

Performance Audit: Managing the Taste of Water

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City Auditor
City of Lawrence, Kansas

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Members of the City Commission

This performance audit is intended to help inform decisions about addressing problems with the taste and odor of city water. The report includes an assessment of how the Utilities Department's managed the problems that occurred last summer. It also includes a survey of water customers.

Naturally occurring substances in Clinton Lake and the Kansas River occasionally cause city water to taste unpleasant. The same problems occur across the country and around the world, but are complex and difficult to predict. While these substances don't cause human health problems, customers express dissatisfaction with water that tastes or smells bad.

The Utilities Department developed a process to better manage problems with taste and odor of water during the summer of 2012. That process increases the chances that the city can manage future taste and odor problems. I made several recommendations intended to improve the city's ability to respond to future taste and odor problems.

I provided the City Manager and the director of the Utilities Department with drafts of this report on January 11, 2012. The City Manager's written response is included in the report.

I appreciate the cooperation and assistance I received from staff in the Utilities Department. I also appreciate the cooperation from water customers who completed the survey.

Michael Eglinski
City Auditor

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Table of Contents

| | |
|---|----|
| Results in Brief | 1 |
| Why City Water Can Taste Bad..... | 2 |
| City Implemented a System to Better Manage Taste Problems | 5 |
| Water Treatment Changes Involve Trade-Offs..... | 15 |
| Survey Helps Understand Customer Point-Of-View | 16 |
| Recommendations..... | 19 |
| Scope, methods and objectives | 20 |
| Appendix A: Customer Survey..... | 22 |
| Management’s Response | 38 |

Performance Audit: Managing the Taste of Water

Results in Brief

City water occasionally has an unpleasant taste caused by natural substances in Clinton Lake and the Kansas River. While these substances don't cause human health problems, customers express dissatisfaction with water that tastes or smells bad.

The Utilities Department developed a process to manage taste and odor problems. The department collects data useful for addressing taste and odor problems, has treatment processes to reduce the impact of problems and ways to evaluate and improve those processes over time, communicates internally and externally and has taken some steps to integrate addressing taste and odor problems into long-term planning.

Additional data collection and analysis, further communications with customers, and developing and reporting relevant performance measures could strengthen the Utilities Department's processes for managing taste and odor events.

Most respondents to a customer survey expressed satisfaction with value, reliability, clarity, smell and taste of water. But, while the majority of respondents expressed satisfaction, a significant portion expressed dissatisfaction with both taste (18 percent) and overall value (22 percent).

Performance Audit: Managing the Taste of Water

Why City Water Can Taste Bad

City water occasionally has an unpleasant taste caused by natural substances in the water from Clinton Lake and the Kansas River. Certain kinds of algae produce substances known as geosmin and MIB that can create an unpleasant taste and odor even after water has been treated.¹

Geosmin and MIB don't cause human health problems, but customers may express dissatisfaction with water that tastes or smells bad. People often judge water quality by considering taste, odor and appearance. Unfamiliar tastes, odors or appearances create a perception of a health risk.

Taste and odor problems can create perception of health risk

People expect their water to taste good and often judge the safety of water by the taste and appearance. Unfamiliar taste and odor can create a perception of health risk. Generally, the compounds that cause taste and odor problems don't cause health risks. Several respondents to a water customer survey raised potential health concerns:

"I have lived here for 26 years. I fear that there are amoeba or other dead animals in the smelly water. It makes me nervous to drink it or make coffee with it!"

"...I drink many liters of water per day, am very physically active. I require clean water with no long term issues. I feel filtered water and bottled water is my only insurance."

"Because of the taste of the water before and after the months of June and July 2012, we always filter the water to avoid less than pleasant tastes and odors. We even provide filtered water to our dog because we do not know what might be in the municipal water supply..."

¹ For more detailed and technical information about algae and taste and odor see *Fate and Transport of Cyanobacteria and Associated Toxins and Taste-And-Odor Compounds from Upstream Reservoir Releases in the Kansas River, Kansas September and October 2011* available from the U.S. Geological Survey online at: <http://pubs.er.usgs.gov/publication/sir20125129>

Lawrence water customers have experienced taste and odor problems occasionally over recent years. In the last seven years, five significant taste and odor events have occurred in Lawrence. Two of the events occurred in winter months and three in summer months.

Table 1 Major taste and odor events

| Significant taste and odor events in Lawrence since 2006 |
|--|
| December 2006 |
| August 2007 |
| February 2010 |
| August 2010 |
| June 2012 |

Taste and odor problems are difficult to predict. Variations in physical, biological and chemical factors affect algae growth. The factors interact in complex ways and vary over time. The problems occur across the nation and around the world. Scientists have found that predicting taste and odor problems has been very difficult.

Very small amounts of taste and odor causing compounds cause people to notice the taste. Sensitive individuals notice geosmin at levels of just five parts per trillion (that is 5/1,000,000,000,000). Water utilities generally expect to receive complaints when geosmin levels reach 10 parts per trillion.

Taste and odor problems noted in Kansas for over 100 years

Taste and odor problems have been noted in Kansas for well over a hundred years. In a 1901 lecture about water supply F.O. Marvin of the University of Kansas quoted an author writing about algae:

“It is organisms of this class which give tastes and odors to water,...the first indication of the pollution of a surface supply is given by the appearance of some member of that richly nitrogenous group of algae called Cyanophyceae, or 'blue greens,'...the odor of their decay is so intolerable as to preclude the use of the water. In some cases the odor accompanying their growth renders the water quite objectionable, and neither natural nor artificial filtration is able to remove it.”

“...When may disagreeable tastes and odors be expected? What precaution or measures may be taken in each case to prevent them? These are the questions the water-works superintendent, equally with the consumer, is asking, for the most part vainly, as yet.”

Marvin noted that “in our own state there has been some little trouble with taste and odors... and, as the state becomes more densely populated and more water plants are built, many of which will be forced to collect and store the water, this is quite likely to increase.”

Individual sensitivities to taste and odor vary

Some people do not notice geosmin while others find it very unpleasant. Responses to the water customer survey highlight some of the different sensitivities.

“Our tap water is pretty good compared to other places. I do remember the earthy taste, but it was no big deal.”

“I did not notice a difference in taste or smell.”

“Never noticed any “earthy” smell or taste. Don’t know what the big deal is.”

“I didn’t notice the “earthy” taste. I can’t taste a difference between bottled water and tap water.”

“I never thought that the water had a funny taste last summer. I think that the city’s tap water taste great! Keep up the good work!”

“I don’t like the smell when the water is earthy”

“Usually the smell and taste of the water is fine, but several times a year the smell and taste are *very* unpleasant. I believe it is usually attributed to algae.”

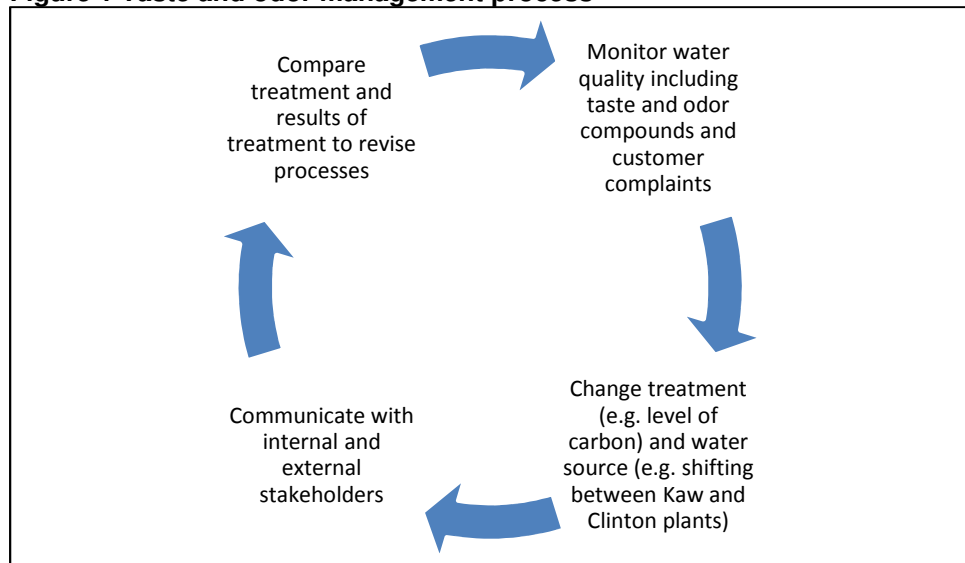
“...The earthy taste described in June/July 2012 came also with an unpleasant odor that made bathing unpleasant as well.”

While the compounds that cause taste and odor problems don’t cause health problems, the city has also been measuring toxins that can co-occur with taste and odor problems. Some algae naturally produce toxins called microcystins. Microcystins are not currently regulated in drinking water in the United State but are on the U.S. EPA list of contaminants for consideration for future regulation. The World Health Organization provides guidelines on levels of microcystins. Water treatments to address microcystins include oxidation through ozone or chlorine and some carbon applications.

City Implemented a System to Better Manage Taste Problems

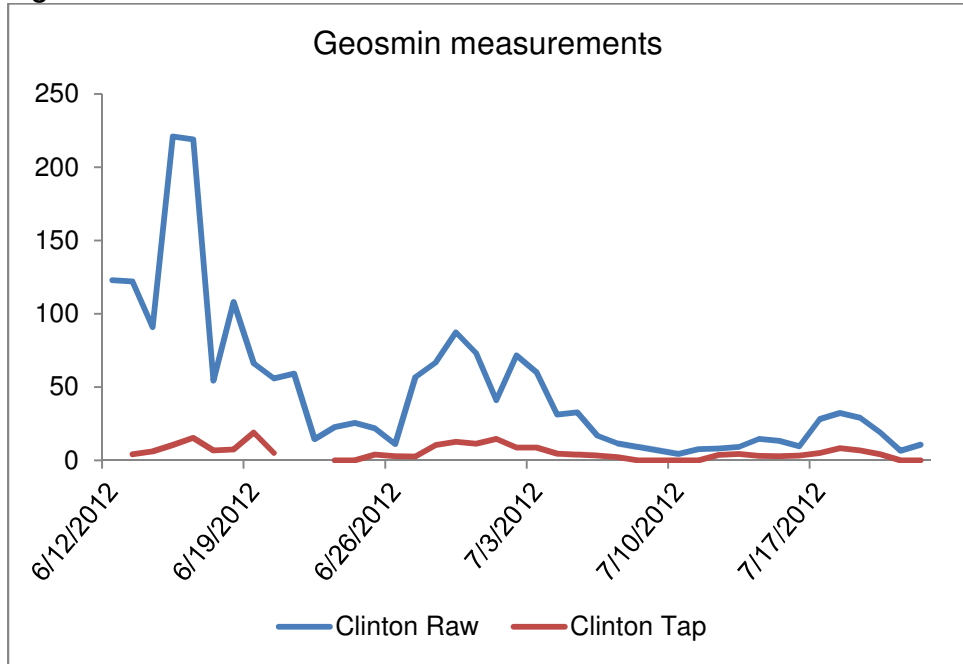
The Utilities Department has developed a process to manage taste and odor problems. The department collects data useful for addressing taste and odor problems, has treatment processes to reduce the impact of problems and ways to evaluate and improve those processes over time, communicates internally and externally and has taken some steps to integrate addressing taste and odor problems into long-term planning. Additional data collection and analysis, further communications with customers, and developing and reporting relevant performance measures could strengthen the Utilities Department’s processes for managing taste and odor events.

Figure 1 Taste and odor management process



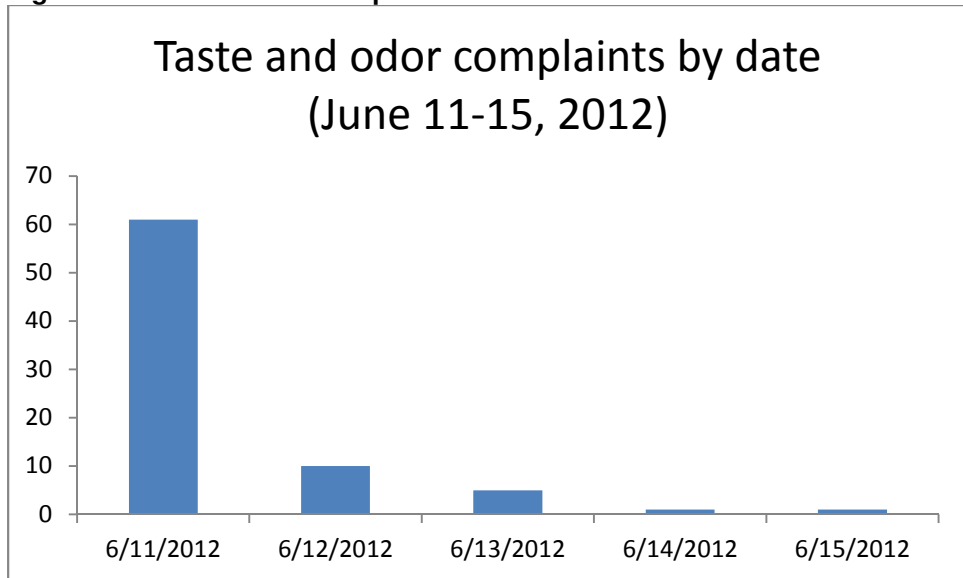
During June and July of 2012, the city had unpleasant tasting water caused by high levels of geosmin in the raw water from Clinton Lake. Geosmin causes water to taste “earthy” or “musty.” The water treatment process removes most, but not all, of the geosmin. When the water from Clinton Lake had especially high levels of geosmin, the tap water had levels high enough to be noticeable to many customers.

Figure 2 Geosmin measures summer 2012



Customers called about the taste problem, with most of the calls being logged on Monday, June 11. The first customer call related to the June taste event was taken at 2:29 a.m. on Sunday, June 10. The number of complaints dropped off quickly over the next few days.

Figure 3 Taste and odor complaints



The City Auditor reviewed the Utilities Department's process for managing taste and odor events by comparing the summer event with a model process. The model process is based largely on recommendations

for managing taste and odor events from other utilities and experts, organizational learning models, and process maturity models.

In its simplest form, managing taste and odor events requires:

- Data to characterize and measure the problem and the effect of treatments
- Processes to treat the problem and make adjustments to improve efficiency and effectiveness of treatments
- Communication within the organization and with external stakeholders
- Strategic plans to address taste and odor events.

A water utility's overall level can be characterized along a scale that runs from ad hoc responses to integrated/optimized responses. Higher levels should be able to better respond to taste and odor events.

Table 2 Model process for taste and odor management

| Level | Overall characteristics | Chances to quickly, effectively and efficiently address taste and odor problems |
|--------------------|--|---|
| Ad hoc | <ul style="list-style-type: none"> • Inconsistent data • Reactive and limited processes • Reactive and incomplete communication • Not integrated into long-term planning | Lowest |
| Foundation | <ul style="list-style-type: none"> • Data may not be complete • Reactive processes with lessons-learned • Inconsistent internal and external communication • Initial integration into long-term planning | |
| Manage | <ul style="list-style-type: none"> • Consistent data collection • Mix of reactive and proactive processes, building a base for optimizing processes • Consistent intern and external communications • Integrated with some long-term plans | |
| Integrate/optimize | <ul style="list-style-type: none"> • Reliable and available data • Proactive processes • Effective internal and external communication • Clearly integrated into long-term plans and performance measures | Highest |

Utilities Department has data useful for addressing taste and odor

The Utilities Department uses specialized lab equipment and plant operators smell heated samples to test for taste and odor compounds. The department purchased the lab equipment, called gas chromatography mass spectrometry (GC/MS), in 2010. The equipment and testing protocols provide the laboratory with the ability to quickly and accurately measure taste and odor compounds. Quick measurement allows for quickly implementing treatment to reduce or eliminate taste and odor problems. Before the city had the equipment, samples had to be collected and sent to an outside lab for testing which took several days.

The department also tracks and uses customer complaints. When customers call with complaints, staff enters those complaints into a work request system. They record information about the nature of the complaint, the location and contact information. The department took steps to improve the reliability of the information when the system was upgraded in early 2012.

Taken as a whole, the City Auditor concludes the department's collection of data to be at the "manage" level. Staff collects high quality data, have methods to help ensure reliable data, and maintain the data in systems that allow for comparisons.

Utilities Department has some flexibility, developing a base to improve existing processes

The main way the department treats taste and odor is to use carbon in the treatment process. Adding powdered activated carbon helps remove taste and odor compounds, herbicides and pesticides, and other chemicals. Plant operators can change the amount of carbon added to address changes in the raw water.

The Utilities Department treats water at two plants and each plant relies on a different source for raw water, allowing for the department to shift some production between when one of plants has a taste and odor problem. In the summer 2012 taste and odor event, geosmin was high in water from the Clinton Plant and consumer complaints came largely from customers served by the Clinton Plant. During the summer, the department shifted some production from the Clinton plant to the Kaw plant. Flexibility in sources of water can reduce the impact of taste and odor events.

Regular plant operator meetings provide a mechanism for the department to evaluate data on processes and taste and odor issues and consider different treatments. Plant operators and water quality staff meet four times each week to discuss operational data. During these meetings they can discuss issues related to taste and odor and share information. The regularly scheduled meetings provide a forum for communicating information.

Geosmin forecast discussions

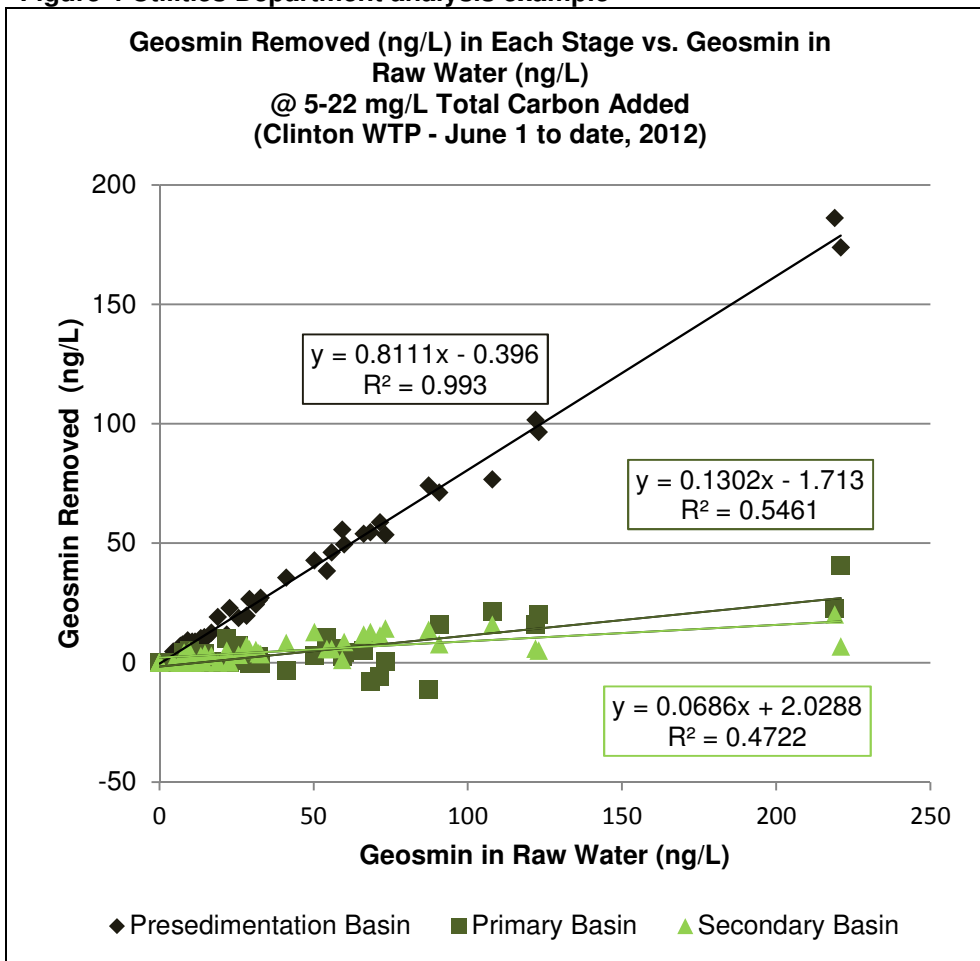
One tool the Utilities Department has begun to use to improve their management of taste and odor problems is to prepare “forecast discussions” to help plant operators develop and articulate their rationales for treatment decisions. Forecast discussions are used in weather forecasting to help readers understand forecasts and the meteorologist’s thinking. An example from the summer of 2012:

Geosmin in Clinton’s raw water increased from 9 to 13 ng/L yesterday, so the carbon has been increased to 8 mg/L. We will continue to evaluate these test results and adjust as needed.

No Geosmin being detected in Kaw’s raw water.

The department evaluated process and water quality data based on the June taste and odor event to better understand treatment effectiveness and help optimize treatment. A project engineer analyzed data on water flow and temperature, geosmin levels at different stages in the treatment process, and amounts of treatment chemicals used. She ran regression analyses to identify relationships between treatment processes and geosmin removal. The analysis can help the department improve treatment processes.

Figure 4 Utilities Department analysis example



Taken as a whole, the City Auditor concludes the department’s processes for managing taste and odor to be at “manage” level. Staff has developed ways to react to taste events and is building a base to improve those processes. The city’s access to two different sources of water allows for shifting production to help reduce taste and odor problems.

Utilities Department communicates internally and externally

The Utilities Department communicates internally, within the department and with the City Manager’s Office, and externally with customers. Internal communications include the regular plant operator meetings and complaint handling. External communications include contacting customers who make taste and odor complaints, addressing press enquiries and providing information to customers through the annual consumer confidence report.

Customer complaints about the taste of water follow a defined process. Department staff logs calls they receive or that an after-hours answering

service forwards. Calls are logged into a database and department staff makes decisions about how to handle the specific complaint, and customers may be contacted for follow-up or to provide additional information. The department has specific instructions for handling taste and odor complaints that include notifying different department divisions, the City Manager's Office, and the customers who called.

During a taste and odor event, external communications with customers involve responding to complaints and the press. The department has developed standard talking points to address specific taste and odor related problems. The talking points provide consistent and concise information to customers who call the department.

Examples of talking points

The Utilities Department prepared talking points to provide information about taste and odor problems to customers. Talking points for taste and odor problems related to geosmin:

- The presence of geosmin causes aesthetic changes including taste and odor, however is in no way a health concern to those who drink it,
- Geosmin causes a musty or muddy taste in water, which can be especially noticeable in hot or warm water.
- City staff are monitoring and taking measures to help control adverse taste and odors, however not all geosmin can be removed through treatment.

Talking points for addressing a problem with cyanotoxins in the river:

- The City chose to shut down the Kaw Water Treatment Plant due to lower customer demand and as a precaution while we wait for recommendations from KDHE and the USEPA.
- The City of Lawrence is always interested in the quality and quantity of our drinking water and continually participates in groups that study these conditions.
- Lawrence drinking water continues to meet all EPA drinking water standards as determined by frequent testing by staff.

The city's annual water quality report provides some information on taste and odor issues. The annual report notes that drinking water may occasionally be affected by Lawrence's source water. The report highlights three most common reasons for bad tasting or smelling water:

- Chlorine added in treatment
- Hydrogen sulfide in some groundwater which causes a rotten-egg odor
- Algae and tiny fungi growing in surface water

The annual water quality report has the potential to reach a significant portion of water customers. A 2003 national survey by the U.S. EPA found that about 29 percent of customers report taking the time to read annual water quality reports.

Taken as a whole, the City Auditor concludes the department's internal and external communications to be at the "manage" level. Staff has clear guidelines and processes for handling complaints and sharing information during taste events.

Taste and odor concerns somewhat integrated with long-term plans

The Utilities Department has taken several actions to integrate managing taste and odor with long-term planning, including:

- Participating in a scientific study lead by the U.S. Geological Survey. The City Commission approved an agreement to participate in the research in November 2011. Other participants include the City of Topeka, WaterOne, the Kansas Water Office and the Kansas Department of Health and Environment.
- Purchasing GC/MS equipment in 2010 to quickly collect data on taste and odor compounds.
- Contracting for additional study of taste and odor treatment options. The department sought proposals for an engineering firm to evaluate treatment processes to improve removal of taste and odor compounds and microtoxins. The department anticipates beginning the study in early 2013.

The Utilities Department's current capital improvement plan includes estimated expenditures and water rate impacts of a capital investment to manage taste and odor problems. The 2003 water master plan addressed taste and odor management through powdered activated carbon and considered ozone treatment, which can have benefits for taste and odor, but determined that ozone treatment would not be cost effective.

Taken as a whole, the City Auditor concludes the department's strategic plans to be at the "foundation" level. The department has taken steps toward developing the capacity to measure and respond to taste events and have begun to develop plans that could lead to further integrating taste and odor management into the department's long-term plans.

Evaluation of taste event management identifies areas for improvement

Based on the evaluation of the Utilities Department's current level for managing taste and odor problems, the city could improve by:

- Developing the ability to forecast taste and odor problems, although this is likely to require significant scientific research and may be years away from practical application,
- Optimizing existing processes through additional data collection and analysis in future taste and odor events,
- Communicating additional information on taste and odor with customers,
- Further integrating taste and odor management into strategic planning, including developing and reporting relevant performance measures.

The City Auditor made specific recommendations to address improvements on page 19 of the report.

Water Treatment Changes Involve Trade-Offs

Among the options the city may consider to improve the taste of water are changes to the treatment process that may require significant capital expenditures. Making decisions about capital investments essentially involves a series of trade-offs. To help inform those decisions, this section of the report identifies some of the different perspectives the city may face in deciding how to address improving the taste and odor of water.

Table 3 Different perspectives

| Proponents of making capital investments to improve treatment for taste and odor might say: | Opponents of making capital investments to improve treatment for taste and odor might say: |
|---|---|
| <ul style="list-style-type: none"> • Customers deserve better quality water. • Citizen survey from 2011 data highlighted desire for improved taste of water. • Depending on the technology, treatment for taste and odor can also address toxins that EPA has on the list of contaminants for consideration for regulations. • The water tastes bad. • This problem happens over and over again and ought to be fixed. • Treating with powdered activated carbon is not always effective and carbon is expensive. | <ul style="list-style-type: none"> • Most customers are satisfied with the taste of water. • Taste and odor issues don't affect the safety of drinking water • The capital investment could address other priorities such as maintenance on the distribution and waste water systems. • Predicting taste and odor problems events is complex and there is a lot of uncertainty about future problems. • Individual consumers can use home filters to address the problems on their own. • Some alternatives, like ozone, are expensive to build and operate and may result in problems with byproducts. |

Survey Helps Understand Customer Point-Of-View

A sample of water customers completed a short survey to provide information on their drinking water, customer satisfaction and reactions to the summer 2012 taste event. The purpose of the survey was to help the city make informed decisions about addressing taste and odor problems by collecting information about customers' perceptions.

The City Auditor surveyed water customers who had provided the city with email addresses. The auditor sent a single email to a sample of 1700 email addresses for customers who receive billing information by email. Enough customers completed surveys (391) to produce results at a 95 percent level of confidence with a precision of at least +/- 4.95 percent.

Drinking water consumption

Many respondents use filters and bottled water, but fewer drink bottled water exclusively.

Table 4 Customer survey on drinking water

| Do you: | Yes | No |
|----------------------------------|-----|-----|
| Drink bottled water? | 56% | 44% |
| Drink bottled water exclusively? | 6% | 94% |
| Drink filtered water? | 64% | 36% |

Few (15 percent) of the respondents do not drink bottled water or have a filter.

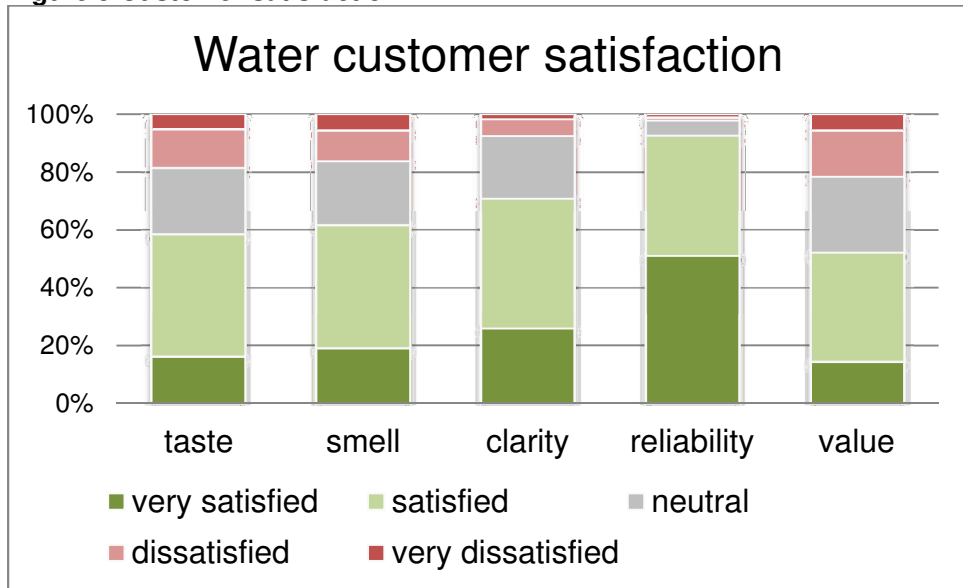
Table 5 Customer survey on bottled and filtered water

| Do you: | |
|---|-----|
| Do not drink bottled water and do not have a filter | 15% |
| Drink both bottled and filtered water | 34% |
| Drink either bottled or filtered water | 51% |

Satisfaction with drinking water

Most respondents expressed satisfaction with taste, smell, clarity, reliability and value of water.

Figure 5 Customer satisfaction



While the majority of respondents expressed satisfaction, a significant portion expressed dissatisfaction with both taste (18 percent) and overall value (22 percent).

Satisfaction with the taste of water and value for rates is related. Respondents satisfied with the taste or water were more likely to be also satisfied with value for rates.

Survey respondents who expressed satisfaction with the taste of drinking water were less likely to report:

- Drinking filtered tap water
- Not drinking tap water

The length of time respondents have lived in Lawrence did not affect their satisfaction with the taste of water. In addition, whether respondents owned their housing or were a university student was unrelated to their satisfaction with the taste of water.

Responses to 2012 taste problems

Most respondents didn't identify changes in their use of drinking water in response to the 2012 taste problems.

Survey respondents who expressed satisfaction with the taste of water were less likely to report that they responded to the 2012 taste problems by:

- Buying and drinking bottled water
- Buying a home filter
- Reducing the amount of water they drink

Appendix A includes more detailed information from the survey.

How some customers describe unpleasant tastes

While most customers who responded to a customer survey reported satisfaction with the taste of drinking water, several respondents described taste and odor of city water. Descriptions of the taste include: earthy, chlorine, like the sewer, like fish, like moss, musty, algae, mineral taste, like chemicals, chalk-flavored.

Recommendations

The City Manager should:

1. Increase communications with water consumers to provide information about:

- The nature of taste and odor problems;
- Steps the city takes to address those problems;
- Steps consumers can take to minimize taste problems;

Consider providing information in advance of taste and odor events as well as during events.

2. Develop and report measures related to taste on a regular basis, such as annually. Sources of data for reporting could include resident surveys, complaints, laboratory testing results and results of sensory tests such as smelling samples of water.
3. If the city does resident surveys in the future include questions about the taste and odor of water and efforts to communicate about taste and odor issues.

During the course of the performance audit work, two issues were raised to consider for future performance audit work:

- Water conservation
- Controlling fat, oils and grease in waste water

Performance Audit: Managing the Taste of Water

Scope, methods and objectives

This performance audit was designed to address:

- What causes taste and odor problems with water in Lawrence?
- Does the Utilities Department's approach to managing taste and odor events address good practices?
- What have customers experienced and how satisfied are they with the taste of water?

To understand the reason city water can taste unpleasant, the City Auditor interviewed Utilities Department employees, interviewed experts and reviewed relevant literature. Among the sources of technical information on taste and odor problems reviewed were:

Fate and Transport of Cyanobacteria and Associated Toxins and Taste-and-Odor Compounds from Upstream Reservoir Releases in the Kansas River, Kansas, September and October 2011, U.S. Geological Survey, 2012.

Harmful Algal Blooms, U.S. Geological Survey, January 2007.

Summer 2006 and summer 2009 issues of *Lake Line*, North American Lake Management Society.

Clinton Lake Water Quality Data 2001-2011, U.S. Army Corps of Engineers.

To evaluate the Utilities Department's management of taste and odor, the City Auditor reviewed literature on managing taste and odor problems and models of organizational learning and process maturity. One of the main sources of information on taste and odor was:

Early Warning and Management of Surface Water Taste-and-Odor Events, William Taylor, Richard Losee, Marcia Torobin, George Izaguirre, Debra Sass, Djanette Khiari and Khalil Atasi, AWWA Research Foundation, 2006.

The auditor also interviewed staff in other water utilities and experts in taste and odor problems. The auditor reviewed data from the summer 2012 taste event including customer complaints, lab test results, and the Utilities Department's analysis of data. To assess the reliability of the data, the auditor interviewed staff to understand the data collection and lab processes. The auditor concluded that the data were reliable given the objectives of the performance audit.

To understand customers' experiences and satisfaction, the City Auditor surveyed a sample of water customers. The survey involved a sample of 1700 residential water customers who receive bills by email. The survey was sent by email and asked respondents to complete a short web-based survey. As of December 5, 2012, 391 respondents had submitted surveys. If those 391 respondents are representative of the city's population, then the sample provides results at a confidence interval of +/- 4.95 percent at a 95 percent confidence interval. The auditor received an additional 18 responses after December 5. Those responses aren't included in the overall analysis. Appendix A includes additional information on the survey.

The City Auditor identified different perspectives on making significant capital investments by reviewing interviews, literature and the customer survey. The approach is based on projects to identify budget options done by the Congressional Budget Office and the New York City Independent Budget Office.

The City Auditor conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require planning and performing the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for findings and conclusions based on the audit objectives. The City Auditor believes that the evidence obtained provides a reasonable basis for the findings and conclusions based on the audit objectives.

The City Auditor provided a final draft of the report to the City Manager on January 11, 2013. The City Manager's written response is included.

Performance Audit: Managing the Taste of Water

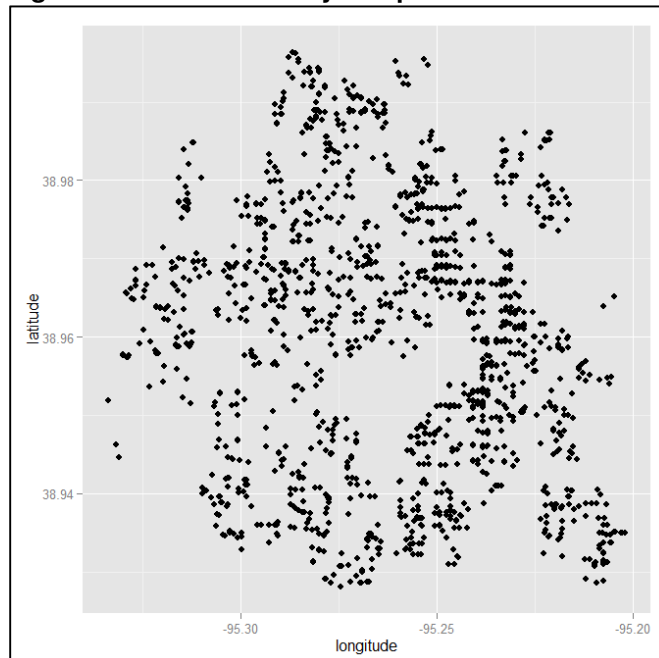
Appendix A: Customer Survey

The City Auditor conducted a survey of water customers to collect information about customers' drinking water routines, customer satisfaction and reactions to the summer 2012 taste and odor problems.

The City Auditor emailed 1700 customers between November 26 and December 3, 2012. The email message requested that recipients complete a short survey as part of the performance audit and included a link to a web-based survey on the City's web page. The auditor closed the survey on December 5. At that point 391 respondents had submitted surveys. Respondents completed 23 additional surveys after the cut-off date and any future analysis can include those. The survey did not include customers of wholesale buyers of city water.

The survey covered the city geographically. The map shows the service location of survey recipients.

Figure 6 Customer survey sample locations



Demographics

Table 6 Years in Lawrence

| How many years have you lived in Lawrence | |
|---|-------|
| 5 or less | 34.3% |
| 6 to 10 | 21.0% |
| 11 to 15 | 12.0% |
| 16 to 20 | 6.6% |
| 21 to 30 | 10.7% |
| 31 or more | 14.8% |
| I do NOT live in Lawrence | 0.5% |

Table 7 Own or rent residence

| Do you own or rent your current residence | |
|---|-------|
| Own | 61.0% |
| Rent | 39.0% |

Table 8 Student in college or university

| Are you a student in a college or university | |
|--|-------|
| Yes | 13.2% |
| No | 86.8% |

Compared to the city's 2011 Citizen Survey, the water customer survey respondents were more likely have lived in Lawrence less than 11 years, to rent their current residence, and to be university students.

Water consumption

The survey asked respondents about how they consume drinking water.

Table 9 Consuming drinking water

| Drink water produced by the City of Lawrence | |
|---|-------|
| Don't know/NA | 1.3% |
| No | 7.9% |
| Yes | 90.8% |
| Drink bottled water | |
| Don't know/NA | 0.5% |
| No | 44.0% |
| Yes | 55.5% |
| Drink bottled water exclusively | |
| Don't know/NA | 2.0% |
| No | 92.1% |
| Yes | 5.9% |
| Drink filtered tap water | |
| Don't know/NA | 0.3% |
| No | 36.1% |
| Yes | 63.7% |
| Drink tap water | |
| Don't know/NA | 2.6% |
| No | 30.2% |
| Yes | 67.3% |

Customer satisfaction

The survey asked respondents about their satisfaction with water.

Table 10 Customer satisfaction

| How satisfied are you with: | |
|---|-------|
| Taste of your drinking water | |
| Very satisfied | 15.7% |
| Satisfied | 41.1% |
| Neutral | 22.4% |
| Dissatisfied | 12.9% |
| Very dissatisfied | 5.1% |
| Don't know/NA | 2.8% |
| Smell of your drinking water | |
| Very satisfied | 18.8% |
| Satisfied | 41.9% |
| Neutral | 21.9% |
| Dissatisfied | 10.3% |
| Very dissatisfied | 5.7% |
| Don't know/NA | 1.5% |
| Clarity of your drinking water | |
| Very satisfied | 25.3% |
| Satisfied | 44.3% |
| Neutral | 21.1% |
| Dissatisfied | 5.7% |
| Very dissatisfied | 1.8% |
| Don't know/NA | 1.8% |
| Reliability of water service | |
| Very satisfied | 50.9% |
| Satisfied | 41.3% |
| Neutral | 5.2% |
| Dissatisfied | 1.0% |
| Very dissatisfied | 1.3% |
| Don't know/NA | 0.3% |
| Overall value you receive for water and wastewater rates | |
| Very satisfied | 14.2% |
| Satisfied | 37.1% |
| Neutral | 26.0% |
| Dissatisfied | 15.5% |
| Very dissatisfied | 5.7% |
| Don't know/NA | 1.5% |

Customer experiences of summer 2012 taste and odor problems

The survey asked respondents about their responses to taste problems during the summer of 2012.

Table 11 Responses to summer 2012 problems

| In the summer months of 2012, the city's water occasionally had an "earthy" taste that some people find unpleasant. The unpleasant taste occurred in parts of June and July. As a result of the taste, did you: | |
|---|-------|
| Purchase and drink bottled water | |
| Don't know/NA | 7.0% |
| No | 67.0% |
| Yes | 26.0% |
| Purchase and use a home filter (such as a "Brita" filter) | |
| Don't know/NA | 6.5% |
| No | 57.0% |
| Yes | 36.5% |
| Reduce the amount of water you drink | |
| Don't know/NA | 5.7% |
| No | 80.6% |
| Yes | 13.7% |
| Reduce the amount of water you use for laundry | |
| Don't know/NA | 4.7% |
| No | 90.9% |
| Yes | 4.4% |
| Reduce the amount of water you use for bathing/showering | |
| Don't know/NA | 4.7% |
| No | 89.0% |
| Yes | 6.3% |
| Reduce the amount of water you use for watering gardens and lawns | |
| Don't know/NA | 13.0% |
| No | 79.5% |
| Yes | 7.5% |

Significant relationships between respondents' answers

To identify significant relationships between respondents' answers, the City Auditor used chi-square tests and combined responses into categories of satisfied (both satisfied and very satisfied) and dissatisfied (both dissatisfied and very dissatisfied). The analysis highlights the significant relationships identified.

Which demographic variables relate to respondents' satisfaction with the taste of water?

None of the demographic measures from the survey relate to differences in satisfaction with the taste of water. Whether respondents lived in Lawrence a relatively short or long time, rented or owned their residence, or were college or university students had no relationship to their satisfaction with the taste of water.

The tables below summarize satisfaction with taste of water by the demographic measures.

Table 12 Taste and years in Lawrence

| | | Years living in Lawrence | |
|----------------------------------|------------------------------------|--------------------------|------------------|
| | | 10 years or less | 31 years or more |
| Satisfaction with taste of water | Satisfied and Very satisfied | 130 | 36 |
| | Dissatisfied and Very dissatisfied | 37 | 11 |

Table 13 Taste and own/rent residence

| | | Do you own or rent your current residence | |
|----------------------------------|------------------------------------|---|------|
| | | Own | Rent |
| Satisfaction with taste of water | Satisfied and Very satisfied | 137 | 81 |
| | Dissatisfied and Very dissatisfied | 41 | 29 |

Table 14 Taste and college or university student

| | | Are you a student in a college or university | |
|----------------------------------|------------------------------------|--|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 193 | 26 |
| | Dissatisfied and Very dissatisfied | 58 | 12 |

Which questions are significantly related to satisfaction with the taste of water?

The analysis identified a number of significant relationships between satisfaction with the taste of water and respondents answers to other questions. Keep in mind that the analysis doesn't identify a cause-effect relationship.

Respondents who expressed satisfaction with the taste of water were more likely to also be satisfied with the overall value they receive for water and wastewater rates.

Table 15 Value and taste

| | | Satisfaction with taste of water | |
|----------------------------------|------------------------------------|----------------------------------|------------------------------------|
| | | Satisfied and Very satisfied | Dissatisfied and Very dissatisfied |
| Satisfaction with value for rate | Satisfied and Very satisfied | 149 | 16 |
| | Dissatisfied and Very dissatisfied | 29 | 31 |

Respondents who expressed satisfaction with the taste of water were more likely to also be satisfied with the smell of their drinking water.

Table 16 Smell and taste

| | | Satisfaction with taste of water | |
|----------------------------------|------------------------------------|----------------------------------|------------------------------------|
| | | Satisfied and Very satisfied | Dissatisfied and Very dissatisfied |
| Satisfaction with smell of water | Satisfied and Very satisfied | 199 | 9 |
| | Dissatisfied and Very dissatisfied | 6 | 42 |

Respondents who expressed satisfaction with the taste of water were more likely to report that they drink tap water.

Table 17 Taste and drinking tap water

| | | Drink tap water | |
|----------------------------------|------------------------------------|-----------------|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 41 | 178 |
| | Dissatisfied and Very dissatisfied | 41 | 27 |

Respondents who expressed satisfaction with the taste of water were less likely to purchase and drink bottled water as a result of the summer 2012 taste and odor problems.

Table 18 Taste and buying bottled water in 2012

| | | Purchase and drink bottled water as a result of summer 2012 taste and odor problems | |
|----------------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 168 | 36 |
| | Dissatisfied and Very dissatisfied | 31 | 35 |

Respondents who expressed satisfaction with the taste of water were less likely to purchase and use a home filter as a result of the summer 2012 taste and odor problems.

Table 19 Taste and buying a home filter in 2012

| | | Purchase and use a home filter as a result of summer 2012 taste and odor problems | |
|----------------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 144 | 59 |
| | Dissatisfied and Very dissatisfied | 28 | 39 |

Respondents who expressed satisfaction with the taste of water were less likely to reduce the amount of water they drink as a result of the summer 2012 taste and odor problems.

Table 20 Taste and reducing drinking water in 2012

| | | Reduce the amount of water you drink as a result of summer 2012 taste and odor problems | |
|----------------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 186 | 19 |
| | Dissatisfied and Very dissatisfied | 46 | 20 |

Which questions are unrelated to satisfaction with the taste of water?

The analysis identified a number of responses to questions that were unrelated to respondents' satisfaction with the taste of water.

Respondents who expressed satisfaction with the taste of water were not significantly more or less likely to drink bottled water.

Table 21 Taste and drinking bottled water

| | | Drink bottled water | |
|----------------------------------|------------------------------------|---------------------|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 106 | 114 |
| | Dissatisfied and Very dissatisfied | 29 | 41 |

Respondents who expressed satisfaction with the taste of water were not significantly more or less likely to drink filtered tap water.

Table 22 Taste and drinking filtered water

| | | Drink filtered tap water | |
|----------------------------------|------------------------------------|--------------------------|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 88 | 133 |
| | Dissatisfied and Very dissatisfied | 19 | 51 |

Respondents who expressed satisfaction with the taste of water were not significantly more or less likely to reduce the amount of water used to water gardens and lawns as a result of the summer 2012 taste and odor problems.

Table 23 Taste and reducing watering lawns and gardens in 2012

| | | Reduce the amount of water you used for watering gardens and lawns as a result of summer 2012 taste and odor problems | |
|----------------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with taste of water | Satisfied and Very satisfied | 175 | 15 |
| | Dissatisfied and Very dissatisfied | 48 | 8 |

Which questions are significantly related to satisfaction with the value for water and waste water rates?

Respondents who expressed satisfaction with the value received for water and wastewater rates were less likely to purchase and drink bottled water as a result of the summer 2012 taste and odor problems.

Table 24 Value and buying bottled water in 2012

| | | Purchase and drink bottled water as a result of summer 2012 taste and odor problems | |
|-------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with value | Satisfied and Very satisfied | 146 | 34 |
| | Dissatisfied and Very dissatisfied | 40 | 38 |

Respondents who expressed satisfaction with the value received for water and wastewater rates were less likely to purchase and use home filters as a result of the summer 2012 taste and odor problems.

Table 25 Value and buying a home filter in 2012

| | | Purchase and use a home filter as a result of summer 2012 taste and odor problems | |
|-------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with value | Satisfied and Very satisfied | 125 | 57 |
| | Dissatisfied and Very dissatisfied | 34 | 44 |

Respondents who expressed satisfaction with the value received for water and wastewater rates were less likely to reduce the amount of water they drank as a result of the summer 2012 taste and odor problems.

Table 26 Value and reducing drinking in 2012

| | | Reduce the amount of water you drink as a result of summer 2012 taste and odor problems | |
|-------------------------|------------------------------------|---|-----|
| | | No | Yes |
| Satisfaction with value | Satisfied and Very satisfied | 167 | 18 |
| | Dissatisfied and Very dissatisfied | 60 | 17 |

Other comments

Survey respondents had a chance to write additional comments and about a quarter of the respondents did. Some of the comments are quoted in the body of the performance audit.

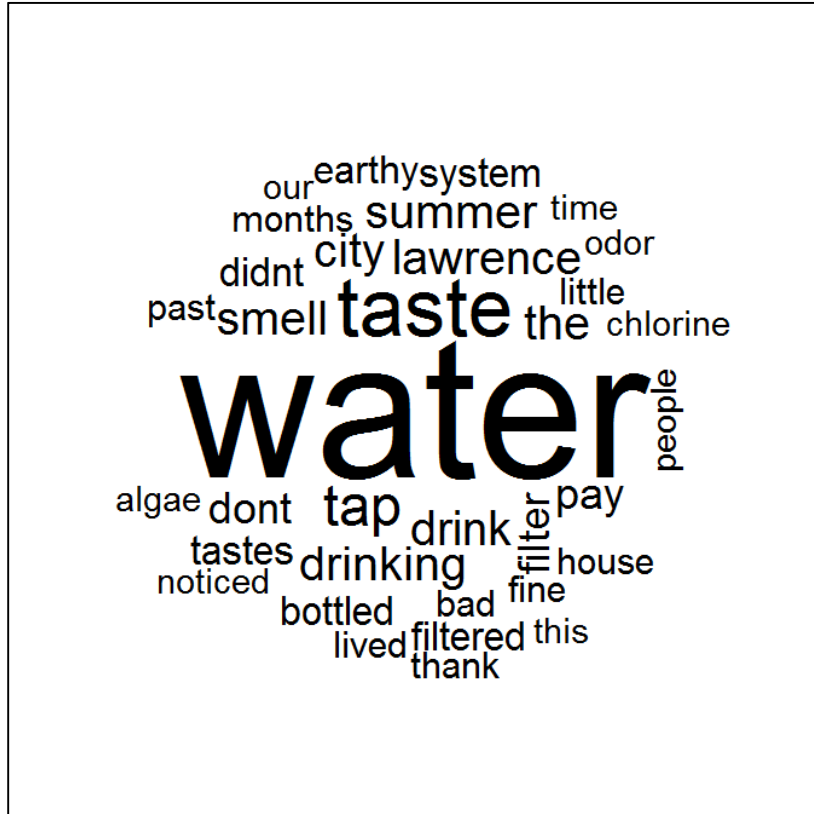
Text mining involves treating written documents as information and systematically analyzing them by, for example, identifying frequently used terms, finding associations between terms, and grouping similar documents. Before analyzing the comments, the City Auditor corrected spelling errors, removed an individual's name included in one comment, and removed one comment that was significantly longer than other comments and focused on describing a trade-marked water treatment process. Text mining was then used on 105 individual comments.

Table 27 Frequent terms in written comments

| Most frequent terms in respondents written comments | | | |
|---|----------|--------|--------|
| algae | bad | bottle | change |
| chlorine | city | didn't | don't |
| drink | earthy | filter | fine |
| house | Lawrence | level | little |
| live | month | notice | odor |
| our | past | pay | smell |
| summer | system | tap | taste |
| thank | the | time | water |

A wordcloud illustrates similar analysis of the frequency of individual words in the written comments. The wordcloud shows terms used at least six times.

Figure 7 Wordcloud of frequent terms in comments



Text analysis allows comments with similar words to be clustered together. The written comments were put into nine groups using a method called “k-means.” Several of the clusters include just one comment.

Table 28 Written comments

| Cluster label | Comments |
|---------------|---|
| A | I don't like the smell when the water is "earthy" |
| | I drink tap water every day and have found it to taste just fine. |
| | We have been drinking filtered tap water for several years now. |
| | I have lived here for 26 years. I fear that there are amoeba or other dread animals in the smelly water. It makes me nervous to drink it or make coffee with it! |
| | Too high of the levels of Chlorine, and chloramine. |
| | Pretty good compared to other municipalities. |
| | Just moved back to town 2 months ago. |
| | Too much chlorine taste. |
| | Good job. |
| | Our tap water is pretty good compared to other places. I do remember the earthy taste, but it was no big deal. |
| | We tested the ppm of the sediments and particulates in the water coming out of our faucet and it was over 500 ppm at one test. It was over 250 ppm on every other test we did. This is totally unacceptable. |
| | DO NOT PUT FLUORIDE IN OUR WATER. IT'S TOXIC~~~!!! |
| | My only comment is about the use (or misuse) by the city commissioners of limited financial resources. In these harsh economic times, it would seem prudent to invest in infrastructure such as water and sewage services, roads, etc. as opposed to elaborate field houses. In other words: fix the stuff that is broke before you buy new stuff to break. |

| | |
|---|---|
| | Always bad a few months in summer...but better in winter. |
| | Great deal for the money. We are lucky |
| | Our water never did get that bad taste some people were talking about |
| | Really what bothers me is the fluoridation, the run off of pesticides and pharmaceuticals in the water. Taste is one thing, but chemicals are another. |
| | Tastes OK. Filtered is better, but not a deal breaker. 100x better than Garnett, KS, but not near as good as Emporia, KS. |
| | I wasn't in Lawrence during the summer so I can't comment on that stuff. |
| | I have a water filter for several years so it is really hard to judge the taste |
| | Don't increase water rates! |
| | We have had a water main break in front of our house on three occasions and have appreciated the immediate response by the on-call repair team as this has happened only at night and on a weekend or holiday. Thank you. |
| | USUALLY PRETTY GOOD. I OCCASIONALLY HAVE NOTICED AN UNPLEASANT TASTE/SMELL, BUT OVERALL GOOD. |
| | Please stop putting fluoride in the water... http://www.fluoridealert.org/issues/health/cancer/ |
| | Thank you for the new trash containers. I hope the City can work out a curbside recycling program, too. |
| | Get the fluoride out of our water!!!! |
| | No problems. Good water. |
| | We still get red algae stains in our toilet and shower. |
| | I would rather drink my own urine before drinking your tap water. |
| | I think the chlore smell of the water is very strong at some occasions. |
| | Water is fine. Wastewater charges are outrageous. |
| | Our only concern is odor. We observed bad odor again last week. |
| | Gatorade is better. |
| | A bit pricey for combined waste/sewage/water but good service. |
| | This isn't about the taste, but I'd like to know how water use and waste are calculated. It might be a helpful publication. Also, I think it would be great if the results of this survey were published. |
| B | My attitude toward the water service has been recently adversely affected by the mandatory city wide participation in the newly purchased trash carts. Since I recycle most of my refuse, I didn't want the cart but was told if I didn't comply, the city would turn off my water. Since that is not liberty of consumer choice, what is it? A word comes to mind. |
| C | compared to the water in our retirement home in Mississippi your water is great. A little hard but then it comes out of the river. No problem. |
| | We buy bottled water for convenience only. Maybe three cases of 16.9 a year. I think our city rates for water/trash are very expensive, and as a residence that uses little water and generates a small amount of trash, I feel we have to pay extra for others use and abuse. |
| | I purchased a water filter for our kitchen sink (the one we use for nearly 100% of our drinking water) about 8 years ago because I found the levels of toxins and other materials found in the city water unacceptable. |
| | Still have times when the water is turned and it smells like the sewer. Goes away after running for awhile...wasting water. |
| | I lived in Lawrence for over 35 years and drank tap water - I was back home for a day in early July but do not remember if I drank any water at my dad's house. I pay his water bills now and will continue until the house is sold. |
| | Several of my friends who live southeast of 23rd and Wakarusa complained about the water this past summer. I live near 15th and George Williams Way and I never experienced a problem with the City's water. |
| | If we didn't already have a filtering system in our home we would have purchased bottled water while the nasty smell and odor lingered in the water. |
| | I don't think you should put fluoride in the water. It's harmful to human health. I grew up on well water and have not ever had a cavity. Also during the drought why didn't the city ration water or ask or require people to reduce their usage? |
| | No particular comments about the taste or smell of the water. I do think water is very expensive in Lawrence. |
| | This past summer wasn't the first time for the taste/smell problem. We've been experiencing it in West Lawrence for several years, winter/summer. I called at first, and I was always given the same |

| | |
|---|---|
| | <p>"explanation," no matter what season: algae. I was told the water was safe to drink. But the smell and taste is nauseating, so we switched to bottled water. I stopped calling.</p> <p>I have found that the water is too hard and am considering adding a whole home water softener solution.</p> <p>I really wish that the city could enforce watering standards for the summers and times when we are in a drought. It is unreasonable for people to water in the heat of the day, and as often as many do during a drought.</p> <p>Water and sewer charges already seem too high and I would rather not pay a large extra fee to reduce to smell or taste of the drinking water.</p> <p>The worst tap water I've encountered in Lawrence is on the KU campus. I assumed it's the pipes there. Our home water is sometimes a little off-tasting and/or smelly but not as bad as the water on campus. Often the water smells and taste like moss. We distill all of our drinking water.</p> <p>We have a water filtration system on our whole house that takes out sediments and chlorine and we have a reverse osmosis system on our kitchen sink to use for drinking water, so we really do not know how the city water tastes.</p> <p>Fortunately I did not experience the 'earthy' water this summer. I do set my water out to let the chlorine dissipate before drinking as it is very strong to me - all the while understanding this is necessary to kill some of the bacteria, etc. I am thankful for the print out sent with the annual (?) water tests results. Thank you for providing our community with water and tending to the waste and storm run off.</p> <p>I use a reverse osmosis system in my house and only drink the water dispensed from this system. It comes out at the fridge. I cook, shower, and do laundry with unfiltered city water. There is a water softener in the house.</p> <p>It is obvious the improvements that have been made regarding our water, and very much appreciated. I thank you for that. This summer the water was so much better than it was in past years under the same condition. Again thank you for your hard work.</p> <p>We appreciate city drinking water. It's a valuable asset that people take for granted. Thank you for the work you do to keep our city's water potable.</p> <p>Compared to water I have tasted elsewhere and I travel a lot and internationally, the water here is better than most places. I will not drink Olathe's water as an example.</p> <p>I've never been a fan of drinking tap water. My family used to buy bottled water, but gave it up because of the expense and the impact on the environment. We now use a water filtration system and we are satisfied.</p> <p>My water has been turned off for nonpayment without any warning whatsoever, when I have little children in the house. After I had paid my bill in full, getting it turned back on was VERY difficult, frustrating, and needlessly costly. VERY dissatisfied, not with water quality, but with customer service.</p> <p>I lived in St Louis where the water is constantly voted as the best and am moving to Chicago where the water is some of the worst. Lawrence water is fine unless there is an algae bloom - but nature gets in the way.</p> <p>The drinking water is great to me. I lived in Chapel Hill NC for about 4 years, and the water quality here is much better. I lived in Asheville NC for about 25 years, and the quality was similar. I wouldn't say the water service is a great value, but it is good water.</p> <p>The water has a heavy mineral taste and there is a white powder in the water. This discourages me from drinking a large amount of the tap water.</p> <p>Thanks for looking into this. While I drink tap water often and am completely satisfied, I also think we need to continue to reduce the number of other people who rely on bottled water. So anything you do to convert the bottle drinkers I applaud you!</p> <p>I prefer not to drink the water out of the faucet directly, I cannot stand the taste of the water unless it is filtered. It leaves an aftertaste in your mouth, which is not something I would expect out of my water.</p> <p>We are concerned about trace pharmaceuticals in the drinking water, particularly synthetic hormones from birth control pills. For this reason, we have recently started to filter our water.</p> |
| D | <p>We were gone the months of June and July of 2012. I do have a comment about the cost I have to pay trash, wastewater while I am gone. We have been gone up to 5- 7 months at a time. The water is turned off so we don't pay for that but have to pay full price for all the rest. It would be nice if you had a plan that we could pay 1/2 or a %. Would like to hear from you on this matter. I answered your questions please answer mine. Thank You</p> <p>Please find a way to pay 'City of Lawrence' bills online without a third party fee. You are the sole remaining bill I have that I still write a check for. Not very 'green' of us.</p> <p>Not regarding the taste, but my biggest problem is the fact that I must pay extra to make a payment online. I'm not sure what year it is in the City of Lawrence office building (I'm guessing around 2000 or 2001), but out here, its 2012 and typically, companies do not require customers to make a 'payment fee' to pay online. Just a thought...</p> <p>Besides the not-too-clear water, I'm most dissatisfied with having to pay an extra three dollars or so in order to make a payment online. Obviously, many people pay many bills online. I don't want to make the time to pay in person or order new checks that I would only use to make payments to my water bill. This is insane.</p> |
| E | <p>Have used either bottled water or a filter for almost 40 years. The tap water makes poor tea, coffee, soups, and drinking water. From all the folks we know in Lawrence, few drink tap water. The taste is poor year-</p> |

| | |
|---|---|
| | <p>round. Always has been.</p> <p>We use a PUR filtration system we fill in the sink and store in the refrigerator. Recently the filter acted as though it needed replacing much sooner than it should have. The FAQs mentioned this possibly due to construction or water system work. We live at 5th & Ohio. Has anything happened in the last weeks that could be cause for the filter being used up quicker than usual? Thanks. (I don't mind drinking the water from the tap either. I think Lawrence is blessed to have good water, just feel like there might be contaminants not affecting smell or taste that would be better to have filtered out) Also---previously submitted incomplete survey.</p> <p>I don't drink a lot of water from the tap. but I've never found it objectionable. I drink a lot of coffee and tea, both made with tap water, and we use tap water in some of our cooking. I just missed the "earthy" taste of June and July 2012.</p> <p>I didn't answer the customer satisfaction survey because I wasn't sure what drinking water it was indicating. If it meant the bottled water I drink then I am completely satisfied. If meant the water out of the tap I don't drink it because it smells like fish and I don't trust it.</p> <p>Because of the taste of the water before and after the months of June and July 2012, we always filter the water to avoid less than pleasant tastes and odors. We even provide filtered water to our dog because we do not know what might be in the municipal water supply. I grew up drinking rural well water and I can tell a major difference between it and what the City of Lawrence produces. While it may be fine for watering, bathing and laundry, I do not want to drink it. It might simply be a matter of the pipes in the area having issues, but there is a constant taste and odor problem.</p> <p>I have a reverse osmosis system and I use it for drinking and cooking. Had I not had this system in place I would have purchased a "Brita" type filter and/or bottled water to drink. I did cut back on length of showers and watering the garden due to the ongoing drought not because of the taste or smell of the water.</p> |
| F | <p>Something changed in the taste of the water, and I do not believe it is back to where it was a year ago. I know use tap water to fill my Brita filter and exclusively drink the filtered water. It would be easier to get the "old" taste back.</p> <p>We have filtered our water for years, otherwise it tastes too much like chlorine for our tastes. Also there is more Calcium than I need in most tap water, but I cannot filter that out as easily.</p> <p>My water didn't really experience any long term effects- just several days of an odd odor that I def. noticed. However, my parents live on Jasu Dr (66046) and their water has definitely developed a different taste in the last few months that has not gone away. It doesn't taste bad- but it doesn't taste like "Lawrence" water out of the kitchen or bath facets- we have all noticed it. It's odd, but not impossible to drink.</p> <p>The tap water tastes pretty terrible and even smells a little now and then. However, once it's filtered, it tastes fine.</p> <p>I didn't notice the "earthy" taste. I can't taste a difference between bottled water and tap water.</p> <p>I never thought that the water had a funny taste last summer. I think that the city's tap water tastes great! Keep up the good work!</p> <p>all tap water tastes basically the same to me so this survey is a little silly. Taste depends a little on the plumbing of the house also, right?</p> <p>Lawrence's water tastes pretty awful. It has been a little better the past year, but I find it still tastes like chemicals. It has improved, but it is the worst water out of all the places I have lived (and I have lived in about 15 different places). It seems like it is the worst when it is the most hot and dry, so at least it is better in the fall/winter/spring.</p> <p>Occasionally, the water comes out of the tap smelling like fish or really bad river water and has a horrible almost a metallic taste. Most recently, it happened for about two weeks just after Thanksgiving. I'm not sure if this is what the survey refers to as an "earthy taste" but it happens way more often than just in the summer.</p> |
| G | <p>The algal blooms significantly affect the taste and smell of the tap water.</p> <p>I have always used a filter on my water, so the summer "bad taste" doesn't change what I normally do.</p> <p>I did not notice a difference in taste or smell.</p> <p>Never noticed any "earthy" smell or taste. Don't know what the big deal is.</p> <p>The bad taste issue seems to be a recurring summer event. In addition to 2012 I remember it happening in either 2010 or 2011, possibly both. I don't know if it's fixable, but it is certainly inconvenient.</p> <p>The mineral deposits are very high which are contributing to the fowl taste. Much needs to be done to address this serious issue in Lawrence.</p> <p>The musty smell this past summer appears to be seasonal. Hopefully the city of Lawrence can't prevent the next occurrence.</p> <p>I didn't notice the funny taste. The water has always been fine for me.</p> <p>Usually the smell and taste of the water is fine, but it several times a year the smell and taste are *very* unpleasant. I believe it is usually attributed to algae.</p> <p>I've noticed that water starts to taste earthy after it has sat for a few hours.</p> <p>I've used a water filter since I moved to Lawrence, so I didn't noticed any change in the taste or smell over the summer.</p> |

| | |
|---|--|
| | <p>I always filter my water with a Brita pitcher, so I didn't notice any change in it this summer.</p> <p>I'm concerned with the ongoing drought, and summertime problems concerning algae and taste. Obviously, if its increased the deer kill in Douglas Co, its a real concern. I don't see how Lawrence can go through another dry winter and hot summer without putting some watering restrictions in place.</p> <p>Sometimes I feel that the water has a chlorine taste and smell higher than normal.</p> <p>I think we have great water except during the summer the last few years. Hard to believe we live in a city and that is a continual issue for multiple years. I would think that would only occur in a small rural area with very limited resources. Very disappointing in the summer!! My answers are based off the summer months for the past few years. I would mark satisfied, if going off the other months of the year.</p> <p>The water during the Summers between 2010-2012 had a very strong taste and smell of algae.</p> <p>Most of the time it is fine. The earthy taste described in June/July 2012 came also with an unpleasant odor that made bathing unpleasant as well.</p> <p>Sometimes the water doesn't taste good, but it's not usually that noticeable.</p> <p>The flavor is chalky like there is a lot of limestone in it or some other chalk-flavored minerals/chemicals, but there is not enough iron to counteract the chalk flavor. Our filter pitcher does a fair job of amending that flavor-issue most of the time. Depending upon the part of Lawrence one lives, the taste of the water changes.</p> <p>Didn't notice the change in taste this past summer.</p> |
| H | <p>I used Lawrence tap water (once) for a ten gallon aquarium. Two goldfish died inside of 48 hours. I used filtered water for the same ten gallon tank and the fish had no problem. I don't have time to test sodium levels or iodine levels or mercury levels or heaven knows what other level in the city water supply. I drink many liters of water per day, am very physically active. I require clean water with no long term issues. I feel filtered water and bottled water is my only insurance.</p> |
| I | <p>What if you treated the water with the "new water" system: New Water™ is a "new science" water system not to be confused with typical alkaline or ionized water treatment systems. The New Water™ system is designed to eliminate bad bacteria in your body by imprinting cancellation frequencies in the water sources which are used to produce New Water™. Through study of many of the previous water investigations and extensive work in the frequency field, New Water™ stands apart from all other water systems. Current pH adjusting water systems have been around for many years and the concentration of those studies push towards the conclusion that by increasing your body's pH these diseases will be killed. We disagree! New Water™ is a new generation water system, which is designed to remove bad bacteria from your body's immune system. We use very specific frequencies, which are programmed into New Water™ to kill/remove these bad bacteria. Once the body's accumulated bad bacterial have been removed or significantly reduced, the body can heal itself as it is designed to do. New Water™ DOES NOT CURE ANY DISEASE. New Water™ does remove bad bacteria, which supports various diseases. With improvement in your immune system, your body can heal itself. New Water™ has been utilized for over 5 years after initial studies were completed. The water has been tested by water qualification laboratories and found to improve various city water systems, which were the source water for the production of New Water™. The New Water™ system actually improves the source water coming through the system. The improvements come from a special water filter contained at the initial input point of the source water into the New Water™ system. Further improvements 2 also come from the processing of New Water™ through a special chamber with a major frequency, which virtually kills any living bacteria in the water. This killing or removal of "bacteria memory" from the water that is coming through the New Water™ system is unique. Other water systems, which include "Water Filters", only take out large particles from the water source and do not address the bacteria coming through the system. Filters are just that...Filters! The final significant improvement and major difference from any other water system is a proprietary array of very special frequencies, which are programmed and imprinted into the water Other systems, which are pH adjusting systems change the pH, but do not address the bacteria coming into the system from the water source. Some bacteria are not killed or removed by just pH adjustment. The pH adjustment systems can also be a potential hazard, in some systems, due to the ability of individuals to program a higher pH than is good for the human body. There have been instances where people have become very ill from utilizing the pH adjusting systems through thinking that if the pH is adjusted a little higher it will improve the body's condition faster and yet increasing the waters pH too high will cause extreme injury or worse to those individuals drinking it. Ionized water is also a water modification, which addresses some of the problems with source water but through significant waste of water and the inability for the ionization process to eliminate bacteria, it too falls short of the New Water™ system. Again the focus of New Water™ is to remove/kill the bad bacteria in the body, which in turn improves the immune system and helps the body to eliminate any diseases which one might picked-up from just living. Through years of working with people, health consultants and watching and hearing all of the anecdotal evidence it is clear that the New Water™ system has many positives going for it. Not only have many people's health improved but their pet's health has improved also. 3 Bad bacteria are our primary target for removal. Your immune system improvement is how we can potentially improve your overall health and well-being utilizing the advantages of New Water™ in your daily life.</p> |

Performance Audit: Managing the Taste of Water

Management's Response



City of Lawrence KANSAS

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January 28, 2013

Mr. Michael Eglinski
City Auditor
City of Lawrence, Kansas

Re: *Draft Performance Audit: Managing the Taste of Water*

Dear Michael,

Thank you for your draft performance audit on managing the taste of water. City staff, including staff from the Department of Utilities, reviewed the draft report. We agree overall with the findings of the report which indicate that the Department has developed a process to manage taste and odor problems. We also agree on the communication recommendations which you make in your report. Staff believes that these recommendations can be implemented in the future, with some recommendation implementation dependent upon taste and odor events in the future.

The customer survey conducted in your report is valuable. While taste and odor events are generally infrequent, a significant number of City customers (approximately 1 in 5) report unpleasant tastes. Staff believes it is necessary and appropriate to prioritize this water treatment need with all other water and wastewater needs identified in the City's recent water/wastewater master plan. Staff has developed a number of funding scenarios which the City Commission should consider in prioritizing utility projects – and the necessary rate increases to support those projects. Taste and odor treatment options should be compared with all other utility department needs – infrastructure maintenance, building additional capacity allowing for future community growth, and regulatory requirements. Staff estimates that enhanced treatment – which increases the likelihood that taste and odor problems can be successfully mitigated – will cost approximately \$9 million per water treatment plant, or approximately \$18 million. I believe your report and survey highlight the relative importance of this project along with other necessary water infrastructure needs.

Sincerely,

David L. Corliss
City Manager

