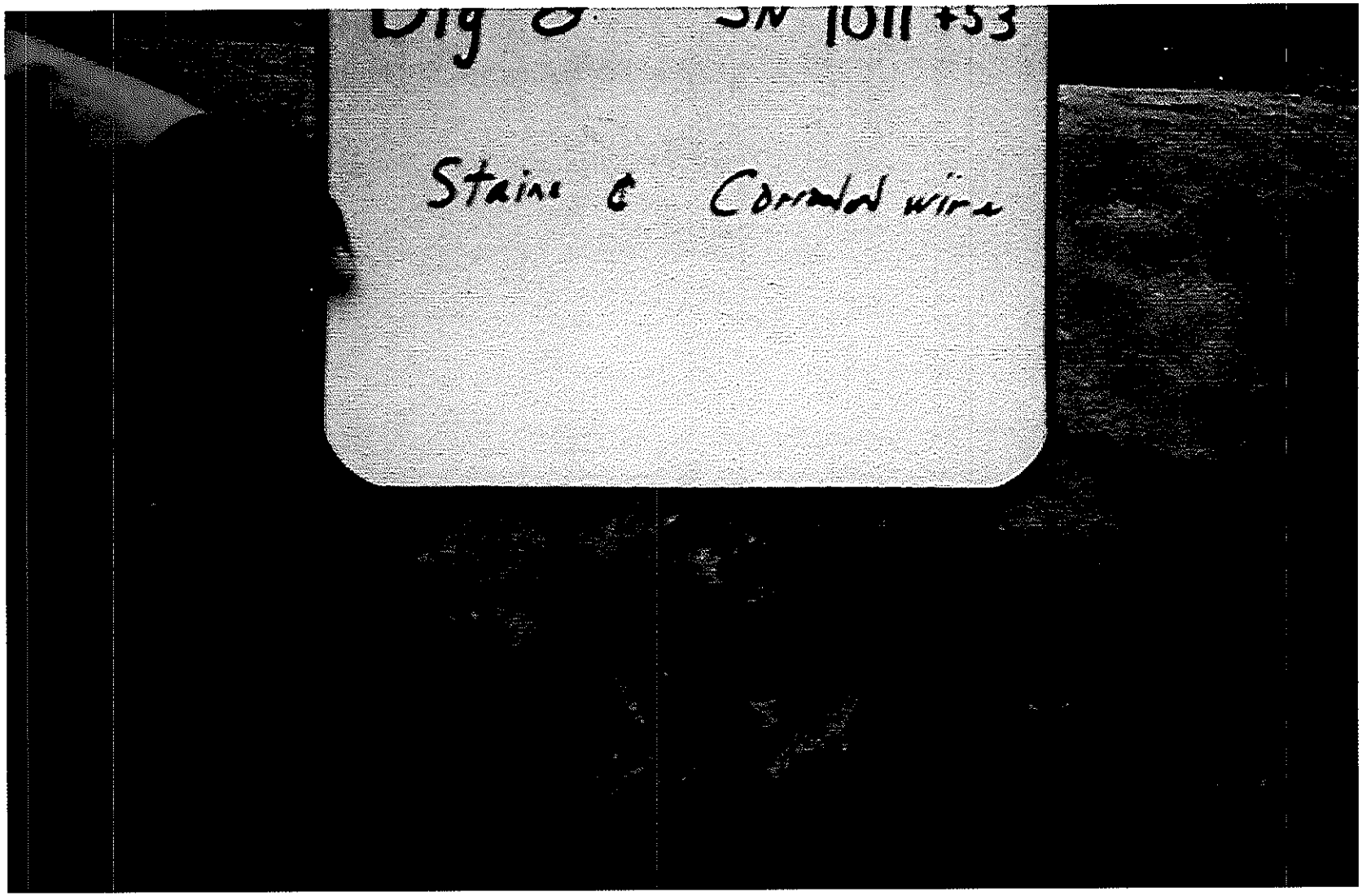


Figure 11. Excavation 7 - Corroded Bar Wrap.

Figure 12. Excavation 3 - Mortar Patch.

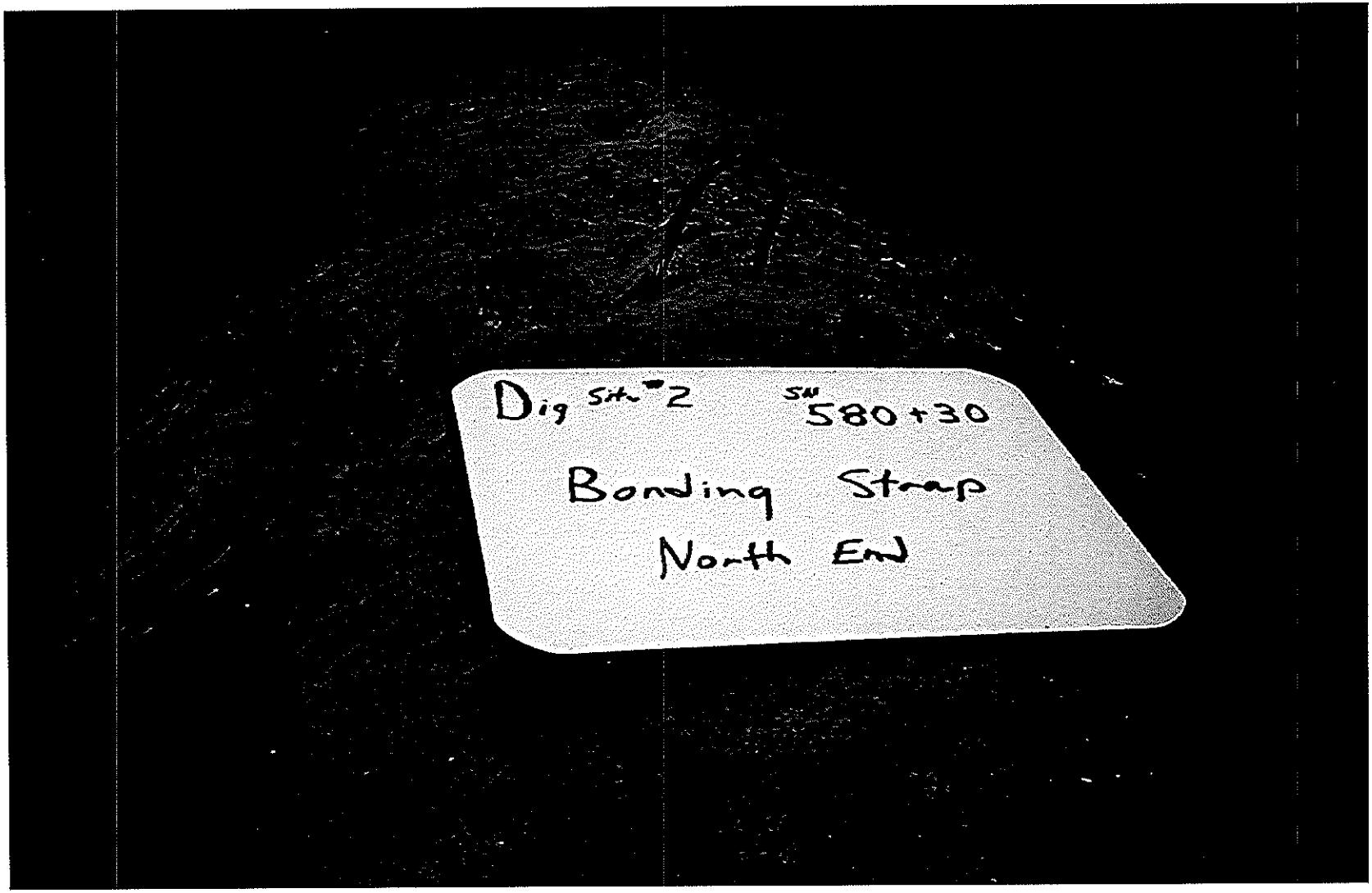


Figure 13. Excavation 2 - Electric Bonding Caple Coating Removed.

Appendix 2 – Final Report from HDR (1984)

August 6, 1984

South Texas Water Authority
P.O. Box 1701
Kingsville, Texas 78363

ATTN: Mr. Tom Brown, Executive Director

RE: A Regional Water Supply System
Corrosive Soil Investigation

Gentlemen:

Henningson, Durham & Richardson has completed its investigation of the corrosive soils found during the construction of the 42-inch main and is pleased to submit the attached report.

Based on our recommendation contained in this report, the construction, testing and disinfection of the main line has been completed. All that remains to be done is the final cleanup and punch list for the final completion of the line.

If you have any questions concerning this matter, please contact us.

Sincerely,

HENNINGSON, DURHAM & RICHARDSON, INC.

Roger K. Noack, P.E.
Project Engineer

RKN:ls

Attachment

Figure 14. Report Cover Page.

INTRODUCTION

During the installation of the 42-inch main between Bishop and Kingsville, some very unusual soil conditions were encountered. See Figure A, Location Map for the limits of the corrosive soils. Some preliminary samples were taken and analyzed. The results of preliminary analysis indicated that the soils in this area are very high in sulphates which are corrosive to the concrete mortar coating on the 42-inch main. This report reconstructs what happened when the Contractor first entered this area, the soil analysis performed and recommends what needs to be done to protect the main.

INITIAL CONTACT

On March 29, 1984, Garney Companies, Inc. was installing the 42-inch treated water transmission main along Spur 428 across from Celanese. As they were installing the main, they noted that the visual characteristics of the excavated material took a drastic change at approximately STA 118+00. They then notified HDR of this change in the soil. Based on our conversations with Garney it appeared that the extent of the potential problem was only a few hundred feet long.

Our recommendation at that time was to continue installing the 42-inch main and initiate a soil testing program that would determine the extent of the problem. This recommendation was made in lieu of stopping the installation of the main until the soil testing program could be completed. Our recommendation was deemed more feasible because (1) the problem appeared to be a very limited one; (2) the time required to complete a soils testing program; and (3) the Contractor would charge the Authority $3,500 per day for each day he could not work.

Figure 15. Introduction report.

SOIL INVESTIGATION

After Garney laid the main thru this area, some grab samples of excess material were taken to Gulf Coast Testing Laboratory, Inc. for analysis. The preliminary results indicated the soil was high in sulphates ranging from 700-32,500 parts per million (ppm). Sulphates are corrosive to the concrete cylinder pipe since it will attack the concrete mortar coating and eventually expose the steel cyclinder to the soil.

On April 25, 1984, at our direction, Gulf Coast Testing began taking soil borings along and around the potentially corrosive area. The borings ranged from near San Fernando Creek north to Mr. Ralph Pascal's house along the pipeline route. The results of the soil analysis of the borings taken indicated that the concentration of sulphates were very high from the first boring to the last (See Appendix A).

After the results were obtained, it was deemed necessary to increase the number of soil borings taken to extend the tested area beyond San Fernando Creek and Carreta Creek. The results of the soil analysis of these borings indicate the corrosive soils extend from San Fernando Creek north to Carreta Creek. This is approximately 16,500 LF or 3 miles.

Figure 16. Investigation and Findings.

CONCLUSIONS

Based on all information available, the alternatives to protect the concrete cylinder pipe are as follows:

1. Concrete encase the pipe providing a sacrficial concrete layer for the sulphates to attack.
2. Coat the pipe with an epoxy or plastic coating.
3. Install more monitoring stations to monitor the electrical potential of the pipe to the soil and when there is a potential, install a cathodic protection system to protect the steel cylinder.

RECOMMENDATIONS

Alternative 1 and 2 are very costly and time consuming, because the line must be reexcavated, relaid and encased in concrete or coated with epoxy. Therefore, HDR recommends the following:

1. Monitoring stations be installed at approximately 1500 feet intervals.
2. Soil to pipe potential readings be taken semiannually.
3. The pipeline be dug up annually to inspect the pipe, in particular the mortar coating, to determine if the sulphates have started attacking the mortar coating.
4. If the soil to pipe potential readings indicate galvanic action has started, then install a cathodic protection system to protect the steel cylinder from corrossion.

Figure 17. Study Recommendations.

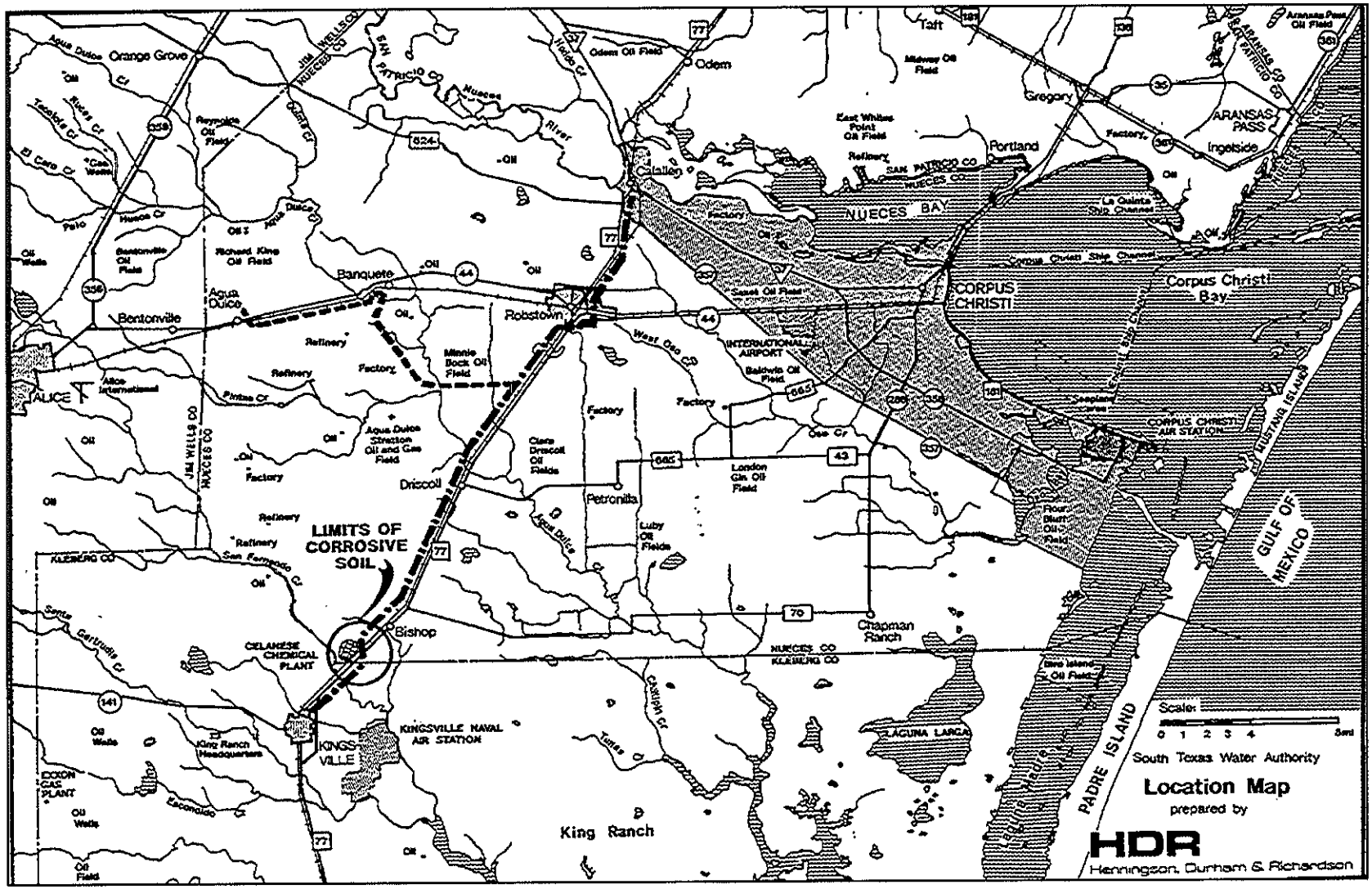


Figure 18. Corrosive Soil Identified by HDR, 1984.

Appendix 3 – Technical Memorandum Desktop Study by HDR ,2016

Technical Memorandum No. 2

42-Inch Pipeline Condition Assessment

Phase 2: Indirect Assessment – Field Investigation and Technology Evaluation

South Texas Water Authority

Kingsville, TX

December 29, 2016

STATE OF TEXAS
JEFFRY B. GIDDINGS
111985
LICENSED
PROFESSIONAL ENGINEER
12/29/2016

TX Firm F-754

Figure 19.Final Report Cover Page.

Executive Summary

South Texas Water Authority (STWA) contracted with HDR Engineering, Inc. (HDR) to perform an indirect condition assessment of the 42-inch diameter AWWA C-303 bar wrapped concrete pressure pipe (BWP) potable water transmission line. The pipeline was installed in the early 1980's and is approximately 28 miles long. The pipeline was constructed under three separate construction contracts.

This assessment was performed in two phases. Phase 1 was a desktop study of both the original construction and pertinent technical documents to provide an understanding of the pipeline construction materials, the surrounding environment, past failures, the installation and performance of the cathodic protection (CP) system, and other relevant factors that provide insight into the physical condition of the pipeline. The relevant material was summarized in Technical Memorandum (TM) No. 1 (provided as Appendix A), and provided the framework used to tailor the planned field component of the next phase. Phase 2 consisted of a field investigation of the main pipeline branch (construction contracts 1, 2, and 3) utilizing indirect assessment techniques to assess the pipeline and evaluating candidate technologies for a future direct assessment of the pipeline. The results of the Phase 2 investigations are detailed in this document.

A significant portion of the field investigation was focused on the assessment of the existing CP system. Emphasis was placed on collecting the data required to understand the system's effectiveness in mitigating corrosion on the pipeline. Corrosion is known to be the most common cause of failure for metallic and concrete-metallic hybrid pipelines. Without mitigation the corrosion process ultimately results in material degradation, loss of structural integrity, and eventual failure. It is therefore critical that the CP system provide adequate protection to mitigate active corrosion.

The industry standard for identifying adequate protection for metallic and concrete-metallic hybrid pipe is based on the criteria specified in NACE International (formerly the National Association of Corrosion Engineers) Standard Practices (SP) 0169 and SP0100. The most common method for evaluating effective pipeline protection relative to NACE criteria is through a pipe-to-soil potential (potential) survey utilizing the existing corrosion test stations (CTS). Findings from the potential survey found that the majority of tested CTS meet or exceeded the -850 mV polarized potential criterion (vs. Cu/CuSO4) cited by NACE Standard SP0169 for complete cathodic protection. Contract 2 was the exception with less than 50 percent of the pipeline achieving adequate protection.

Historical documentation reviewed for the Phase 1 component of this project indicated electrical continuity (EC) varies over the three pipeline contracts. Ideal conditions for the application of CP include the candidate pipeline having EC over its entirety. With the understanding that this was not the status of the 42-inch pipeline, EC tests were performed over eight pipe spans, five of which were selected to correlate with locations previously tested by Russell Corrosion Consultants, Inc. (RCC). Duplicate test sections were selected to evaluate the success of corrosion mitigation systems installed earlier in preventing additional failure of the joint bonds. Test results indicated that two spans located in Contract 1 have lost EC following efforts per RCC's 2001 report to STWA. Test results also indicated that three spans in Contract 2 previously tested as discontinuous now test as EC as a result of improvements overseen by RCC in 2009. The remaining three spans tested did not

Figure 20. Study Summary.

Key Referenced Documentation

Below is a list of the provided historical documents which yielded the most useful information for this technical memorandum.

1. Russell Corrosion Consultants, Inc., "Cathodic Protection Acceptance Testing," RCC Project Number 891, September 2009;
2. Russell Corrosion Consultants, Inc., "Corrosion Control Program and Cathodic Protection Criteria Pipeline Contracts 1 -3," RCC Project Number 750, June 2007;
3. Russell Corrosion Consultants, Inc., "Continuity and Cathodic Protection Contract No. 1, RCC Project Number 284," January 2001;
4. Russell Corrosion Consultants, Inc., "Continuity and Cathodic Protection Contract No. 1," RCC Project Number 284, February 1999;
5. STWA, Inter-Office Memo "Update on 42" Line CP/Continuity," March 1999.
6. Corrpro Companies Inc., "Treated Water Transmission Main Concrete Cylinder Pipe Failure Analysis," June 1995;
7. HDR Engineering, "Corrosive Soil Investigation," August, 1984;
8. Contracts 1 -3 Pipe Lay Sheet Sets.

Figure 21. Key Reference HDR study (2016) .

5 Conclusions and Recommendations

Overall the CP system upgrades to Contracts 1-3 have resulted in the majority of the pipeline receiving some or achieving adequate cathodic polarization of -850 mV per the NACE SP0169 criteria polarization. However, more than half the pipeline potentials on Contract 2 demonstrate inadequate protection. The lack of CP polarization required to mitigate active corrosion in conjunction with documented observations that include both concrete coating issues and corroded structural components on this contract give it a high probability of imminent failure.

Another consequence of inadequate CP at the various locations identified on Contracts 1-3 is the continuation of active corrosion of the pipe resulting in the loss of EC on pipe spans previously tested and verified as being continuous (RCC reports dated 2001 & 2007, Appendix D). This was observed at two locations in Contract 1 (Table 3.10).

An issue that has not been thoroughly addressed by the CP system upgrades to this point are the seven foreign oil and gas crossings (six of which are on Contract 2). CP at adequate levels will mitigate stray current corrosion cause by foreign pipelines. The installation of anodes in the vicinity of most of these crossings has likely added some protection against stray current, but a more thorough evaluation is required. Prior to performing additional testing, specific information regarding the type and locations of the CP systems protecting the foreign pipelines should be determined. Foreign pipelines protected with galvanic anode CP systems are not a concern, but those protected with impressed current CP will require additional testing .This testing should be coordinated with the owners of the foreign utilities with the request that they perform current interruption of the impressed current rectifiers while testing is performed on STWA's line both upstream and downstream of the crossing.

The three areas of concern have been identified from the results of the Phase 1 and 2 studies. Each location has a distinct set of issues or concerns resulting in these locations being classified as critical and recommended for additional assessment using different techniques to verify the condition of the steel structural components, assess the severity of concrete coating or steel degradation, and detect leaks. The additional investigations of the three pipe spans include a location in the sections identified for Contracts 1-3 unique to each span of pipe. The recommended approach for each has been tailored for the best use of STWA's resources, as well as attempting to minimize the impact on system operation.

The following conclusions are directed toward the three areas deemed critical. These recommendations discuss the reason the pipe is classified as critical and also provide the appropriate path forward.

The piping of Contract 1 located between STA 0+00 and STA 50+00 is located in severely corrosive soil, has never achieved adequate CP levels, and is also where the 1994 failure occurred. Observations made during excavations following the 1994 leak showed pipe in good condition with some documented concerns at the joints due to improper joint mortar installation. Based on the concern regarding continued corrosion at poorly mortared joints, this segment of Contract 1 is recommended for additional evaluation as detailed in the next section.

Documentation from multiple excavations conducted to evaluate Contract 2, and during the installation of CP upgrades, indicates that numerous locations demonstrated varying degrees of significant degradation of the concrete-mortar coating, leading to the exposure and corrosion of the

Figure 22. Final Recommendations.

Pre-1994 Pipeline Failure Soil Corrosivity Investigation

Corrosion records and survey documentation was limited prior to the August 1994 pipeline failure. Two documents of particular interest were the following:

1. Ductile Iron Pipe Research Association soil analysis performed in 1982. The data indicated the soil to be severely corrosive with both high sulfate and chloride concentrations along the proposed route of the alignment. The sulfate concentrations ranged from 480 to 12,000 parts per million (ppm) with a mean value of 2,800 ppm. The chloride concentrations ranged from 700 to 4,800 ppm with a mean value of 1,950 ppm.

2. HDR Engineering conducted a "Corrosive Soil Investigation," and submitted to STWA August, 1984. The report details a near 3-mile long section of the Contract 1 alignment having severely corrosive soils. Gulf Coast Testing Laboratory collected the chemistry of the soil and determined that extremely high concentrations of sulfates ranging from 700 – 32,500 parts per million (ppm) were present in this stretch of the alignment.

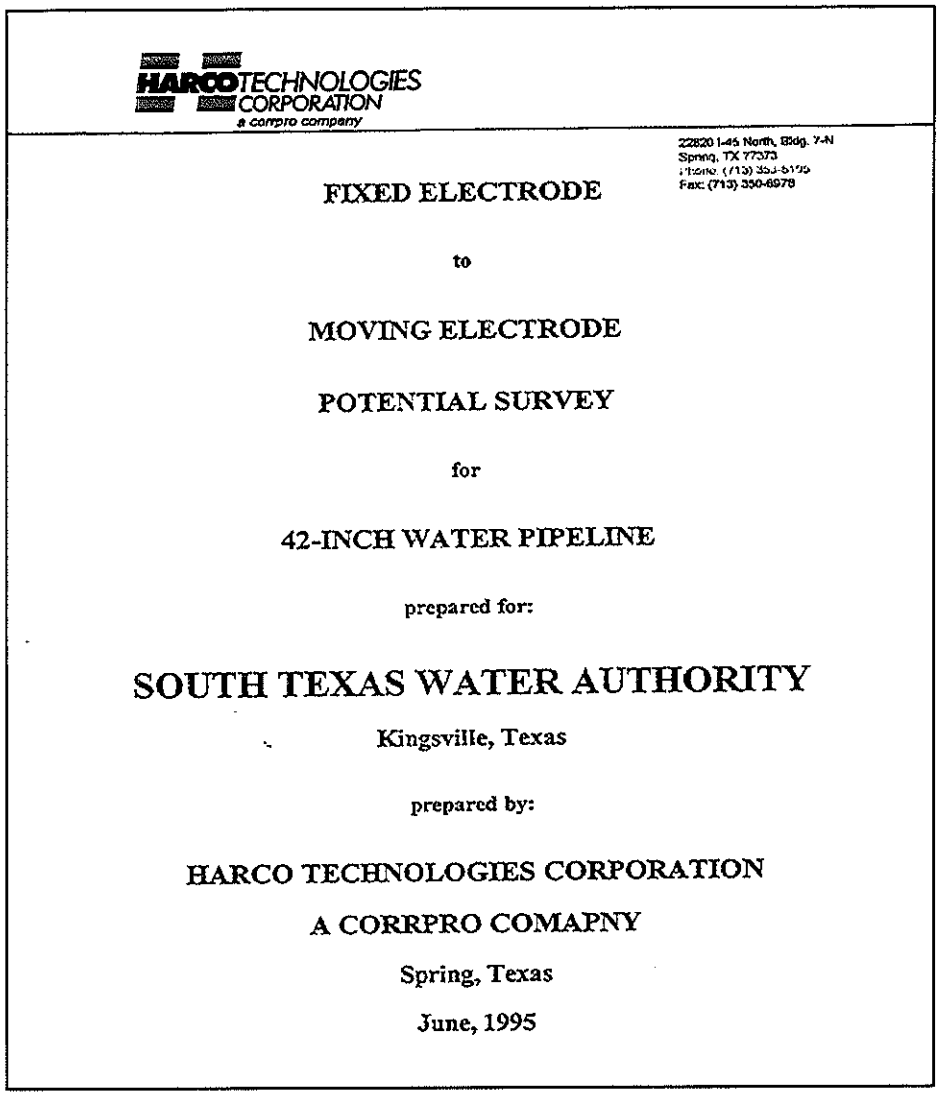
   The report concludes that due to the aggressiveness of sulfates attacking the concrete that either additional concrete casing, plastic or epoxy coating, or additional corrosion monitoring stations should be added to address this issue.

   The final recommendation proposed additional test stations, semi-annual pipe-to-soil potential survey of the test stations, and annual pipeline excavations. Depending on the findings of these excavations, the installation of a CP system to mitigate corrosion and future failure of the pipeline may be required.

No other documentation was reviewed that indicated the above reports resulted in specific actions or programs to monitor the known aggressive areas of the alignment.

Figure 23. Major Findings.

Appendix 4 – Moving Electrode Potential Survey by Harco – 1995



HARCO TECHNOLOGIES CORPORATION
a compro company

22820 I-45 North, Bldg. Y-N
Spring, TX 77373
Phone: (713) 353-5199
Fax: (713) 350-6978

FIXED ELECTRODE

to

MOVING ELECTRODE

POTENTIAL SURVEY

for

42-INCH WATER PIPELINE

prepared for:

SOUTH TEXAS WATER AUTHORITY

Kingsville, Texas

prepared by:

HARCO TECHNOLOGIES CORPORATION

A CORRPRO COMAPNY

Spring, Texas

June, 1995

Figure 24. Report Cover Page.

1.0 INTRODUCTION

Corrpro Companies, Inc. was retained to perform a close interval potential gradient and resistivity survey during the month of March of 1995 on the South Texas Water Authority's 42-inch diameter water pipeline running from Kingsville to Robstown, Texas. The purpose of the survey was to obtain soil resistivity and potential gradient data along the pipeline for use in evaluating the relative corrosion activity on the buried portion of the pipeline.

The data was evaluated and eleven sites were selected for excavation and inspection. This report presents the results of the survey and inspections.

2.0 SUMMARY

2.1 A total of eleven excavations and inspections were completed at selected locations along the 42-inch diameter pretensioned concrete steel cylinder water pipeline. Some form of corrosion activity was detected and observed on the steel portions of the pipe joints at ten of the eleven locations. Steel-to-concrete potentials recorded on ten pipe joints indicate that there is a better than 90% probability that corrosion is occurring on these pipe sections.

2.2 The results of the soil samples analysis indicated the following:

1. pH varied in a range of 7.0 to 9.6
2. Chlorides varied in a range of 2 to 4,131 ppm.
3. Resistivities varied in a range of 591 to 5,235 ohm-cm.

2.3 The data obtained during the soil resistivity survey indicate the following:

Maximum resistivity	5,700 ohm-cm
Minimum resistivity	138 ohm-cm
Average resistivity	591 ohm-cm

90% of the readings are less than 1,000 ohm-cm
98% of the readings are under 2,000 ohm-cm

Soils with Resistivities less than 2,000 ohm-cm are considered very corrosive to ferrous metals and should be protected from corrosion with coatings and cathodic protection.

2.4 Steel-to-concrete potentials measured on ten of the eleven pipe joints are in a range that is indicative of active corrosion on the embedded steel cylinder and reinforcing wires. The 42-inch concrete water line was installed approximately ten

Figure 25. Report Summary.

6.0 RESULTS

6.1 The 42-inch diameter water line was excavated, tested and data acquired for evaluation purposes at eleven locations.

6.2 Steel-to-concrete potentials more negative than -0.350 volts CSE were recorded on exposed pipe joints at all eleven locations.

In accordance with ASTM Test Method C-876-80 for copper sulfate half cell potentials of reinforcing steel in concrete, when potentials over an area are more negative than -0.350 volts, there is a greater than 90% probability that active corrosion is taking place. Potentials measured between -0.200 volts and -0.350 volts to copper sulfate reference electrode indicate a breakdown of alkalinity at the steel surface which eventually will result in the initial phase of active corrosion.

6.3 Rust staining at the joints and/or the pipe cylinder was observed at all excavations, except Excavation No. 6.

6.4 No active leaks were detected during the excavation process.

6.5 The analysis of the soil samples indicated the following:

pH	Range from 7.0 to 9.6
Chlorides	Range from 2 to 4,131 ppm,
Resistivities	Range from 391 to 5,235 ohm-cm

6.6 All pipe surfaces were tested for delamination. One area of minor delamination was found at a patch area in Excavation No. 9.

Figure 26. Major Results.

Report of South Texas Water Authority Inspection

42-Inch Water Pipe Line

May 1, 1995

Excavation No. 4
Station No. 757+13

Potential Measurements in Volts - North to South

	Top of Pipe	West Side	East Side	Bottom
North End	-0.350	-0.289	-0.270	
Joint	-0.395	-0.310	-0.245	
^	-0.375	-0.298	-0.233	
	-0.384	-0.290	-0.244	
	-0.434	-0.320	-0.289	-0.355
	-0.375	-0.313	-0.350	-0.346
	-0.440	-0.358	-0.300	-0.332
	-0.525	-0.360	-0.345	-0.371
Flow	-0.390	-0.343	-0.310	-0.326
	-0.385	-0.345	-0.359	-0.360
	-0.367	-0.340	-0.365	-0.347
	-0.390	-0.329	-0.425	
	-0.350	-0.307	-0.325	
	-0.350	-0.330	-0.345	
	-0.495	-0.330	-0.345	
	-0.389	-0.300	-0.316	
South End	-0.355	-0.268	-0.266	-0.290
Joint	-0.308	-0.270	-0.297	

Pipe-to-soil potentials - -0.326 North End and -0.319 South End.

Results of soil sample analysis. Three samples obtained:

pH	7.8 to 8.6
Chlorides	2 ppm
Resistivity	2,347 to 4,975 ohm-cm

Figure 27. Excavation 4 - Identified Low Potential - Less than earth Potential, High future corrosion chance.

Report of South Texas Water Authority Inspection

42-Inch Water Pipe Line

May 2, 1995

I Excavation No. 5
Station No. 970+62

Potential Measurements in Volts - North to South

	Top of Pipe	West Side	East Side	Bottom
North End	-0.505	-0.606	-0.706	
Joint	-0.470	-0.609	-0.679	
^	-0.512	-0.655	-0.677	
|	-0.510	-0.687	-0.671	
|	-0.547	-0.681	-0.677	
|	-0.562	-0.687	-0.636	
|	-0.534	-0.748	-0.640	-0.649
|	-0.527	-0.628	-0.675	-0.629
Flow	-0.558	-0.629	-0.669	-0.616
|	-0.547	-0.651	-0.656	-0.667
|	-0.541	-0.677	-0.666	-0.548
|	-0.525	-0.656	-0.680	
|	-0.528	-0.426	-0.672	
|	-0.540	-0.396	-0.690	
|	-0.544	-0.576	-0.673	
|	-0.599	-0.570	-0.682	
	-0.221	-0.598	-0.671	
South End	-	0.305	-0.701	
Joint			-0.224	

Pipe-To-Soil Potentials - -0.416 Volts CSE North End and -0.406 volts CSE South End.

Results of soil sample analysis. Three samples obtained:

pH	7.8 to 8.1
Chlorides	143 to 1,139 ppm
Resistivity	1,028 to 3,424 ohm-cm

Figure 28. Excavation 5 - Identified Low Potential - Less than earth Potential, High future corrosion chance.

Report of South Texas Water Authority Inspection

42-Inch Water Pipe Line

May 3, 1995

Excavation No. 7
Station No. 1024+03

Potential Measurements in Volts - North to South

	Top of Pipe	West Side	East Side	Bottom
North End	-0.364	-0.487	-0.383	-0.466
Joint	-0.425	-0.464	-0.310	
^	-0.412	-0.438	-0.342	
|	-0.419	-0.456	-0.149	
|	-0.356	*-0.518	-0.215	
|	-0.188	*-0.573	-0.188	
|	-0.496	-0.307	-0.270	
|	*-0.544	-0.449	-0.298	-0.360
Flow	*-0.611	*-0.661	-0.187	-0.423
|	-0.480	-0.532	-0.436	-0.562
|	-0.445	-0.552	-0.267	0-.638
|	-0.567	-0.528	-0.248	
|	-0.548	-0.428	*-0.526	
|	*-0.564	-0.464	-0.529	
|	-0.575	-0.368	-0.496	
|	-0.578	*-0.632	-0.520	
South End	-0.446	*-0.576	-0.527	
Joint	-0.290	-0.578	*-0.601	

Pipe-to-soil potentials - -0.495 CSE North end and -0.524 CSE South end. (*) indicates points of apparent active corrosion.

Results of soil sample analysis. Three samples obtained:

pH	7.9 to 9.6
Chlorides	7 to 70 ppm
Resistivity	1,049 to 3,401 ohm-cm

Figure 29. Excavation 7 - Identified Low Potential - Less than earth Potential, High future corrosion chance.

Appendix 5 – Cathodic Protection Inspection Report by Corrpro, 2020

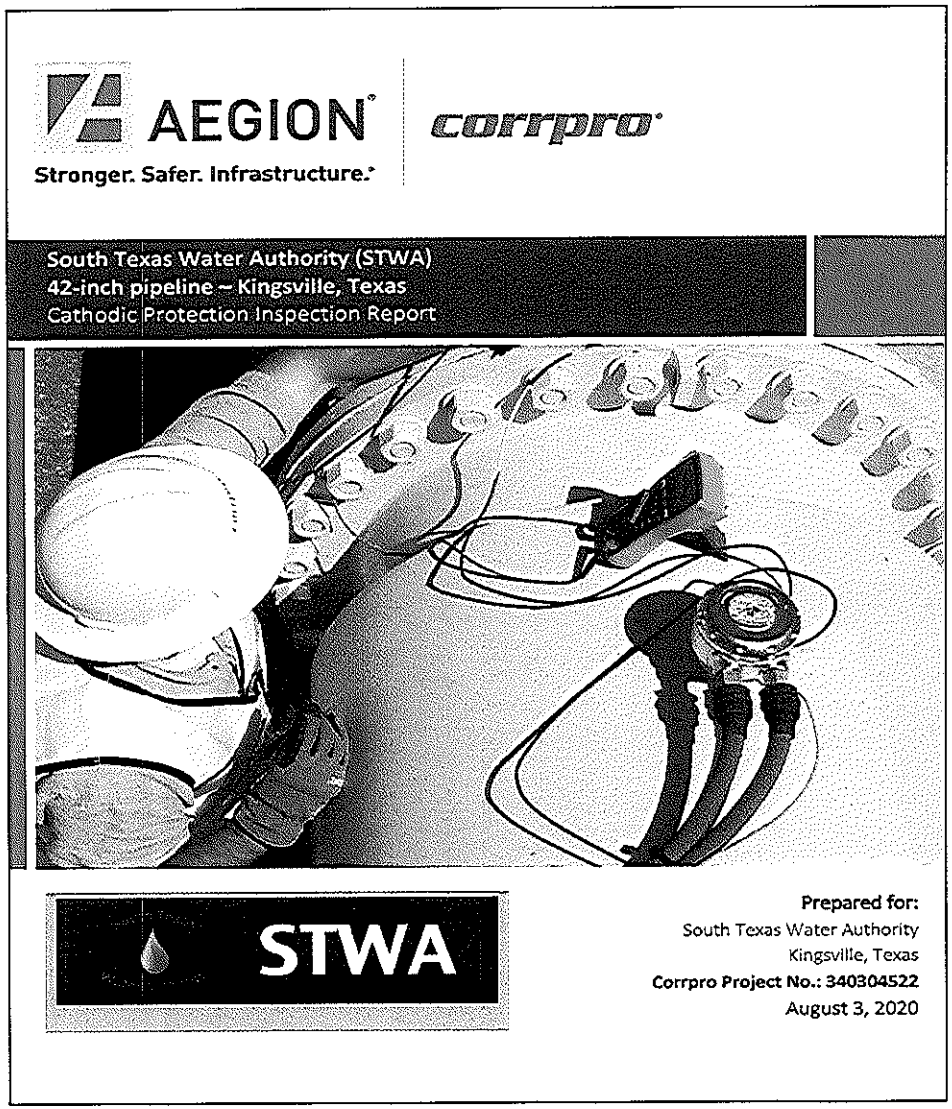


Figure 30. Report Cover Page.

AEGION
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EXECUTIVE SUMMARY

Corrpro was retained by South Texas Water Authority (STWA) to identify discontinuous pipeline segments for its 42" STWA pipeline located in Bishop, Texas. Corrpro utilized the close interval survey (CIS) data from its STWA 42" report dated February 21, 2020 and identified nine (9) pipeline segments that have a high likelihood of containing high-resistance or discontinuous bonding straps between pipe joints. The pipeline segment from STA 263+10 to 272+70 was removed from further investigation because the test station at STA 281+90 survey was found to have faulty lead wires, which have since been repaired.

Testing was conducted between June 22, 2020 and July 2, 2020 by Corrpro engineer Technician Yuxi Duan. Corrpro technician Jason Williams, Corrpro technician Justin Vanderwater, and Corrpro engineering manager Steven Padden assisted in testing the 42" STWA pipeline.

Below are findings from Corrpro's inspection report:

- Test station (TS) 281+90 was properly repaired. The CIS data that Corrpro collected on July 1, 2020 shows that the CP system between 281+90 and 293+88 meets NACE criteria.
- Corrpro did not locate any discontinuities inside the King Ranch portion for the 42" STWA pipeline.
- Corrpro identified a high-resistance bond between station 304+82 and 305+46. The high-resistance bond is most likely at the pipe segment underneath an active roadway, Farm-to-Market (FM) 70.
- The first pipe segment downstream from 473+76 and upstream from 475+36 are discontinuous.
- There is a high-resistance or discontinuous bond two pipeline segments downstream from 475+36.
- The first pipe segment downstream from 134+00 and upstream from 141+60 are discontinuous.
- The pipe segments immediately upstream and downstream from 193+00 are discontinuous.
- Corrpro identified one (1) possible discontinuity between station IDs 71+76 and 93+60.

Pipe segment discontinuities were identified using a Pipeline Current Mapper (PCM) unless otherwise specified. Corrpro provided recommendations to maintain cathodic protection (CP) efficacy for the 42" STWA pipeline in this report.

Figure 31. Report Summary.

Segment	Date	Begin	End	Output (A)	Groundbed	Conclusion(s)
1	6/25/20	17+28*	20+00	1.0	To Pipe	No discontinuities identified.
2	6/25/20	20+00*	35+28	1.0	Temporary	No discontinuities identified.
3	7/2/20	71+76	93+60*	0.6	To Pipe	Potential discontinuity 100-yards downstream of ARV (headed towards 93+60). Potential discontinuity in fields past 71+76 (see Figure 2).
4	7/2/20	134+00	141+60*	0.6	To Pipe	Discontinuous immediately downstream from 134+00. Discontinuous immediately upstream from 141+60.
5	7/1/20	159+00*	193+00*	1.0	Temporary	No discontinuity identified near 159+00. Immediately discontinuous both upstream and downstream at 193+00.
6	6/24/20	473+76*	475+36	0.6	To Pipe	Immediately discontinuous downstream from 473+76. Immediately discontinuous upstream from 475+36.
7	6/24/20	475+36*	486+56	0.6	To Pipe	Second joint downstream from 475+36 discontinuous.
* denotes where the PCM (and temporary groundbed, if applicable) were located						

Figure 32. Corrpro Test Results - Potential Electrical discontinuity identified.

Bidders Selection Matrix Evaluation	
Categories	**Overall, Weight %**
Company past Projects on water lines	20%
Staff experience on Drinking water lines	30%
Project Approach	20%
Total Cost	20%
Safety and Contingency	10%
Total	**100%**