

**FAST Start Program
City of Flint**

BG (ret) Michael C.H. McDaniel
Coordinator

1 November 2016

Keith Creagh, Director
MI Department of Natural Resources
Constitution Hall
525 W. Allegan
Lansing, MI 48909

VIA EMAIL

Dear Sir: *Keith*

Please find enclosed two documents: (1) the analysis of the available data on lead service lines in Flint, by lead authors Professors Jacob Abernethy and Eric Schwartz of the University of Michigan, Ann Arbor, their graduate assistants, and by my staff, CPT Nick Anderson and Ryan Doyle, PE; and (2) an explanation of our analysis by Ryan Doyle, PE, of the FAST Start Team. While those documents are extremely thorough, I must provide some comment.

First, please note that our determination of 29,100 service lines which require replacement is intentionally conservative. The number is based on an overall 55,000 parcels in the City of Flint. The 29,100 service lines is based on a calculation of 52% of the total lines in the City needing replacement. There are roughly 51,000 residential parcels in the City. There is a lesser number, then, of occupied residential parcels with lead or partial lead service lines within the City. But given the existing but unquantifiable number of short-term renters, the inability to often discern if a home is habitable, and our unwillingness, during a city public health emergency, to disregard any potential residence, we have assumed a conservative estimate.

Secondly, the 52% is based on a rather small sample size, as it is based on the number of addresses which were hydrovacked to determine the composition of the service lines. We did not include in our calculations the number of homes and the composition of their lines, where replacement work has already been accomplished. Those homes and neighborhoods were selected due to the high assurance that they would have lead or partial lead service lines so their inclusion would have skewed the results towards a higher percentage of lead service lines. We do intend to conduct further hydrovacking to provide a greater sample size, and will provide our updated numbers accordingly.

The FAST Start Program and the City of Flint remain committed to removing all sources of lead in the City's homes, starting with the replacement of all lead and partially lead service lines. Our on-going efforts focus on high risk neighborhoods, defined by the presence of lead in water sampling, the density of lead and galvanized service lines in a neighborhood, the age of the water and the age of its residents. We appreciate the efforts and assistance of the Department of Environmental Quality and other agencies in assisting us to reach these goals.

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City of Flint**

**BG (ret) Michael C.H. McDaniel
Coordinator**

1 November 2016

Sincerely,

A handwritten signature in black ink, appearing to read 'MCDaniel', written in a cursive style.

Michael C.H. McDaniel
FAST Start Coordinator

C:

Dr. Karen Weaver, Mayor
Sylvester Jones, City Admr.
C. Heidi Grether, Dir., MDEQ
George Krisztian

Inventory of Service Lines in Flint

Jacob Abernethy and Eric Schwartz (Professors at University of Michigan, Ann Arbor)

Arya Farahi and Jared Webb (PhD students at U-M)

Nicholas Anderson (U.S. National Guard, FastStart), **Ryan Doyle** (MDOT, FastStart)

We acknowledge Martin Kaufman and Troy Rosencrants (U-M Flint GIS Center) who initially digitized Flint City Records.

What has been found?

There are over 55,000 unique parcels of land in Flint with roughly 51,000 residential properties. We have physical verification of the complete service line materials for 457 homes.

- 36 from replacements Rowe pilot;
- 262 from replacement phases 1 (complete) and 2 (in progress); and
- 159 from hydrovac program.

Using this data as of November 1, 2016, we summarize what has been found, compare it to what the city records suggested, and then estimate the total number of homes with lead requiring partial or full service line replacements.

<u>Method of discovery</u>	Truth in Public Service Line:			
	Can't tell	Copper	Lead	All
Hydrovac	72	65	94	231
Replacement Phase 1 (and 2)*	0	4	257	262
Rowe	0	6	30	36
All	72	75	381	529

*Note: One home in Replacement Phase had a Galvanized public service line.

Among the 457 homes where the service lines were physically verified, there were 381 public service service lines made of Lead, 75 Copper, and 1 Galvanized.

The hydrovac teams visited a total of 231 homes. They could not inspect the service lines at 72 homes for any one of a variety of reasons, such as, the curbstop was under a driveway, or they were unable to find curbstop. Rowe Pilot Phase was completed in March 2016. Replacement Phase 1 is complete (and excludes the Rowe Pilot Phase). Replacement Phase 2 is underway. The data we use throughout this document includes results from the replacements (from Phase 1, 2, and Rowe Pilot) and hydrovac program.

The key decision is whether the home needs Full Replacement (Public and Private portion), Partial Replacement (Public or Private portion), or No Replacement. If a service line portion is made of Lead or Galvanized (or Tubeloy) we say it requires a replacement. A copper portion does not require replacement.

Service Line Replacement Needed/Performed:

No	Partial	Full
70	208	180

The replacement and hydrovac programs show that the vast majority of the concern (lead) is typically found in the public portion of the service line. We present the true public service line material grouped by each city record type.

Truth in Public Service Line:

City Records	Can't tell	Copper	Lead	All	Replace Rate
Copper	19	42	16	77	21%
Copper/Lead	16	9	145	170	85%
Galvanized/Other*	1	2	98	102	97%
Lead	8	2	22	32	69%
Unknown/Other	28	20	100	148	68%
All	72	75	381	529	72%

Note: For the one home in Replacement Phase which had a Galvanized public service line but its City Record was Galvanized/Other. The City Records come from UM Flint GIS Center data. The row for Lead represents the following labels in the City Records: "Lead," "Lead/Zinc," "Lead/Tubeloy," and "Tubeloy." Copper includes "Copper," "Copper/Zinc." The Replace Rate is the proportion out of homes that were successfully physically verified.

We report a "Replace Rate," which is the proportion of homes in any group requiring a Partial or Full replacement. Partial Replacement occurs when Lead or Galvanized appears in only the Private or Public portion. Full Replacement occurs when Lead or Galvanized appears in both portions of the service line.

Looking at the complete description of the Public and Private portions of the service lines suggest how many partial replacements and full replacements are needed. We also provide these rates in two ways -- using all data and using only data from the hydrovac program.

The following letters will be used in the tables below:

C-C = Copper-Copper L-C: Lead-Copper
 C-G = Copper-Galvanized L-G: Lead-Galvanized
 C-L = Copper-Lead L-L: Lead-Lead
 L-O: Lead-Other

All homes where public and private lines verified

Truth in Public-Private service line												
<u>City Records</u>	Can't tell	C-C	C-G	C-L	L-C	L-G	L-L	L-O	All	Full	Partial	Replace Rate
										Replace Rate	Replace Rate	
Copper	19	42	0	0	10	4	2	0	77	10%	17%	27%
Copper/Lead	16	7	0	2	134	9	2	0	170	7%	88%	95%
Galvanized/Other	1	2	1	0	24	72	2	0	102	73%	25%	98%
Lead	7	2	0	0	5	3	14	1	32	68%	20%	88%
Unknown/Other	28	17	2	1	29	48	21	2	148	57%	27%	84%
All	71	70	3	3	202	136	41	3	529	39%	45%	84%

Note: One home had a Galvanized/Other record, and actually had Galvanized-Copper, since that is the only case of Galvanized in public line, we count it with the Copper-Galvanized.

Homes where public and private lines were verified by hydrovac only

Truth in Public-Private service line												
<u>City Records</u>	Can't tell	C-C	C-G	C-L	L-C	L-G	L-L	L-O	All	Full	Partial	Replace Rate
										Replace Rate	Replace Rate	
Copper	19	39	0	0	2	3	1	0	64	9%	4%	13%
Copper/Lead	16	7	0	0	20	1	0	0	44	4%	71%	75%
Galvanized/Other	1	0	0	0	1	2	0	0	4	67%	33%	100%
Lead	7	1	0	0	1	0	9	1	19	75%	8%	83%
Unknown/Other	28	16	1	1	17	19	17	1	100	50%	26%	76%
All	71	63	1	1	41	25	27	2	231	32%	27%	59%

How Much Lead Is There? Estimating the Number of Service Line Replacements Needed

Estimating the number of lead service lines in Flint is still not easy. The service line replacement program targets at-risk homes, so it does not give us a representative sample of the 55,000 parcels in Flint. The hydrovac program samples from a broader group of homes since its purpose is to gain information, but still does represent all of Flint.

So how many homes require a Full replacement (private and public portion) or Partial replacement?

We estimate this by first calculating the replacement rate by City Record. For example, a home with a City Record of “Copper/Lead” has chance of 75% needing a replacement (71% for Partial or 4% for Full). Then we take into account how common each City Record is throughout Flint. For instance, there are 4,161 Copper/Lead records (7% of Flint).

We use the estimated “Replacement Rate” described above. Using the hydrovac data only reflects a lower total number of replacements than using hydrovac and replacement data. We will use the rates from the hydrovac only since we know the hydrovac sample is a better reflection of all of Flint than the homes that have already received service line replacement.

Using the rates observed in the sample of homes so far, we estimate approximately 29,100 parcels (about 52% Flint parcels) would require some replacement. Among those, about 17,500 would be full replacements and 11,600 would be partial replacements.

We want to provide some uncertainty around this estimate and give the reader an illustration of how sensitive this estimate may be to changes in what we understand about the true rate of lead corresponding to each City Record. For instance, if you decided to be optimistic that only 60% of parcels with non-Copper records and 10% of Copper records some lead or galvanized service lines, then you would estimate 20,600 parcels required some replacement.

City Record	Percent of City	Total Parcels	Optimistic Assumption	Hydrovac Only	Replacement and Hydrovac	Pessimistic Assumption
Copper	46%	25843	10%	13%	27%	30%
Copper/Lead	7%	4161	60%	75%	95%	100%
Galvanized/Other	22%	12261	60%	100%	98%	100%
Lead	0%	111	60%	83%	88%	95%
Unknown/Other	24%	13517	60%	76%	84%	95%
Total Predicted Number of Replacements			20614.3	29106.4	34398.3	37121.5
As Percent of All Parcels			36%	52%	61%	66%

*Note: Lead represents records saying “Lead, Lead/Tubeloy Lead/Zinc Tubeloy Copper/Tubeloy.” “Replacement Rate” is the probability of finding either lead or galvanized in either the private or public service line.

It is important to note that since the replacement program made up about 2/3 of our records and they were located in three at-risk neighborhoods, it still does not give us a representative sample of the 55,000 parcels in Flint. A large scale hydrovac excavation project is needed to determine the true percentage of the lines that are all or partially lead. It would also allow for a more sophisticated estimate using statistical algorithms using all factors that describe parcels such as city record of service line, year built, home value, land value, zoning, location, vacancy status, home condition, and others. In addition to determining a much more precise number of lead lines, the hydrovac excavation project would provide us with other useful information, such as breakdowns by city ward, occupied vs. vacant, age of home, material listed in city records, and any other parcel attribute. After receiving guidance on how to define occupied residential homes, we will be able to provide these numbers for occupied vs unoccupied residential properties.

We will continue to update these results and add additional helpful information as new data is submitted.



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
DAVISON TRANSPORTATION SERVICE CENTER

KIRK T. STEUDLE
DIRECTOR

November 1, 2016

Brigadier General (Ret.) Mike McDaniel
FAST Start Coordinator
City of Flint
1101 South Saginaw Street
Flint, MI 48502

Re: October 14, 2016 DEQ Letter – Inventory of Lead Service Lines – City of Flint

Dear General McDaniel,

As you are aware, the DEQ has requested a report detailing the lead service line quantities in Flint. As requested, I enclose the FAST Start team's analysis of this issue.

The hydro-excavation contract was recently completed which was designed to provide a more certain assessment of service line materials in the City (159 confirmed homes). In addition, we have records on the currently 298 homes with lines replaced through the Rowe Pilot and FAST Start program.

The FAST start team has been working with two assistant professors from the University of Michigan to compile the data and support our projections. The attached report details our findings to date and provides a breakdown of the information requested by the DEQ.

To get straight to the core of the issue, our analysis currently projects approximately 29,100 of the 55,000 parcels in Flint either need full or partial replacement. It is important to note, however, that the confidence level in this estimate is low and the deviation could be high - as noted on the "Replacement Rate" chart (Page 4). We feel that using the percentages found in the hydrovac data is the most representative at this point (29,106 lines). In order to raise confidence in these numbers and provide a more sophisticated estimate, a large hydrovac project would need to be initiated. When complete, a representative sample would provide not only the number of lines, but could also be broken down by ward, occupied vs. non-occupied/vacant parcels, etc. Extensive hydrovac work would also pay for itself through cost savings in the replacement program.

It should also be noted that the above information considers all Flint parcels. Due to the lack of funding to replace all lines, it is the FAST Start team's belief that the City's occupied parcels should be prioritized for replacement. In order to ensure these lines are replaced, an adequate assessment is needed to determine the number of occupied homes needing line replacement. In addition to working with the state agencies to determine how many homes are occupied, an extensive hydrovac project would help determine what percentage of occupied homes will need replacement.

A final note regarding the information requested by the DEQ : The FAST Start team did not witness any locations that had only a lead gooseneck. The public line portion was always made of the same material. We did have several instances where a copper “band-aid” was used at the curb stop, resulting in 6”-24” of copper on each side of the curb stop.

If you have any questions, please contact me at 989-220-9447 or doyler3@michigan.gov.

Sincerely,

Ryan P. Doyle, PE
Cost & Scheduling Engineer
Assisting with FAST Start - Flint