Innovative approaches
Practical results
Outstanding service

LEAD AND COPPER RULE REVISION COMPLIANCE PROGRAM – PHASE 1: INITIAL RISK AND RESOURCE SCREENING REPORT

Prepared for:

Town of Little Elm

August 2023

Prepared by:

FREESE AND NICHOLS, INC.
801 Cherry Street, Suite 2800
Fort Worth, TX 76102
817-735-7300

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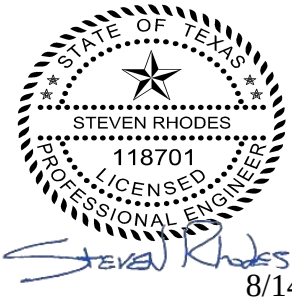

8/14/2023

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

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LTE22860

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List of Abbreviations

Abbreviation	Actual
AI	Aggressiveness Index
AL	Action Level
ARPA	American Rescue Plan Act
AWWA	American Water Works Association
°C	Degrees Celsius
C	Corrosive
CAS	Customer Account Services
CCPP	Calcium Carbonate Precipitation Potential
CCS	Corrosion Control Study
CCT	Corrosion Control Treatment
CDBG	Community Development Block Grant
CSMR	Chloride-to-Sulfate Mass Ratio
DENTON CAD	Denton County Appraisal District
Dfund	Texas Water Development Fund
DWSRF	Drinking Water State Revolving Fund
EDA	Economic Development Administration
EP	Entry Point
EPA	Environmental Protection Agency
FAQ	Frequently Asked Questions
FNI	Freese and Nichols, Inc.
GIS	Geographic Information System
HUD	U.S. Department of Housing and Urban Development
LCRI	Lead and Copper Rule Improvement
LCRR	Lead and Copper Rule Revision
LSI	Langelier Saturation Index
LSL	Lead Service Line
LSLR	Lead Service Line Replacement
MFR	Multi-Family Residences
mg/L	Milligram per Liter
NC	Non-corrosive
NEPA	National Environmental Policy Act
OB-GYN	Obstetricians and Gynecologists
P90	90th Percentile
PQL	Practical Quantitation Limit
PWP	Public Works Program
RCAD	Rockwall County Appraisal District
RSI	Ryznar Stability Index
SC	Slightly Corrosive
SDWA	Safe Drinking Water Act
SFS	Single-family structures
SOP	Standard Operating Procedure
SRF	State Revolving Fund
TCEQ	Texas Commission on Environmental Quality
TL	Trigger Level
µg/L	Microgram per Liter

Abbreviation	Actual
WIFIA	Water Infrastructure Finance Innovation Act
WIIN Act	Water Infrastructure Improvements for the Nation Act
WQ	Water Quality
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) released the long-awaited Lead and Copper Rule Revisions (LCRR) on January 15, 2021, setting new standards aimed at removing harmful levels of lead from drinking water. On December 16, 2021, the LCRR went into effect with the compliance date set to October 16, 2024. Meanwhile, the EPA also announced that it intends to develop a follow-on rule, the Lead and Copper Rule Improvement (LCRI), before October 2024 to strengthen various requirements in LCRR. While the LCRI will make additional improvements to the LCRR, it is not expected to change the requirement for water systems to submit their initial lead service line inventories to the Texas Commission on Environmental Quality (TCEQ) by October 16, 2024. The TCEQ has provided guidance on how the inventory should be submitted and provided a spreadsheet template for municipalities to utilize.

ES-1. RISK ASSESSMENT

A brief, planning-level risk assessment was conducted as part of this report to better understand the likelihood that lead service lines (LSLs) will be identified within the distribution system and if lead concentrations are expected to increase above the currently proposed Action Level (AL, 15 µg/L based on the 90th percentile concentration) or the Trigger Level (TL, 10 µg/L based on the 90th percentile concentration) in regulatory samples.

Historical Lead Sample Results – At the time of writing this report, the Town of Little Elm (Town) had 13,932 service connections per the publicly available database on "Texas Drinking Water Watch". In 2010, the Town had a single sample exceeding the AL; however, the overall system 90th percentile was still below the Practical Quantitation Limit (PQL, 5 µg/L). If the Town exceeds the AL for individual samples in the future, the LCRR requires the City to develop and implement a "Find and Fix" program to identify and resolve the issue of high lead concentrations. Out of the 180 samples collected between 2007 and 2022, one sample was above the AL and TL (less than 1%), and five samples were above the PQL. The overall system 90th percentile was highest in 2007 and 2010 in the dataset analyzed; however, it was still below PQL for all sampling events. Current sampling results do not suggest an extensive lead issue at existing sample locations. It is possible this may change based on modifications to the lead sampling program required by the LCRR which includes modifications to the materials and methods to test for lead, as described in **Section 2.3**. The Town will need to develop and implement a "Find and Fix" program in the event another individual AL exceedance occurs.

Corrosivity Overview and Current Corrosion Treatment – The Town provided monthly mineral analysis results from December 2021 to December 2022 from the primary source of the Town's water, the North Texas Municipal Water District (NTMWD) Wylie Water Treatment Plant (WTP). The ten sampling events from December 2021 to December 2022 were used as the model inputs for calculating corrosivity indices to represent the Town's typical drinking water tap sample. Based on the sampling results from the NTMWD Wylie WTP and TCEQ's scoring guideline, the water upstream of the Town's distribution system ranges from slightly corrosive to corrosive. Samplings from August 2022 through September 2022 were determined to have a corrosive classification per TCEQ's scoring guideline. The slightly lower pH (pH < 7.7) may be the reason for this classification. However, these results should only be viewed as a snapshot at the water treatment plant and do not consider water quality variations that may occur with time and movement as the water travels from the treatment plant and throughout the distribution system. A comprehensive water corrosivity evaluation of the Town's finished water quality is beyond the scope of this report but would provide the Town with additional insight on variations in water quality.

Potential Risk of Lead Service Line Existence – The risk of encountering LSLs or galvanized lines requiring replacement increases in areas of the Town with service lines installed before the use of lead was prohibited by the 1989 federal lead ban. The Town does not maintain information on the age or material of the publicly or privately owned portion of the service lines. However, it was assumed that the service line install date was equivalent to the building construction date, which is available from the Denton County Appraisal District (Denton CAD). Based on a review of the Denton CAD parcel information, approximately 11,979 parcels are within the Town's operational limits. Of these approximately 305 (2.5%) parcels were constructed before the 1989 lead ban. Out of the 842 (7%) parcels that are missing construction dates, 750 parcels (6.2% of total) are greenbelt, flood elevation or undeveloped parcels and the Town should verify that no service lines exist in these parcels. 92 (0.8% of total) parcels are missing construction dates and have some form of development on them. While this estimate in no way suggests that all or any of these service lines contain lead, it does provide a sense of the level of effort required to build a comprehensive service line inventory, should the Town choose to field-verify all service lines designated as lead status unknown. As part of the resource assessment, FNI reviewed as-built plans and town permitting records to determine if these data sources contained service line material information.

ES-2. RESOURCES ASSESSMENT

Freese and Nichols, Inc. (FNI) collected and evaluated data and records that may be useful in complying with the LCRR, to the development of the service line inventory. The LCRR requires that all public water

systems develop an inventory of all service lines within their system by the compliance date. As part of the resource assessment, the Town's water main GIS layer and a sample of the Town's as-built plans and permit records were reviewed to determine if these data sources contained service line material information. Based on the data review, it was determined that the permit records data didn't contain sufficient information to identify the material of the property's service line. The as-built plans did contain material information for the publicly owned portion of the service line. It's important to note that not every as-built plan set that was reviewed contained service line material information and the presence of this information can only be determined through a manual review process. The resources available to the Town should be considered to maximize the desktop assessment and to minimize field inspections.

ES-3. COMPLIANCE BUDGET AND SCHEDULE

The primary focus of this report is to outline the cost and compliance schedule due date of **October 16, 2024**. The costs are meant to provide an order of magnitude for planning purposes only. Actual costs may vary depending on final regulatory decisions by the EPA and TCEQ, changes to the LCRR via the LCRI, and the Town's determination of the optimal program for compliance, risk management and public welfare. Opportunities for optimizing the recommended budget exist, such as reducing the magnitude of certain activities and deferring certain tasks to future years to accommodate budget limitations. Other costs, especially those presented in Phase 5, may not be necessary and may be avoided by the Town. The estimated order of magnitude of the costs recommended for planning purposes for Phases 1 through 5 are summarized in **Table ES-1.** Costs are presented in 2023 dollars and do not include inflation.

Table ES-1: Planning Level Compliance Costs by Fiscal Year with Hypothetical LSL Replacement Enforcement

Task	Planning Level Budget			
	FY 2022 - 2023	FY 2023 - 2024	FY 2024 - 2025	FY 2025 - 2026
Phase 1 - 5 LCRR Compliance	**$48,804**	**$302,500**	--	--
LCRR Compliance Subtotal	**$351,304**			
Hypothetical LSL Replacement Enforcement	--	--	$225,000	$225,000
Hypothetical LSL Replacement Enforcement Subtotal	**$450,000**			
LCRR Compliance with Hypothetical LSL Replacement Enforcement	**$801,304**			

ES-4. RECOMMENDED FUNDING OPPORTUNITIES

Government funding mechanisms are essential for water systems to identify and reduce/eliminate lead and copper from drinking water. In Texas, there are five existing funding programs to help identify and

replace lead and copper water components: three existing low-interest loan programs and two existing grant programs that can fund the identification, planning, design and construction of projects to help systems meet LCRR requirements.

In March 2021, the American Rescue Plan Act of 2021 (ARPA) was signed into law providing $350 billion for eligible state, local, territorial and Tribal governments to respond to the COVID-19 emergency and bring back jobs. The U.S. Treasury administers this direct allocation program delivering funds, among other things, to provide investment in water and sewer infrastructure which includes compliance with the LCRR.

More recently, Congress passed an infrastructure bill (Infrastructure Investment & Jobs Act (H.R. 3684)) in the fall of 2021. Among other provisions, the bill will provide $15 billion in loans and grants through the Drinking Water State Revolving Fund (DWSRF) for lead service line replacement. The Budget Reconciliation package includes an additional $9 billion for lead service lines through non-state revolving fund grant programs.

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) released the long-awaited Lead and Copper Rule Revisions (LCRR) on January 15, 2021, setting new standards aimed at removing harmful levels of lead from drinking water. In June 2021, the EPA delayed the LCRR's effective date to December 16, 2021, and the compliance date to October 16, 2024. This rule revision will require community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) to take significant action to protect customers from the health risks associated with lead and comply with the LCRR. **Table 1-1** describes major changes in six key areas. A list of abbreviations used throughout this report are provided in the report index. Major changes within the LCRR are primarily focused on lead and not copper; therefore, the focus of this report will be on lead compliance.

Table 1-1: Key Requirements of the LCRR

Key Requirements of the LCRR	Additional Details
All public water systems will be required to:	
Lead Service Line Inventory	Develop and publish an inventory of all service connections, categorizing the service line material used on both the public and private side of the meter.
Public Communication	Enhance communication with the public and provide educational materials to schools, childcare facilities, obstetrics, and gynecology (OB-GYN) centers, and other healthcare facilities under various situations.
Water Quality Sampling	Update sampling procedures and sampling sites based on revised requirements.
"Find and Fix" Initiative	Find and address lead-contributing sources within any individual home with a detected lead concentration above 15 µg/L.
Depending on the compliance sampling results and the existence of lead service lines, some public water systems will have to:	
Lead Service Line Replacement (LSLR)	Develop and implement an LSLR plan.
Corrosion Control Studies (CCS) and Treatment	Optimize Corrosion Control Treatment (CCT), possibly including pipe loop studies.

On December 16, 2021, the LCRR went into effect with the compliance date of October 16, 2024. Meanwhile, the EPA also announced that it intends to develop a follow-on rule, the Lead and Copper Rule Improvement (LCRI), before October 2024 (latest communication with EPA indicated summer 2024) to

strengthen various requirements in the LCRR. While the LCRI will make additional improvements to the LCRR, it is not expected to change the requirement for water systems to submit their initial lead service line inventories to the Texas Commission on Environmental Quality (TCEQ) by October 16, 2024. The TCEQ may also negotiate changes with the EPA as to how Texas will enforce changes to the rule because of the LCRI. For the purpose of this report, Freese and Nichols, Inc. (FNI) assumes that the Town of Little Elm (Town) will need to be in compliance with all requirements of the LCRR by October 16, 2024. However, the recommended approach and schedule may be subject to change pending any additional rule changes to the LCRR via the LCRI.

The goal of Phase 1 is to assess the effort required by the Town to comply with the LCRR. The level of effort required for compliance will be related to the probability of lead service lines (LSLs) within the municipality and resources available to the municipality. Resources may include records and information on service line materials, funding, and staff availability for required compliance activities.

Future phases are categorized into four phases that will be discussed in **Section 4.0**:

- Phase 2 – Initial Service Line Inventory Development
- Phase 3 – Service Line Inventory Completion and Field Inspections
- Phase 4 – Sample Plan Update, Preliminary Sampling and Other Compliance Preparations
- Phase 5 – Lead Service Line Replacement Planning and Mitigation

This report concludes with a summary of resource requirements, a planning-level budget, and a proposed compliance schedule.

2.0 RISK ASSESSMENT

Certain compliance activities, such as implementing a Lead Service Line Replacement (LSLR) plan, are only required if a public water system has known LSLs, galvanized service lines downstream of LSLs, service lines with lead status unknown, or detects certain concentrations of lead as part of regulatory sampling. When estimating the future effort associated with LCRR compliance, it is important to understand the risk of encountering these conditions. A brief, planning-level risk assessment was conducted as part of this report to better understand the likelihood of LSLs in the distribution system and whether lead concentrations will increase above the Action Level (AL, 15 µg/L) or the Trigger Level (TL, 10 µg/L) based on the 90th percentile concentration in regulatory samples.

2.1 HISTORICAL LEAD SAMPLE RESULTS

Figure 2-1 illustrates the Town's existing water system with the location of the historical and existing lead and copper sampling sites. Historical lead sample results, sample site information, and sampling instructions were reviewed to generally assess the Town's proximity to the future AL, TL and Practical Quantitation Level (PQL). The PQL (5 µg/L based on the overall system 90th percentile concentration) is an important criterion for reduced monitoring frequency, and the state regulators have been given the flexibility in the LCRR to require public water systems serving 50,000 or more people to update its Corrosion Control Study (CCS) to optimize their Corrosion Control Treatment (CCT) if the 90th percentile lead value is above the PQL. **Figure 2-2** shows the systemwide 90th percentile values for lead sampling from 2007 to 2022 and their relation to the PQL, TL and AL. This sampling data was taken from the "Texas Drinking Water Watch". The historical 90th percentile results are compared against the future AL (15 µg/L), TL (10 µg/L) and PQL (5 µg/L). **Table 2-1** shows the number of Individual Lead AL, TL and PQL exceedances for the city between 2007 and 2022.

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LCR039

FIGURE 2-1
CITY OF LITTLE ELM
LEAD AND COPPER SAMPLING SITES

LEGEND

Sampling Sites
- Tier 1 (30)
- Tier 3 (27)
- Inactive (4)

Operational Area
- Lower
- Upper
- West

- Streams
- Lakes
- City Limits

LITTLE ELM

FREESE AND NICHOLS

N

0 2,000
SCALE IN FEET

Figure 2-2: Historical P90 for Town Lead Samples

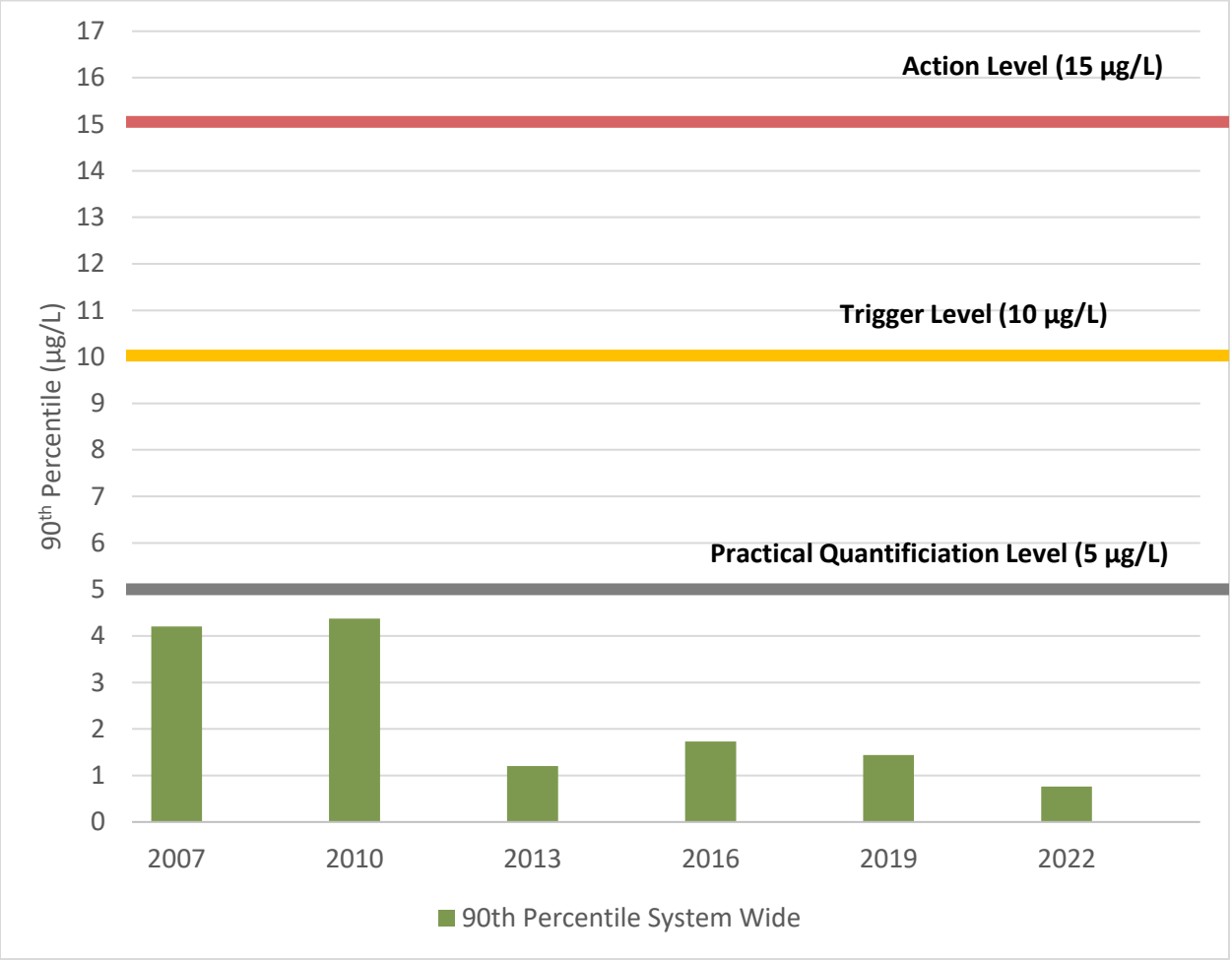


Table 2-1 Number of Individual Lead AL, TL and PQL Exceedances from 2007-2022

Year	Number of AL Exceedances	Number of TL Exceedances	Number of PQL Exceedances
2007	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)	1 (1 out of 30; 3.33%)
2010	1 (1 out of 30; 3.33%)	1 (1 out of 30; 3.33%)	2 (2 out of 30; 6.67%)
2013	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)	1 (1 out of 30; 3.33%)
2016	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)	1 (1 out of 30; 3.33%)
2019	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)
2022	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)	0 (0 out of 30; 0%)
Total (2007 – 2022)	1 (1 out of 180; 0.56%)	1 (1 out of 180; 0.56%)	5 (5 out of 180; 2.78%)

Current sampling results do not suggest an extensive lead issue at existing sample locations. It is possible this may change based on modifications to the lead sampling program required by the LCRR which includes modifications to the materials and methods to test for lead, as described in **Section 2.3**. The Town will need to develop and implement a "Find and Fix" program in the event another individual AL exceedance occurs.

2.2 EXISTING SAMPLE PRACTICES VERSUS FUTURE REQUIREMENTS

The EPA has made several changes to the criteria for tap sampling to perform lead testing at more vulnerable locations that are expected to have higher levels of lead in drinking water. **Table 2-2** describes the major changes to tap samplings included in the LCRR. A comparison of the current and proposed tier structure is given in **Table 2-3**. Understanding these changes is important because of the actions required if the TL or AL is exceeded and the possibility of higher lead concentration detection within the system once the changes are implemented.

Table 2-2: Changes to Sampling Requirements by the LCRR

Area of Change	Description
Sampling Tier Structure	The proposed sampling tier specifically targets structures with LSLs. Details of the new tier system are discussed in Table 2-3.
Sampling Procedure	The new sampling procedures require the use of wide mouth bottles to collect the samples and require the fifth liter of water from the tap to be tested for lead. Pre-stagnation flushing or cleaning/removal of faucet aerators is prohibited.
Annual Sampling at Schools and Childcare Facilities	The LCRR requires all childcare facilities and elementary schools to be sampled in five years, at a rate of 20% of primary schools and childcare facilities per year. (During those five years, secondary schools must be sampled upon request.) After the first round of mandatory elementary school testing, elementary schools and childcare facilities must be sampled upon request.

Table 2-3: Comparison of Current and Proposed LCR Tier Structures

	Current LCR[1]	Proposed LCR
Tier 1	A single-family structure (SFS) that contains lead pipes or is served by LSLs, or an SFS that contains copper pipes with lead solder installed after 1982 but before the Safe Drinking Water Act (SDWA) lead ban in 1988.	Collect samples from SFSs served by known LSLs. Samples may be collected from MFRs if they represent at least 20% of structures served by the water system.
Tier 2	A building or multi-family residence (MFR) that contains lead pipes or is served by LSLs, or a building or MFR that contains copper pipes with lead solder installed after 1982 but before the SDWA lead ban in 1988. A school or childcare facility that contains lead pipes or is served by an LSL, or a school or childcare facility that contains copper pipes with lead solder installed after 1982 but before the SDWA lead ban in 1988.	Collect samples from buildings and MFRs served by LSLs.
Tier 3	SFSs that contain copper pipes with lead solder installed before 1983.	Collect samples from SFSs with galvanized service lines downstream of an LSL, currently or in the past or known to be downstream of a lead connector.
Tier 4	N/A	Collect samples from SFSs with copper pipes with lead solder installed before the effective date of the state's lead ban.
Representative Sites (Current LCR) Tier 5 (Proposed LCR)	Collect samples from sites where the plumbing is similar to that used at other sites served by the water system.	Collect samples from sites where the plumbing is similar to that used at other sites served by the water system.

[1] Referenced from TCEQ-20467(a) (Rev 05-01-17)

2.3 CORROSIVITY OVERVIEW AND CURRENT CORROSION TREATMENT

The corrosivity and current CCT of the Town's drinking water is another area of potential risk of future LCRR compliance and was briefly assessed through a preliminary desktop analysis of recent water quality sampling of the Town's entry points. The Town receives treated water from the North Texas Municipal Water District (NTMWD), which enters the Town's distribution system at the Mansell Pump Station. At the time of writing this report, the Town serves a population of 41,796 per the publicly available database on "Texas Drinking Water Watch". The TCEQ has been given the flexibility in the LCRR to require public water systems serving less than 50,000 people to conduct a Corrosion Control Treatment Study (CSS) if the 90th percentile lead value is above the 10 µg/L TL and below the 15 µg/L AL. While the Town purchases water from NTMWD and currently does not perform CCT on its own, the LCCR now allows the state to request that the Town performs a CSS at the entry point to the water distribution system if the P90 lead concentrations exceed the 10 µg/L TL. Furthermore, if the 90th percentile lead value is greater than the 15 µg/L AL, then systems such as Little Elm's without CCT will be required to perform a complete CCT installation regardless of subsequent testing levels.

The method used by the TCEQ to evaluate the corrosivity of the water is outlined in a presentation titled "New Sources, Treatment and Evaluating Corrosivity," dated August 5, 2020 (included in **Appendix A**). **Table 2-4** summarizes the five indices used by the TCEQ to evaluate corrosivity and the designations given to the calculated values of those indices. The TCEQ guidance also outlines how these indices are used to determine the corrosivity of the water:

- Three or more indices rated "C" – Corrosive (red)
- Three indices rated "SC" under 25°C – Slightly Corrosive (yellow)
- Four total indices rated "C" and "SC" – Slightly Corrosive (yellow)
- Otherwise, Non-Corrosive (green)

Table 2-4: TCEQ Corrosivity Indices

Corrosivity Index	Non-Corrosive (NC)	Slightly Corrosive (SC)	Corrosive (C)
Langelier Saturation Index (LSI)	> -0.25	-1 < LSI < 0.25	< -1.0
Ryznar Stability Index (RSI)	< 7	7 < RSI < 8.5	> 8.5
Aggressiveness Index (AI)	> 12	10 < AI < 12	< 10
Calcium Carbonate Precipitation Potential (CCPP)	> 0.0	-3 < CCPP < 0	< -3.0
Chloride-to-Sulfate Mass Ratio (CSMR)	< 0.2	0.2 < CSMR < 0.5	> 0.5 (if TALK < 50) [1]

[1] TALK is total alkalinity. If the CSMR is > 0.5 but the TALK is > 50, then the classification would be SC.

Water quality parameter testing results at the Town's entry point is the best representation of the water quality in the Town's distribution system, however, the Town currently does not sample these water quality parameters at its entry points. Therefore, data was extracted from the monthly water quality reports reported from the Wylie WTP from December 2021 to December 2022 and used as the model inputs for calculating corrosivity indices to represent the Town's typical drinking water tap sample. **Table 2-5** summarizes both the model input and the output TCEQ corrosivity grade. The corrosion indices for each location led to the corrosion grade provided in **Appendix B**.

Based on the sampling results from the NTMWD Wylie WTP and TCEQ's scoring guideline, the water upstream of the Town's distribution system ranges from slightly corrosive to corrosive. Samplings from August 2022 through September 2022 were determined to have a corrosive classification per TCEQ's scoring guideline. This is not an indication that NTMWD is supplying corrosive water to the Town of Little Elm due to the conservative nature of this model. The slightly lower pH (pH < 7.7) may be the reason for this classification. However, these results should only be viewed as a snapshot at the water treatment plant and do not consider water quality variations that may occur with time and movement as the water travels from the treatment plant and throughout the distribution system. The water quality data utilized for the model is an average monthly data; therefore, the ions present in the water are unbalanced. This is not an exact representation of water quality. A comprehensive water corrosivity evaluation of the Town's finished water quality is beyond the scope of this report but would provide the Town with additional insight on variations in water quality.

Table 2-5: Model Inputs and TCEQ Corrosivity Grade
(NTMWD Wylie WTP from December 2021 – December 2022)

Date	TDS (mg/L)	pH (S.U.)	Total Alkalinity (mg-CaCO3/L)	Calcium (mg-CaCO3/L)	Chloride (mg/L)	Sulfate (mg/L)	TCEQ Grade
Dec-21	290	8.27	87	47.3	31.9	91.1	Slightly Corrosive
Jan-22	301	8.26	101	50.5	33.3	94.4	Slightly Corrosive
Feb-22	327	8.22	107	54.5	33.4	103	Slightly Corrosive
Mar-22	364	8.26	111	60.2	37	127	Slightly Corrosive
Apr-22	370	8.28	116	53.7	108	111	Slightly Corrosive
May-22	454	8.26	113	59.8	83.9	138	Slightly Corrosive
Jun-22	380	8.28	96	47.8	65.5	114	Slightly Corrosive
Jul-22	344	7.96	83.5	36.6	63.9	107	Slightly Corrosive
Aug-22	382	7.96	79.2	36.9	70.5	112	Corrosive
Sep-22	416	8.03	77	35.1	85.8	127	Corrosive
Oct-22	413	8.06	80.2	37.1	76.7	114	Slightly Corrosive
Nov-22	451	8.1	85.8	47.6	94.4	132	Slightly Corrosive
Dec-22	418	8.19	89.3	45	88.8	143	Slightly Corrosive

The CSMR parameter for the 13 sampling dates were categorized as slightly corrosive, while two were categorized as corrosive. The TCEQ also prepared a separate reference figure (as shown on **Figure 2-3**) to emphasize the importance of the CSMR parameter. Extensive research and real-world case studies at various water utilities suggest a strong relationship between higher lead concentrations and higher CSMR. Chloride and sulfate sampling from the sampling results at the NTMWD Wylie WTP from December 2021 to December 2022 and their associated CSMRs are summarized in **Table 2-6**.

Figure 2-3: Level of Lead Corrosion Concern Relative to CSMR*

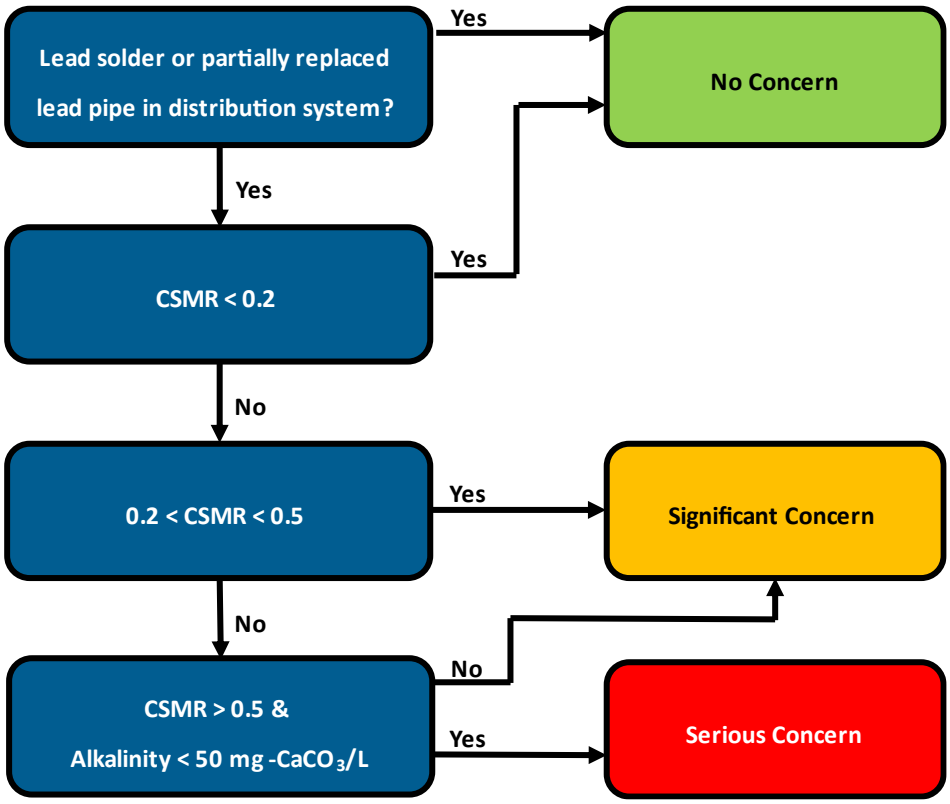


Table 2-6: CSMR Results from Recent Sampling

Sampling Date	Alkalinity (mg-$CaCO^3$/L)	Chloride (mg/L)	Sulfate (mg/L)	CSMR
Dec-21	87	31.9	91.1	0.35
Jan-22	101	33.3	94.4	0.35
Feb-22	107	33.4	103	0.32
Mar-22	111	37	127	0.29
Apr-22	116	108	111	0.97
May-22	113	83.9	138	0.61
Jun-22	96	65.5	114	0.57
Jul-22	83.5	63.9	107	0.60
Aug-22	79.2	70.5	112	0.63
Sept-22	77	85.8	127	0.68
Oct-22	80.2	76.7	114	0.67
Nov-22	85.8	94.4	132	0.72
Dec-22	89.3	88.8	143	0.62

The Town does not have any recent corrosion control studies and does not provide any treatment for the potable water purchased from NTMWD. The Wiley WTP adds orthophosphate to their water for corrosion control. The LCRR continues to include pH adjustment and phosphate inhibitors (orthophosphates only) as acceptable corrosion control treatment options.

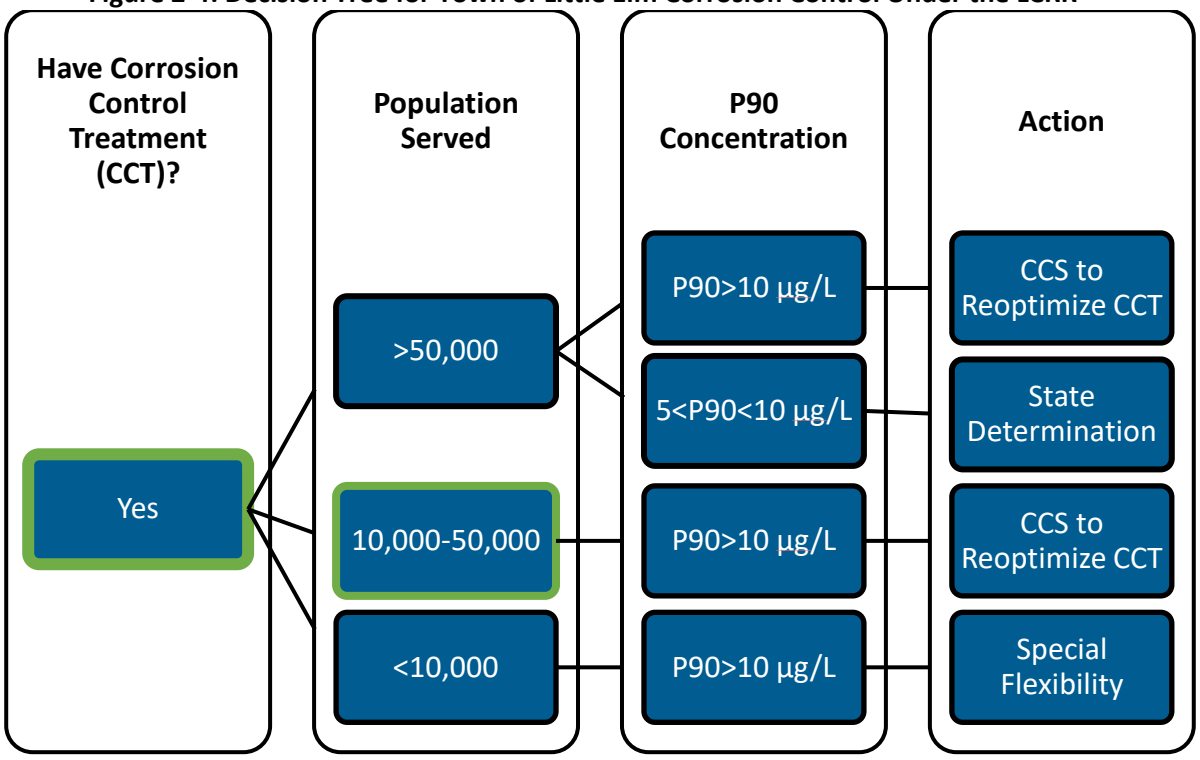
A few things to note under the LCRR or as best practice:

- The Town is required to update their corrosion control strategies if the 90th percentile lead value is above the TL (10 µg/L). Coordination with NTMWD may be required if lead concentrations increase in future compliance sampling.

- State regulators have the authority to require cities with populations exceeding 50,000 people to update its CCS to optimize CCT if the 90th percentile lead value is above the PQL (5 µg/L). While the latest population estimate on "Texas Drinking Water Watch" is 41,796, population estimates taken from the North Central Texas Council of Governments for 2022 indicate a population 51,640. Therefore, the Town should be aware of these additional requirements of the LCRR. See **Figure 2-4** for a decision tree.

- For cities that have no existing CCT, such as Little Elm, state regulators have the flexibility to require the Town to perform a CCS if 90th percentile lead sampling results are between the TL (10 µg/L) and the AL (15 µg/L). If 90th percentile lead sampling results are above the AL (15 µg/L), the Town will be required to install CCT at the entry point to the system, the Mansell Pump Station.

Figure 2-4: Decision Tree for Town of Little Elm Corrosion Control Under the LCRR



2.4 POTENTIAL RISK OF LEAD SERVICE LINE EXISTENCE

Amendments to the Safe Drinking Water Act (SDWA) of 1986 were passed into law on June 19, 1986. These amendments included the prohibition on use of lead pipes, solder and flux. Under these amendments, states were required to enforce the prohibition on the use of lead through state or local plumbing codes, or other means by June 19, 1988.

For the purpose of this assessment, a lead ban date of January 1, 1989 was utilized to estimate the potential risk of lead service lines, which is consistent with guidance from TCEQ. It is important to note that the SDWA and the associated UPC did not include the prohibition of galvanized pipe; however, under the LCRR there is a category for "galvanized requiring replacement" lines, which are galvanized lines that are treated as an LSL if the galvanized line is or ever was downstream of an LSL. While there may be galvanized service lines on the private side of the meter, any structures built after the local lead ban are considered to be free of lead or galvanized requiring replacement lines in regard to the Town's public service line inventory evaluated as part of this assessment, refer to **Figure 2-5.** Recent conversations with the TCEQ have indicated that lead "pigtail" or "gooseneck" fixtures found on either side of the water meter would not constitute the service line as lead and therefore, any galvanized service lines found downstream of these fixtures would not constitute a galvanized requiring replacement line.

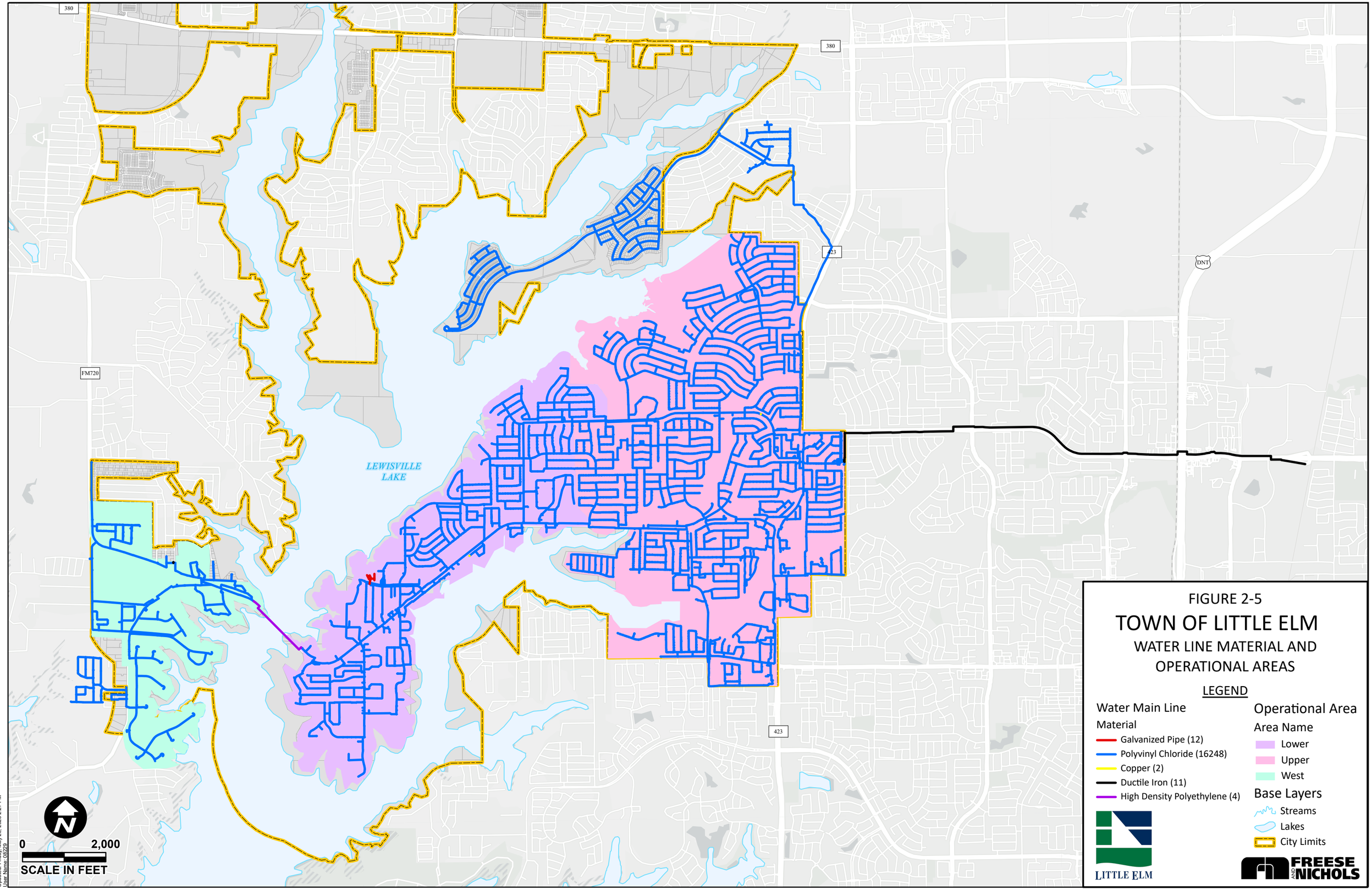


FIGURE 2-5

TOWN OF LITTLE ELM

WATER LINE MATERIAL AND OPERATIONAL AREAS

LEGEND

Water Main Line Material

- Galvanized Pipe (12)
- Polyvinyl Chloride (16248)
- Copper (2)
- Ductile Iron (11)
- High Density Polyethylene (4)

Operational Area Area Name

- Lower
- Upper
- West

Base Layers

- Streams
- Lakes
- City Limits

LITTLE ELM

FREESE AND NICHOLS

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Updated: Friday, May 26, 2023 2:27 PM
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Updated: Thursday, June 15, 2023 2:48 PM
User Name: 08529

FIGURE 2-6

CITY OF LITTLE ELM

PARCELS BUILT BEFORE AND AFTER 1989

LEGEND

- Post Lead Ban (10832)
- Pre Lead Ban (305)
- Unknown & Undeveloped (750)
- Unknown & Developed (92)

- Streams
- Lakes
- City Limits

Operational Area
- Lower
- Upper
- West

LITTLE ELM

FREESE AND NICHOLS

LEWISVILLE LAKE

423

423

0 2,000
SCALE IN FEET

The Town doesn't maintain information on the age or material of the publicly or privately owned portion of the service lines. However, it was assumed that the service line install date was equivalent to the building construction date, which is available from the Denton County Appraisal District (Denton CAD). Based on a review of the Denton CAD parcel information, approximately 11,979 parcels are within the Town's operational limits. Of these approximately 305 (2.5%) parcels were constructed before the 1989 lead ban. Out of the 842 (7%) parcels that are missing construction dates, 750 parcels (6.2% of total) are greenbelt, flood elevation or undeveloped parcels and the Town should verify that no service lines exist in these parcels. 92 (0.8% of total) parcels are missing construction dates and have some form of development on them, refer to **Figure 2-6**. The parcel information was compared to the Town's water main GIS layer to identify pre-lead ban parcels with a water main replaced after the lead ban. As part of these water main replacement projects, the publicly owned portion of the service lines could have been replaced. Based on this comparison, approximately 10,832 of the 11,979 parcels are served by a post lead ban water main and the public portion of the service lines may have been replaced, as summarized in **Table 2-7**.

Table 2-7: Potential Lead Service Line Existence Summary

Parameter	Number of Parcels
Total Number of Parcels	11,979
Pre-Lead Ban Construction (1990 or older)	305
Post-Lead Ban Construction (1991 or newer)	10,832
Unknown Construction Date (Undeveloped)	750
Unknown Construction Date (Developed)	92

While this estimate in no way suggests that all or any of these service lines contain lead, it does provide a sense of the level of effort required to build a comprehensive service line inventory, should the Town choose to field-verify all service lines designated as lead status unknown. This estimate can also be used to validate the number of potential service lines predating the local lead ban as estimated using the data identified in LSL Inventory Resources discussed in **Section 3.1**.

2.5 POTENTIAL RISK OF LEAD ACTION OR TRIGGER LEVEL EXCEEDANCE

The AL for both lead (15 µg/L) and copper (1.3 mg/L), based on the 90th percentile concentration, remains the same as under the previous rule, but exceeding the AL now requires additional action. There also is the new TL for lead (10 µg/L) based on the 90th percentile concentration and exceeding it may result in the need for additional planning, monitoring and treatment requirements. An assessment of future lead levels detected in the system and the likelihood of exceedances above the PQL, TL or AL is beyond the

scope of this study. Historically, as shown in **Figure 2-2**: Historical P90 for Town Lead Samples, the Town has not experienced an AL exceedance since 2010, and the 90th percentile values for the overall system have been below the PQL since that sampling cycle. Based on the mineral analytes analyzed for corrosivity, all the water at the Town's entry points is slightly corrosive or corrosive water according to the TCEQ corrosivity scoring guidelines. Additionally, the CSMR ratio for all the water samples were slightly corrosive as shown in **Table 2-6**, which is a concern due to the link between higher CSMR values and lead leaching. Other factors such as the new sampling requirements and the age of the system may increase the likelihood of detecting higher lead concentrations as part of future sampling efforts. **Table 2-8** summarizes potential circumstances that may contribute to an increased potential for measuring higher lead levels when calculating the 90th percentile based on the new sampling requirements under the LCRR. Each of the seven areas is marked as having a significant, moderate or no impact on the potential for measuring higher lead levels, specific to the Town's system.

Table 2-8: Summary of Risk Indicators for Measuring Increased Lead Levels under the LCRR

No.	Risk Criteria	Yes/No?	Increased Potential for Detecting Higher Lead Levels under the LCRR
1	Are all samples taken at Structures served by a Lead Service Line?	No	Significant
2	Was a significant portion of the Town built before local lead ban?	No	No Indication of Increased Potential
3	Has the Town observed a notable amount of lead service lines in the system?	No	No Indication of Increased Potential
4	Have the 90th percentile lead results been above the 10 µg/L Trigger Level?	No	No Indication of Increased Potential
5	Are fifth liter tap samples being collected at lead service lines?	No	Moderate
6	Does the Town's water chemistry have potential for lead concentration spikes (e.g., corrosive water, high CSMR, etc.)?	Yes	Moderate[1]
7	Is a corrosion control treatment implemented that is recommended in the LCRR?	No	Moderate[2]

[1]The treated surface water is classified as slightly corrosive and corrosive under TCEQ guidelines, and the CSMR for all entry points is slightly corrosive.
[2]The Town does not have their own corrosion control treatment; however, NTMWD provides treated water that includes the addition of orthophosphate as a corrosion inhibitor.

3.0 RESOURCES ASSESSMENT

The level of effort required for any town or city to come into compliance with the LCRR is proportional to the number of its available resources. Such resources may include records, manpower and funding. FNI collected and evaluated data and records that may be useful in complying with the LCRR, in particular for the development of the service line inventory.

3.1 SERVICE LINE INVENTORY

The LCRR requires that all public water systems develop an inventory of all service lines within their system and categorize each into one of four categories: Lead, Non-Lead, Galvanized Requiring Replacement or Lead Status Unknown. There are several sources that can be utilized to develop the service line inventory suggested by the LCRR in section 141.84(a)(3). FNI's recommended approach is depicted in **Figure 3-1** and includes the consideration of existing inventories, readily available digital data, historic hardcopy data and field inspections. The approach is designed to maximize the number of service lines inventoried as part of the desktop assessment and minimize the number of field inspections required.

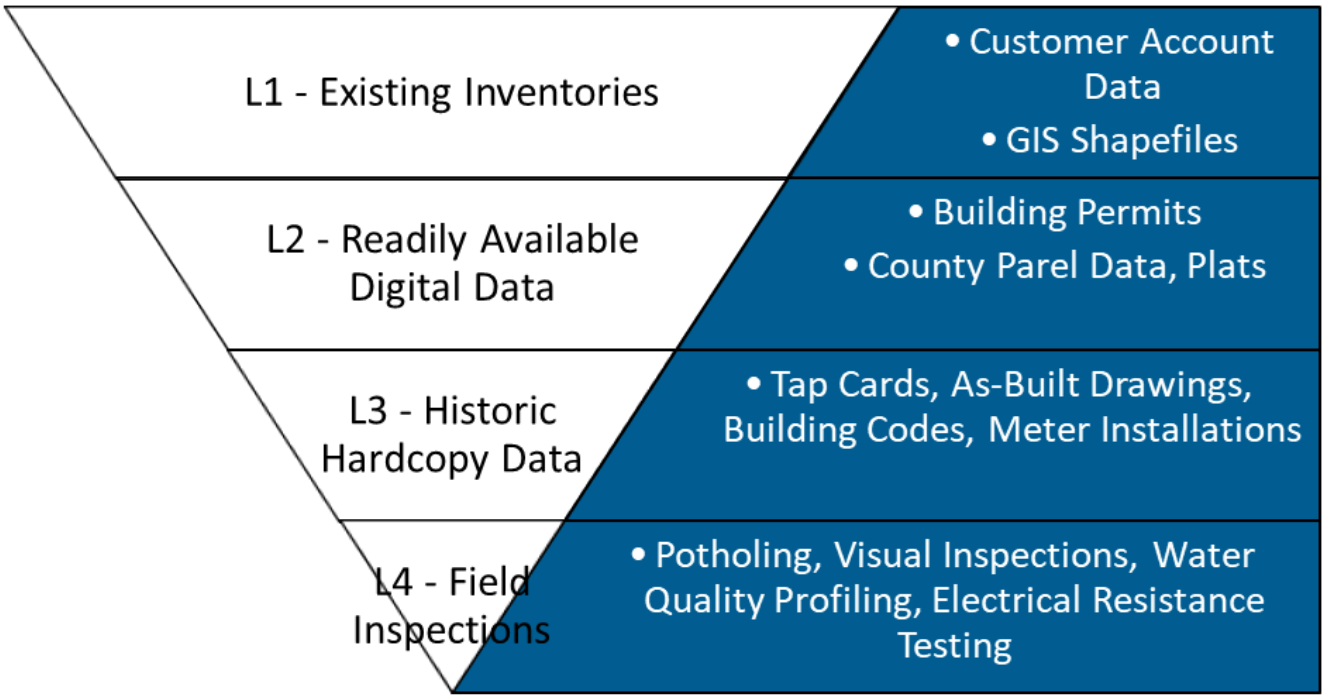

Figure 3-1: Available Data Resources for Service Line Inventory Development

The resources available to the Town that should be considered to maximize the desktop assessment and to minimize field inspections are summarized in **Table 3-1**.

Table 3-1: Data Resource Summary

Data Source	Available	Notes
Existing Water Main Information	Yes	Town maintains a GIS layer of the water mains with install date, as-built plan ID, and material information
Potable Water Customer Account Records	Yes	Total number of connections with location data
County Parcel Data	Yes	County property data is available through the Denton County Appraisal District (Denton CAD), which maintains an online database providing dates of original construction that may be useful in developing the inventory
Building/ Demolition Permits	No	Data is stored in multiple sources and doesn't provide detail on service line material
Plumbing Codes	Yes	List of ordinances referenced adopting Uniform Plumbing Codes (UPC) with associated dates that these went into effect
Previous LCR Sampling Plans and Locations	Yes	Including the sample map with sample location IDs when available
List of Childcare Facilities and Elementary Schools the Town Serves Water To	Yes	Public, private and childcare facilities collected from collection data, Texas Health and Human Services
Historical Lead Sampling Results	Yes	Via "Texas Drinking Water Watch"
Water Qualities and Quantities of the Town's Drinking Water Sources	Yes	NTMWD laboratory results are available
Existing Corrosion Control Treatment Technologies	No	No existing corrosion control treatment system
Existing Corrosivity Studies	No	Not available
Current LCR Outreach Program Procedures and Materials	No	No existing outreach program beyond communication with customers at sample site locations

The scope of this report is to identify resources that can be useful in developing the inventory. Additional details on the quality of the data and how the data can best be used to develop the inventory will be considered as part of Phase 2.

3.2 FIELD INSPECTION AND VERIFICATION EFFORT

FNI recommends completing the initial service line inventory to the greatest degree possible using the resources discussed in **Section 3.1**. The Town should expect there to be numerous service lines with an unknown lead status after the desktop exercise is complete. The LCRR allows public water systems to mark service line materials as "lead status unknown"; however, doing so has consequences that will be described later in this report. **Table 3-2** describes the options available for field inspections for lead service line material validation, should the Town determine that it is appropriate to continue confirming service line material. As each option has its own pros and cons, it is recommended to utilize a combination of these methods for field inspections. As part of Phase 2, FNI recommends that the Town perform a field investigation pilot consisting of meter box and pothole inspections. The results of the pilot will be utilized to determine which field inspection methods are most effective for the Town and to develop a defensible protocol to confirm lead or non-lead when developing the service line inventory.

The task of conducting field inspections to confirm service line materials can be demanding. Therefore, contracting this task, partially or completely, may assist the Town in meeting the compliance schedule.

Table 3-2: Field Inspection and Verification Options to Identify Lead Service Lines

No.	Option	Description	Pros	Cons	Demonstrated Use
1	Physical Inspection – Potholing	Potholing is excavating holes to inspect the water service line underground. Typically requires two or more holes to inspect different segments of the service lines.	• Lower risk of "false negative"	• Significant effort • Does not eliminate risk of "false negative" • Not effective if the service lines are too deep	Common across country
2	Physical Inspection – Visual Inspection at Meters or Curb-box	Visually inspect the service line materials within the meter box.	• Less invasive • Less effort	• Higher risk of "false negative" • TCEQ approved method	Common across country
3	Water Profile Sampling	Single or multiple consecutive samples are collected from a customer's faucet to analyze for lead. The resulting concentrations are then used to identify lead sources.	• No digging • Less invasive	• Lab costs • More public interaction • Does not provide visual confirmation by itself	Denver Water; Montreal, QC; Washington D.C.
4	Predictive Modelling/ Machine Learning	Use data, records, and field inspection results to predict the probability of service line material.	• Desktop study • Reduced, but not eliminated, field work	• Limited familiarity by regulatory agencies and acceptance	Flint, MI; Denver Water
5	Pipe Material Electric Resistance Testing	Measure electric resistance at different points of the service lines to predict materials based on their different electric resistance.	• No digging • Less invasive	• Emerging technology • Questionable accuracy	Still in bench/ pilot stage
6	Customer-driven Data	Carefully designed campaign for customers to self-report the material of service lines.	• Leverage and engage customers	• Require well designed and managed program • Requires some degree of verification from the utility	Cincinnati, OH
7	Mark as "Lead Status Unknown"	Mark the service line as material "Lead Status Unknown".	• Allowed for compliance	• Must notify resident of status • Must treat as LSL under certain circumstances	Expected to be commonly used for larger cities to some extent

3.3 PUBLIC COMMUNICATION AND OUTREACH

A major aspect of the LCRR is increased communication with the public. FNI recommends that the following public outreach templates, educational materials, and brochures be developed by the Town for public communication. **Table 3-3** summarizes the types of communication required by the LCRR.

Table 3-3: LCRR Public Communication Templates

No.	Communication Requirement
1	Public education material to all consumers and most at risk population
2	Systemwide 24-hour notification of action level exceedance
3	Notification of trigger level exceedance
4	Notification of sampling results to all homeowners participating in tap sampling
5	Annual notification to customers with lead status unknown, galvanized (needing replacement), and lead service line material
6	Notification of disruptions to lead or potentially lead service lines
7	Notification of LSLR related events and follow-up activities
8	Communication with local and state health agencies regarding “Find and Fix” activities
9	When appropriate, systemwide notification to customers if the LSLR rate is not met

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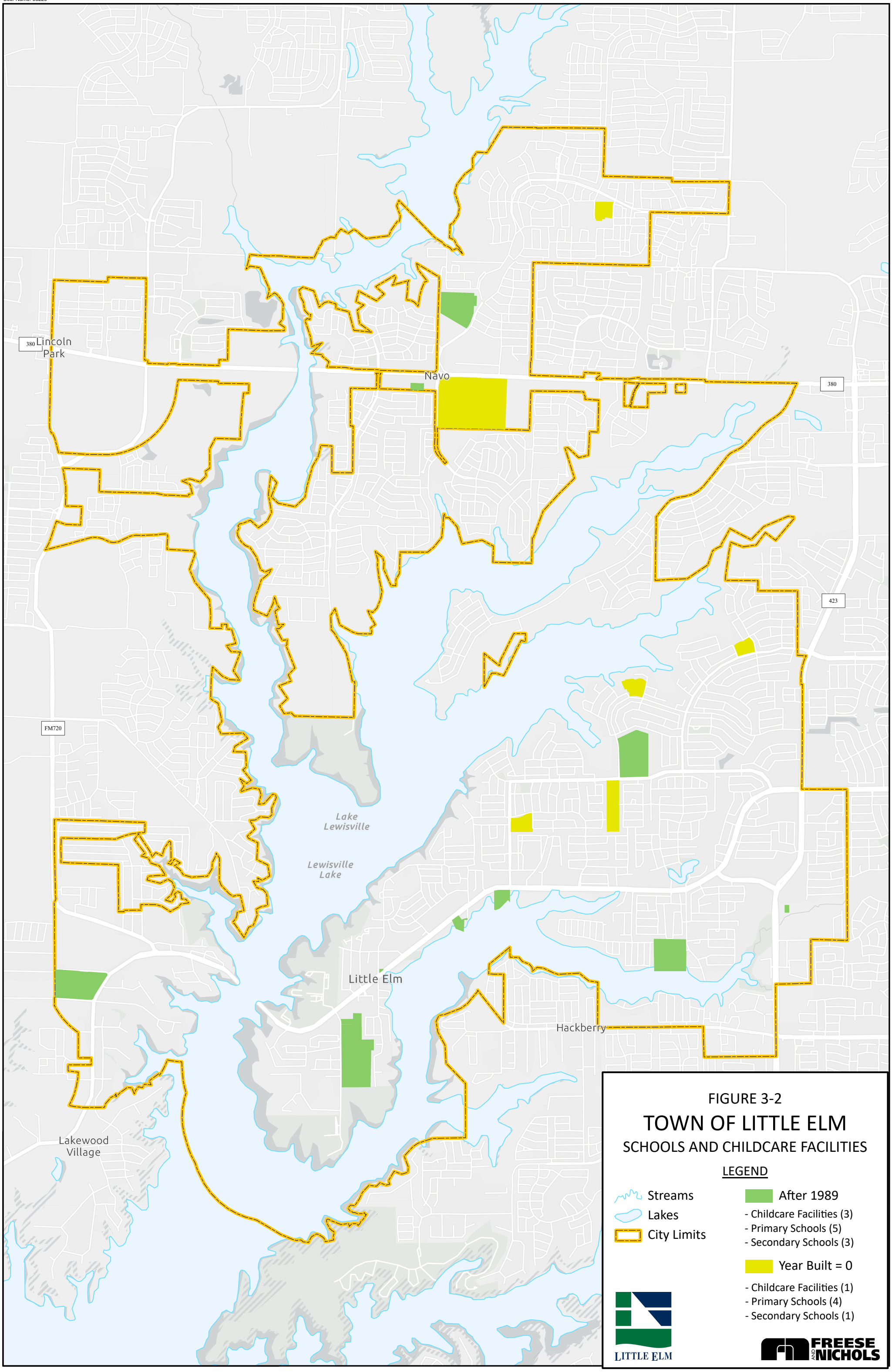

FIGURE 3-2

TOWN OF LITTLE ELM

SCHOOLS AND CHILDCARE FACILITIES

LEGEND

- Streams
- Lakes
- City Limits

After 1989
- Childcare Facilities (3)
- Primary Schools (5)
- Secondary Schools (3)

Year Built = 0
- Childcare Facilities (1)
- Primary Schools (4)
- Secondary Schools (1)

LITTLE ELM

FREESE AND NICHOLS

3.4 CHILD CARE FACILITIES AND SCHOOLS

The Town will be required to sample all licensed childcare facilities and elementary schools within five years of the effective compliance date at a rate of 20% of primary schools per year, 20% of childcare facilities per year, and at secondary schools upon request. After this first testing cycle, sampling must be conducted at all schools and childcare facilities upon request. **Figure 3-2** provides a map of the childcare facilities and schools in the Town of Little Elm. Elementary schools and licensed childcare facilities that were constructed after 2014 are exempt from testing but are entitled to request sampling by the Town. **Table 3-4** provides an estimate of the number of childcare facilities within the Town's water system, and **Table 3-5** provides an estimate of the number of schools in the Town's water system.

Table 3-4: Childcare Facilities

	Number of Facilities[1]
Licensed Child Care Centers	4
Total	**4**

[1]Per data available from Texas Health and Human Services. TCEQ has not yet provided guidance on what type (e.g., licensed center, registered childcare home, etc.) will be required under the LCRR.

Table 3-5: Pre-K/Elementary and Secondary Schools

	Number of Pre-K/Elementary Schools[1]		Number of Secondary Schools[1]	
	Public	Private	Public	Private
	5	4	4	0
Total	**9**		**4**	

[1]Per data available from greatschools.org and Texas School Directory.

4.0 COMPLIANCE BUDGET AND SCHEDULE

A primary focus of this report is to outline the costs and schedule for complying with the LCRR by the compliance due date of October 16, 2024. The costs are meant to provide an order of magnitude for planning purposes only. Actual costs may vary depending on final regulatory decisions by the TCEQ, revisions to the LCRR by the LCRI, and the Town's determination of the optimal program for compliance, risk management and public welfare. Opportunities for optimizing the recommended budget exist, such as reducing the magnitude of certain activities and deferring certain tasks to future years to accommodate budget limitations. Other costs, especially those presented in Phase 5, may entail work necessary and these costs could be avoided by the Town.

The current phase, Phase 1 – Initial Risk Screening, Compliance Budgeting and Scheduling, will be completed with this technical report. Future efforts can be categorized into four phases:

- Phase 2 – Initial Service Line Inventory Development
- Phase 3 – City-wide Service Line Material Verification Program and Field Services
- Phase 4 – Sample Plan Update, Preliminary Sampling and Other Compliance Preparations
- Phase 5 – Lead Service Line Replacement Planning and Mitigation

Table 4-1 provides a brief scope description of the tasks in each phase, and **Table 4-2** summarizes the planning level costs of each of these phases by fiscal year. As each compliance phase is completed, the planning level costs of subsequent phases will be revised based on the information gained in that phase. The cost of the Town's existing LCR sampling program or future cost increases to the Town's LCR sampling program, such as sampling at schools and daycare facilities, is not included in **Table 4-1**.

Table 4-1: Remaining Compliance Phases and Tasks

Phase	Task	Description
2	Desktop Service Line Material Research & Inventory Development	The initial inventory of service lines based on a desktop assessment of the records and data identified during Phase 1.
	Service Line Material Verification Pilot	A pilot program to field-verify the material of the lead status unknown service lines utilizing meter box and potholing inspections.
	LCRR Compliance Phase 3 Planning	A plan that details the approach to completing the LSL inventory using field services.
3	Service Line Material Verification Program	Field inspections with the aim of identifying the material of service lines using various techniques (visual inspection, hand-dig, vac-truck, etc.) that proved to be efficient and effective during the Phase 2 field inspection study.
	Corrosion Control Study	A desktop study to evaluate the Town's water corrosivity at its entry points, with an understanding of the current corrosion control treatment and strategies performed by NTMWD.
4	"Find and Fix" Procedure Planning	One or more SOPs for implementation of the LCRR "Find and Fix" procedure in which lead sources are identified and removed from individual homes that exceed the AL.
	Public Communication and Outreach Plan	A plan that summarizes public communication requirements within the LCRR, including the recommended method and frequency of communication. Public outreach templates, educational materials and brochures will be provided.
5	Sample Plan Update	An update will be provided to ensure that sample locations comply with the LCRR. The update will also include changes in the sampling procedure (e.g., use of wide mouth bottles, fifth liter sampling, etc.). The sampling plan update will also include sampling of elementary schools and childcare facilities.
	LSLR Plan	A plan detailing the approach, anticipated timeline, rate and cost of LSLR along with contracting details. The LCRR requires any municipality that has known LSLs or service lines with lead status unknown within their system to include the following plans and procedures (will be provided as part of the scope).

Table 4-2: Planning Level Compliance Costs by Fiscal Year

Proposed Compliance Phase	Planning Level Budget[1]	
	FY 2022 - 2023	FY 2023 - 2024
Phase 1 (Complete)	$48,804.00	
Phase 2 – City-wide Service Line Material Verification Program[1] (500 Connections @ $125/ea.)		$62,500
Phase 2 – Initial Service Line Inventory Development[2]		$40,000
Phase 2 – Corrosion Control Study		$50,000
Phase 3 – "Find and Fix" Procedure Planning and Public Communication Plan		$50,000
Phase 4 (Required) – Sample Plan Update and LSLR Plan		$100,000
Fiscal Year Subtotal	**$48,804**	**$302,500**
Overall Program Total	**$351,304**	

[1]*Assumes meter box inspections to verify material of pre-Lead Ban service lines with unknown material type.*

[2]*Inventory populated based on all available data, any remaining unknowns after Pilot Program will be classified as unknowns.*

4.1 HYPOTHETICAL LSL REPLACEMENT ENFORCEMENT

At this time, the number of LSLs that will be encountered, if any, is not possible to estimate. The Town is only aware of LSLs used for sampling in their system, and anecdotal evidence suggests that LSLs have been replaced if encountered; therefore, a significant number of LSLs is not expected. Under the current rule, public water systems are required to remove LSLs in Texas if the AL (15 µg/L) is exceeded, but under the new rule, they may be required to perform LSLRs by the TCEQ if either the AL or TL (10 µg/L) is exceeded. The replacement rate set by the LCRR if the P90 for the water system exceeds the AL, is an annual rate equal to 3% of the total known LSLs and service lines with lead status unknown. There is speculation that this replacement rate is subject to change and will be increased under the LCRI. TCEQ has not yet provided guidance on their replacement rate requirements if the P90 exceeds the TL.

The following provides assumptions and unit price information from local and national sources. FNI recommends using this information to consider the potential budgetary impacts, should LSLs be encountered within the Town and need to be replaced. The EPA estimates the cost of lead service line replacements (LSLRs) to be around $1,200-$12,300 per replacement[1]. Based on information provided by others involved in national LSLR programs, the cost of replacement may be closer to $15,000 per replacement. LSLR cost includes not only the physical replacement of the service line but also the following:

- Development and distribution of LSLR program outreach materials.

[1] United States Environmental Protection Agency (EPA), 2019

- Contacting customers and conducting site visits to confirm service line material and site conditions before replacement.
- Providing customers with flushing procedures following a replacement.
- Delivering pitcher filters and cartridges concurrent with the LSLR and providing maintenance for six months.
- Collecting and analyzing a tap sample three to six months after the replacement of an LSL and informing the customer of the results.
- Reporting on program results to the state.

For this hypothetical exercise, it was assumed that the Town populated the service line inventory with all unknown service lines for any line installed before the lead ban (1988), which is approximately 500 lines. For 500 service lines with lead status unknown, if the AL is exceeded, the TCEQ will require the Town to have an LSLR rate equal to 15 service lines (3%) per year. **Table 4-3** shows the cost of replacing 15 service lines in one year is over $225,000. This rate of LSLR would be required until the P90 sample results drop below the AL.

Table 4-3: Estimated LSL Replacement Cost

Assumed No. of Lead/ Unknown Service Lines[1]	Assumed Annual Number of Line Replacements[2]	Unit Cost ($ / LSL)	Total Cost
500	15	$15,000	$225,000

[1]Estimated number of service lines installed before the lead ban.

[2]3% of 500 unknown service lines.

For the purpose of this exercise, it is assumed that this LSLR rate would be required for two years to reduce the P90 sample results below the AL. The planning level cost of LCRR compliance with hypothetical LSL replacement enforcement is $801,304, as summarized in **Table 4-4**. This illustrates the importance of reducing the number of service lines with lead status unknown, maintaining proper corrosion control strategies in conjunction with NTMWD as required, and preventing exceedances above the TL or AL.

Table 4-4: Planning Level Compliance Costs by Fiscal Year with Hypothetical LSL Replacement Enforcement

Task	Planning Level Budget			
	FY 2022 - 2023	FY 2023 - 2024	FY 2024 - 2025	FY 2025 - 2026
Phase 1 - 5 LCRR Compliance	**$48,804**	**$302,500**	--	--
LCRR Compliance Subtotal	**$351,304**			
Hypothetical LSL Replacement Enforcement	--	--	$225,000	$225,000
Hypothetical LSL Replacement Enforcement Subtotal	**$450,000**			
LCRR Compliance with Hypothetical LSL Replacement Enforcement	**$801,304**			

5.0 RECOMMENDED FUNDING OPPORTUNITIES

Government funding mechanisms are essential for water systems to identify and reduce/eliminate lead and copper from drinking water. Congress passed the Water Infrastructure Improvements for the Nation Act (WIIN Act) in 2016 which included Section 2105, Reducing Lead in Drinking Water Grant Program. The initial appropriation was allocated in 2020 and Congress has yet to appropriate additional funds for this program. However, there are existing programs that can help identify and replace lead and copper water facility components in Texas. In addition, two new opportunities have been added to the list of programs recently.

- There are three existing low-interest loan programs and two existing grant programs that can fund the identification, planning, design, and construction of projects to help systems meet the lead and copper rule revision requirements.

  Loan programs include:
  - The Drinking Water State Revolving Fund (DWSRF) administered by the Texas Water Development Board (TWDB)
  - The Texas Water Development Fund (Dfund) administered by the TWDB
  - The Water Infrastructure Finance Innovation Act (WIFIA) administrated by the EPA

  Grant programs include:
  - The Community Development Block Grant Program (CDBG) Entitlement Program administered by the U.S. Department of Housing and Urban Development (HUD)
  - The Public Works Program from the U.S. Economic Development Administration (EDA)

  See **Table 5-1** for more details.

- In March 2021, the American Rescue Plan Act of 2021 (ARPA) was signed into law providing $350 billion for eligible state, local, territorial and Tribal governments to respond to the COVID-19 emergency and bring back jobs. The U.S. Treasury will administer this direct allocation program delivering funds, among other things, to provide investment in water and sewer infrastructure which includes compliance with the LCRR. See **Table 5-1** for more details.

- Lastly, Congress passed an infrastructure bill (Infrastructure Investment & Jobs Act (H.R. 3684)) in the fall of 2021. Among other provisions, the bill will provide the following water-related benefits:

- Clean Water State Revolving Fund (SRF) and Drinking Water SRF each receive a guaranteed $11.7 billion over five years.
- State SRF programs will be required to provide 49% of the funding as grants and principal forgiveness loans to financially distressed communities.
- $1 billion will be provided in grants through the Clean Water SRF to address emerging contaminants.
- $4 billion will be provided in grants through the Drinking Water SRF to address PFAS in drinking water.
- **$15 billion in loans and grants will be provided through the Drinking Water SRF for lead service line replacement. The Budget Reconciliation package includes an additional $9 billion for lead through non-SRF grant programs.**
- WIFIA will receive $250 million over the next five years and facilities applying will be required to have only one rating agency opinion letter instead of two.

Table 5-1: Recommended Funding Opportunities

	American Rescue Plan Act of 2021	Drinking Water State Revolving Fund	Texas Water Development Fund	Water Infrastructure Finance Innovation Act	Community Development Block Grant Entitlement Program	Public Works Program
Acronym	ARPA	DWSRF	Dfund	WIFIA	CDBG	PW
Sponsor	U.S. Treasury	Environmental Protection Agency	Texas Water Development Board	Environmental Protection Agency	U.S. Department of Housing and Urban Development	U.S. Economic Development Administration
Administrator	U.S. Treasury	Texas Water Development Board	Texas Water Development Board	Environmental Protection Agency	U.S. Department of Housing and Urban Development	U.S. Economic Development Administration
Types of Projects	- Water & sewer infrastructure (all projects eligible in the EPA SRF programs including lead and copper line replacement) - Projects that address negative economic impacts - Broadband infrastructure - Support public health response - Replace public sector revenue loss - Premium pay for essential workers	Wide range of projects that facilitate compliance with drinking water standards like - Identification and replacement of lead and copper drinking water lines - Treatment plants - Distribution systems - Pump stations -Storage tanks - Source water protection	- Water supply projects - Conservation - Water quality enhancements including lead and copper line replacements - Flood control - Wastewater - Municipal solid waste	Projects eligible in the SRF programs including - Lead and copper line replacements - Enhanced energy efficiency projects - Brackish or seawater desalination - Aquifer storage and recovery - Alternative water supplies - Water recycling - Drought prevention/ reduction/mitigation	- Construction of public facilities and improvements (Water & sewer, streets, neighborhood centers, conversion of school building for eligible purposes) - Activities related to energy conservation and renewable energy resources - Acquisition, relocation, demolition - Rehabilitation of residential and non-residential structures	- Physical infrastructure upgrades and/or demolition - Reuse of publicly owned buildings
Lead and Copper Rule Revision Compliance	Planning, building the service line inventory, LSLR, public outreach	Planning, building the service line inventory, LSLR, public outreach	Planning, building the service line inventory, LSLR, public outreach	Planning, building the service line inventory, LSLR, public outreach	Planning, building the service line inventory, LSLR, public outreach	Planning, building the service line inventory, LSLR, public outreach
Types of Funds Available	- Direct Allocation from Congress	- Capacity - $342 million (no project limit) - Low-interest loans, principal forgiveness (like a grant)	- Capacity - $6 billion rolling bond authorization (no project limit) - Low-interest loans	- Capacity - varies, 2022 was $58.5 million - Low-interest loans	- Allocation varies per Congressional formula - Grants	- Capacity - $118.5 million (Up to $30 million per project) - Grants
Cost Share	None	None	None	51% Local Share	None	50%
Availability	1/2 in 2021, 1/2 in 2022	Year-round	Year-round	Normally 2Q-3Q each year	Annually	Ongoing after publication of NOFO

	American Rescue Plan Act of 2021	Drinking Water State Revolving Fund	Texas Water Development Fund	Water Infrastructure Finance Innovation Act	Community Development Block Grant Entitlement Program	Public Works Program
Requirements	- 2 CFR 200 Procurement - Periodic Status Reporting - Accounting Standards	- Disadvantaged Business Enterprise Good-Faith Effort Procurement - Davis-Bacon Act Wages - American Iron & Steel - NEPA-like environmental - National Historical Preservation Act - Water Conservation Plan - Excessive Water Loss Provisions	- Water Conservation Plan - State Environmental - Water Loss Provisions - US Iron & Steel	- NEPA Environmental - National Historic Preservation Act - American Iron & Steel - Davis-Bacon Act Wages -Disadvantaged Business Enterprise Good-Faith Effort Procurement	- Development of a Comprehensive Plan -70% of CDBG funds received must be used for activities that benefit low- and moderate-income persons - Citizen participation - Regular reporting	- The project's demonstrated alignment with at least one of EDA's current investment priorities: Equity, Recovery & Resilience, Workforce Development, Manufacturing, Tech-based Economic Development, Environmentally-Sustainable Development, Exports & FDI - The project's potential to increase the capacity of the community or region to promote job creation and private investment in the regional economy - Ability of the applicant to successfully implement the proposed project, including the applicant's financial and management capacity and the applicant's capacity to secure the support of key public and private sector stakeholders
Application Deadlines	Summer 2021, Spring/Summer 2022	First of March each year for principal forgiveness, none for loan	None	Typically, third calendar quarter each year	None, annual allocation	None, funds available until allocated
Program Website	https://home.treasury.gov/policy-issues/coronavirus/assistance-for-state-local-and-tribal-governments/state-and-local-fiscal-recovery-funds	http://www.twdb.texas.gov/financial/programs/DWSRF/index.asp	http://www.twdb.texas.gov/financial/programs/TWDF/index.asp	https://www.epa.gov/wifia	https://www.hudexchange.info/programs/cdbg-entitlement/	https://eda.gov/programs/eda-programs/

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Nguyen, C. L., Stone, K. R., Clark, B., Gagnon, G., & Edwards, M. A. (June 24, 2010). *Impact of Chloride: Sulfate Mass Ratio (CSMR) Changes on Lead Leaching in Potable Water.* The Water Research Foundation.

United States Environmental Protection Agency (EPA). (2019). *Strategies to Achieve Full Lead Service Line Replacement (EPA 810-R-19-003).*

Appendix A
New Sources, Treatment and Evaluating Corrosivity from the TCEQ

New Sources, Treatment and Evaluating Corrosivity

2020 Public Drinking Water Conference

Austin, Texas

Wednesday, August 5, 2020

Craig A. Stowell, P.E.

Plan Review Team (PRT)

Why all the Concern about Corrosivity?

- Public health - source and treatment changes may impact distribution systems negatively
- Rule requirement – 290.117(a) “Public water systems must control the levels of lead and copper in drinking water by controlling the corrosivity of the water”

Where We Are

- PRT began proactive approach in May 2016
- Over 450 systems have had removal of reduced monitoring
- Over 600 system required to do a follow-up engineering report or install corrosion control treatment
- Some systems on their second reduced monitoring

Constituents Required

New Sources and Interconnect Submittals

- Total Dissolved Solids
- Temperature
- pH
- Total Alkalinity (as $CaCO_3$)
- Calcium (as $CaCO_3$)
- Chloride
- Sulfate
- Sodium

Corrosive Saturation Indices for Determination of Corrosiveness

Tetra Tech (RTW) Model* for Water Chemistry, process, and corrosion Control

- Langelier Saturation Index
- Ryznar Stability Index
- Aggressive Index
- Calcium Carbonate Precipitation Potential
- Chloride to Sulfate Mass Ratio

*Distributed by AWWA

Determination of Corrosiveness

- Two scenarios based upon two temperatures (10 and 25 degree Celsius)
- Noncorrosive
- Slightly Corrosive
- Corrosive

Determination of Corrosiveness

- Criteria Table:

CRITERIA TABLE	NC	SC	C
Langelier Index	NC > -0.25	-1<SC<-0.25	C<-1.0
Ryznar Index	<7.0	7<SC<8.5	C>8.5
Aggressiveness Index	>12.0	10>SC<12	C<10.0
CCPP	>0.0	-3>SC<0	C<-3.0
CSMR	<0.2	>0.2SC<0.5	C>.5 (TALK <50)

Determination of Corrosiveness

- Create a table, determine if each number is NC, SC or C based on the criteria table, for example:

INDEX	10 ° C	25 ° C
LSI	NC	NC
RSI	SC	SC
AI	NC	NC
CCPP	NC	NC
CSMR	SC	SC

Determination of Corrosiveness

Key: Use the following to determine if water is corrosive, slightly corrosive or noncorrosive:

If the table has

- 3 C's or more= corrosive
- 3 SCs under 25 °C=Slightly Corrosive
- 4 - C's and SC's Total =Slightly Corrosive
- Otherwise noncorrosive

New Systems and Existing TNC Systems With New Sources

- Noncorrosive:
  - No Follow-up Engineering Report
- Slightly Corrosive:
  - If No Corrosion Control - Follow-up Engineering Report
  - If approved Corrosion Control – No Follow-up Engineering Report
- Corrosive:
  - No use until an Engineering Report on why no Corrosion control is required
  - Or Corrosion Control Treatment Approved
  - Follow-up Engineering report required after approval

Existing Systems With New Source

- Noncorrosive:
  - Use No Problem with compliant Pb Cu"
- Slightly Corrosive:
  - If No Corrosion Control - Use granted with Follow-up Engineering Report with reduced monitoring removed
  - If approved Corrosion Control – No Follow-up Engineering Report required with reduced monitoring removed

Existing Systems With New Source

- Corrosive:
  - No use until an Engineering Report on why corrosion control is not required
  - Or Corrosion Control Treatment Approved
  - Follow-up Engineering report required after approval along with removal of reduced monitoring
- Interconnects:
  - No removal of reduced monitoring for emergency interconnects
  - Open interconnects treated same as a well
- As-built wells and interconnects:
  - Removal of reduced monitoring only if SC or corrosive with approved corrosion control treatment and last LCR tap sampling analysis is older than 2 years.

Change in Treatments

- Remove Reduced Monitoring:
  - Change from liquid chlorine to gas chlorine
  - Change from chlorine to chloramine
  - Addition of acid
  - Addition of Oxidants
  - Water Softeners
  - RO/Nano filtration
  - Membranes for credit
  - Changes in coagulants

Change in Treatments

- Remove Reduced Monitoring (continued)
  - Blending of sources
  - Ion Exchange/water softeners
  - Ozone
  - Greensand/BIRM
  - Chlorine Dioxide
  - Polyphosphate
  - Orthophosphates/ Blended Phosphates for corrosive water
  - Aeration

Change in Treatments

- Reduced Monitoring not Removed
  - Gas chlorine to liquid chlorine
  - Granular Activated Carbon
  - Corrosion Control Treatments for Noncommunity systems
  - Corrosion Control Treatments for community systems unless they have corrosive water
  - pH adjustments that will result in increased pH
  - UV
  - Filters including cartridge unless the filtration involves oxidants

Corrosion Control Treatment Submittals

- Water Quality Parameter (WQP) analysis before treatment;
- Anticipated WQPs after treatment;
- Vendor letter of product recommendations for inhibitors;
- Plans showing injection points and storage of chemicals relative to plant components; and
- Engineering Calculations for sizing metering pump, bulk tanks and day tanks.

Available Corrosion Control Treatment Methods

- pH/Alkalinity/DIC Adjustment
- Phosphate-based corrosion inhibitors
- Silicate Inhibitors

  - No Calcium Hardness Adjustment

EPA OCCT Guidance

Corrosion Control has to be in accordance with this document

- Contains treatment recommendation flowcharts, dependent on pH, Alkalinity and DIC (dissolved inorganic carbon) [Ch. 3]
- Contains Estimated DIC Tables (Total Alkalinity & pH needed) [App. B]

Office of Water (4606M)
EPA 816-B-16-003
March 2016

Evaluation of Systems that Received Removal of Reduced Monitoring

- Complete four quarters of WQPs
- Complete 2 six-month LCR tap samples without an Action Level Exceedance
- Complete follow-up engineering report if required
- Water must be not be corrosive or have effective corrosion control
- All LCR samples below 0.015 mg/l for lead
- All LCR samples below 1.3 mg/l for copper

Evaluation of Follow-up Engineering Report

- Recommendation if LCR samples above 0.015 mg/l for lead or LCR samples above 1.3 mg/l for copper:
  - Retest Sites
  - Look at LCR tap sampling history of site
  - Determine vulnerability of site (i.e lead service line, high lead solder or fixtures not low lead)
  - Determine why corrosion control not working at site

Questions?

TCEQ
Plan Review Team

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Appendix B
Model Input and Output of Corrosivity Indices for Each Entry Point

Table B-1: December 2021

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	290
pH	S. U	8.27
Alkalinity	mg / L as CaCO3	87
Ca	mg / L as CaCO3	47.3
Cl	mg / L	31.9
SO_4^{2-}	mg / L	91.1
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.04	0.18
Ryznar Index	8.35	7.90
Aggressiveness Index	11.88	11.88
CCPP	-0.39	1.42
CSMR	0.35	0.35
TCEQ Grade	**Slightly Corrosive**	

Table B-2: January 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	301
pH	S. U	8.26
Alkalinity	mg / L as CaCO3	101
Ca	mg / L as CaCO3	50.5
Cl	mg / L	33.3
SO_4^{2-}	mg / L	94.4
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	0.04	0.26
Ryznar Index	8.18	7.73
Aggressiveness Index	11.97	11.97
CCPP	0.29	2.41
CSMR	0.35	0.35
TCEQ Grade	**Slightly Corrosive**	

Table B-3: February 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	327
pH	S. U	8.22
Alkalinity	mg / L as CaCO3	107
Ca	mg / L as CaCO3	54.5
Cl	mg / L	33.4
SO_4^{2-}	mg / L	103
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	0.05	0.28
Ryznar Index	8.12	7.67
Aggressiveness Index	11.99	11.99
CCPP	0.44	2.73
CSMR	0.32	0.32
TCEQ Grade	**Slightly Corrosive**	

Table B-4: March 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	364
pH	S. U	8.26
Alkalinity	mg / L as CaCO3	111
Ca	mg / L as CaCO3	60.2
Cl	mg / L	37
SO_4^{2-}	mg / L	127
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	0.14	0.37
Ryznar Index	7.97	7.52
Aggressiveness Index	12.08	12.08
CCPP	1.39	3.84
CSMR	0.29	0.29
TCEQ Grade	**Slightly Corrosive**	

Table B-5: April 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	370
pH	S. U	8.28
Alkalinity	mg / L as CaCO3	116
Ca	mg / L as CaCO3	53.7
Cl	mg / L	108
SO_4^{2-}	mg / L	111
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	0.13	0.36
Ryznar Index	8.02	7.57
Aggressiveness Index	12.07	12.07
CCPP	1.29	3.78
CSMR	0.97	0.97
TCEQ Grade	**Slightly Corrosive**	

Table B-6: May 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	454
pH	S. U	8.26
Alkalinity	mg / L as CaCO3	113
Ca	mg / L as CaCO3	59.8
Cl	mg / L	83.9
SO_4^{2-}	mg / L	138
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	0.13	0.36
Ryznar Index	7.99	7.55
Aggressiveness Index	12.09	12.09
CCPP	1.30	3.78
CSMR	0.61	0.61
TCEQ Grade	**Slightly Corrosive**	

Table B-7: June 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	380
pH	S. U	8.28
Alkalinity	mg / L as CaCO3	96
Ca	mg / L as CaCO3	47.8
Cl	mg / L	65.5
SO_4^{2-}	mg / L	114
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	0.00	0.22
Ryznar Index	8.29	7.84
Aggressiveness Index	11.94	11.94
CCPP	-0.09	1.91
CSMR	0.57	0.57
TCEQ Grade	**Slightly Corrosive**	

Table B-8: July 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	344
pH	S. U	7.96
Alkalinity	mg / L as CaCO3	83.5
Ca	mg / L as CaCO3	36.6
Cl	mg / L	63.9
SO_4^{2-}	mg / L	107
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.49	-0.27
Ryznar Index	8.94	8.50
Aggressiveness Index	11.45	11.45
CCPP	-4.08	-2.27
CSMR	0.60	0.60
TCEQ Grade	**Slightly Corrosive**	

Table B-9: August 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	382
pH	S. U	7.96
Alkalinity	mg / L as CaCO3	79.2
Ca	mg / L as CaCO3	36.9
Cl	mg / L	70.5
SO_4^{2-}	mg / L	112
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.52	-0.29
Ryznar Index	9.00	8.55
Aggressiveness Index	11.43	11.43
CCPP	-4.09	-2.38
CSMR	0.63	0.63
TCEQ Grade	**Corrosive**	

Table B-10: September 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	416
pH	S. U	8.03
Alkalinity	mg / L as CaCO3	77
Ca	mg / L as CaCO3	35.1
Cl	mg / L	85.8
SO_4^{2-}	mg / L	127
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.49	-0.26
Ryznar Index	9.01	8.56
Aggressiveness Index	11.46	11.46
CCPP	-3.63	-2.06
CSMR	0.68	0.68
TCEQ Grade	**Corrosive**	

Table B-11: October 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	413
pH	S. U	8.06
Alkalinity	mg / L as CaCO3	80.2
Ca	mg / L as CaCO3	37.1
Cl	mg / L	76.7
SO_4^{2-}	mg / L	114
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.42	-0.19
Ryznar Index	8.89	8.45
Aggressiveness Index	11.53	11.53
CCPP	-3.19	-1.56
CSMR	0.67	0.67
TCEQ Grade	**Slightly Corrosive**	

Table B-12: November 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	451
pH	S. U	8.1
Alkalinity	mg / L as CaCO3	85.8
Ca	mg / L as CaCO3	47.6
Cl	mg / L	94.4
SO_4^{2-}	mg / L	132
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.25	-0.02
Ryznar Index	8.59	8.14
Aggressiveness Index	11.71	11.71
CCPP	-2.04	-0.25
CSMR	0.72	0.72
TCEQ Grade	**Slightly Corrosive**	

Table B-13: December 2022

Model Input		
Parameters	**Units**	**Values**
TDS	mg / L	418
pH	S. U	8.19
Alkalinity	mg / L as CaCO3	89.3
Ca	mg / L as CaCO3	45
Cl	mg / L	88.8
SO_4^{2-}	mg / L	143
TCEQ Corrosion Indices		
Temperature	**10 ° C**	**25 ° C**
Langelier Index	-0.16	0.07
Ryznar Index	8.50	8.06
Aggressiveness Index	11.79	11.79
CCPP	-1.33	0.49
CSMR	0.62	0.62
TCEQ Grade	**Slightly Corrosive**	