TTHM Reduction Corrective Action Update

1st Progress Meeting

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Tri County Joint Municipal Authority background

- Why are we here?
  - Stage 1 Disinfection Byproduct Rule (2004)
  - Stage 2 Disinfection Byproduct Rule (Monitoring 2013)
    - Public Notifications

IMPORTANT INFORMATION ABOUT YOUR DRINKING WATER

Este informe contiene informacion muy importante sobre su agua de beber. Traduzcalo o hable con alguien que lo entienda bien.

Tri-County Joint Municipal Authority Has Levels of Total Trihalomethanes (TTHMs) Above Drinking Water Standards

Our water system recently violated a drinking water standard. Although this incident was not an emergency, as our customers, you have a right to know what happened and what we are doing to correct this situation.

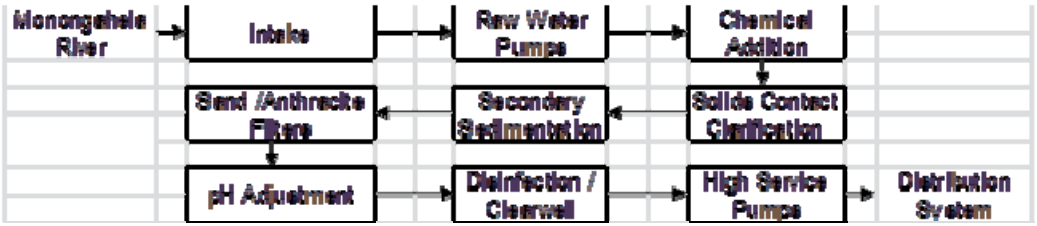
We routinely monitor for drinking water contaminants. Our latest results show that our system exceeds the maximum contaminant levels (MCLs) for TTHMs. The standard for TTHMs is a Locational Running Annual Average (LRAA) of 0.080 mg/L. This is an average of the four most recent quarterly samples at each monitoring location used to determine compliance. The LRAA for TTHMs at all four of our monitoring

Tri County Joint Municipal Authority background

- TCJMA System
  - Service Area
    - East Bethlehem Township
    - Centerville Borough
    - West Pike Run
    - Luzerne
    - North Bethlehem Township
    - Somerset Township
    - Deemston Borough
    - California Borough
    - Beallsville
  - Five (5) Pressure Districts

Tri County Joint Municipal Authority background

- TCJMA System
  - Millsboro / Fredericktown WTP
    - Ice Plant
    - Originally constructed in 1921
    - Significant renovations in 1940 and 1952



Tri County Joint Municipal Authority background

- 2015 Administrative Consent Order and Agreement
  - eDMR for NPDES Compliance
  - Back Record Updates
    - Withdrawal Records
    - Primary and Sub-facility Reports
  - Drought Contingency Plan
  - Corrective Action Plan - Unaccounted Water Reduction
  - Filter Repairs
  - Corrective Action Plan - Disinfection By Products (DBP)

Tri County Joint Municipal Authority dbp reduction

- Stage 2 Disinfection By Product Rule
    - Four (4) monitoring locations
    - Locational Running Annual Average (LRAA)
    - Contributing Factors
        1. pH
        2. Temperature
        3. Detention Time (water age)
        4. Organic Concentration (Precursors)
        5. Free Chlorine Residual

Tri County Joint Municipal Authority dbp reduction

- Stage 2 Disinfection By Product Rule
    - Haloacetic Acids (60ppb or 0.06mg/L)
        - Monochloroacetic Acid
        - Dichloroacetic Acid
        - Trichloroacetic Acid
        - Monobromoacetic Acid
        - Dibromoacetic Acid

The sum of the concentrations in milligrams per liter of the Haloacetic Acid compounds rounded two significant figures after addition. Haloacetic Acids include the family of organic compounds named as a derivative of acetic acid, wherein one of the three hydrogen atoms in the methyl group in acetic acid are each substituted by a halogen atom (namely chlorine and bromine) in the molecular structure.

Tri County Joint Municipal Authority dbp reduction

- Stage 2 Disinfection By Product Rule
- TABULATED LRAA RESULTS

	Site	HAA5
3/20/2015	701	0.0285
	702	0.0350
	703	0.0275
	704	0.0409
6/19/2015	701	0.0200
	702	0.0270
	703	0.0222
	704	0.0406
9/18/2015	701	0.0154
	702	0.0113
	703	0.0156
	704	0.0193
12/18/2015	701	0.0450
	702	0.0376
	703	0.0354
	704	0.0472
3/20/2016	701	0.0530
	702	0.0515
	703	0.0439
	704	0.0482
6/17/2016	701	0.0442
	702	0.0370
	703	0.0325
	704	0.0444

Tri County Joint Municipal Authority dbp reduction

- Stage 2 Disinfection By Product Rule
    - Total Trihalomethanes (80ppb or 0.08mg/L)
        - Trichloromethane (Chloroform)
        - Dibromochloromethane
        - Bromodichloromethane
        - Tribromomethane (Bromoform)

The sum of the concentrations in milligrams per liter of the Trihalomethane compounds rounded to two significant figures after addition. Trihalomethanes include the family of organic compounds named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen in the molecular structure.

Tri County Joint Municipal Authority dbp reduction

- TABULATED LRAA RESULTS

	Site	Chloroform	Bromoform	Bromo-Dichlor	Chloro-Dibro	TTHM	LRAA
3/20/2015	701	0.0327	0.0000	0.0095	0.0021	0.0443	0.1020
	702	0.0502	0.0000	0.0113	0.0018	0.0633	0.1032
	703	0.0377	0.0000	0.0104	0.0020	0.0501	0.0914
	704	0.0604	0.0000	0.0123	0.0023	0.0750	0.1298
6/19/2015	701	0.0398	0.0028	0.0321	0.0218	0.0965	0.0919
	702	0.0506	0.0035	0.0470	0.0280	0.1291	0.0998
	703	0.0464	0.0030	0.0366	0.0241	0.1101	0.0833
	704	0.0692	0.0027	0.0452	0.0250	0.1421	0.1164
9/18/2015	701	0.0366	0.0179	0.0456	0.0549	0.1550	0.0877
	702	0.0234	0.0255	0.0388	0.0566	0.1443	0.0971
	703	0.0329	0.0212	0.0460	0.0568	0.1569	0.0930
	704	0.0484	0.0170	0.0519	0.0561	0.1734	0.1130
12/18/2015	701	0.0618	0.0000	0.0302	0.0087	0.1007	0.0991
	702	0.0687	0.0000	0.0284	0.0078	0.1049	0.1104
	703	0.0558	0.0000	0.0262	0.0075	0.0895	0.1017
	704	0.0752	0.0000	0.0297	0.0075	0.1124	0.1257
3/18/2016	701	0.0410	0.0000	0.0150	0.0020	0.0580	0.1025
	702	0.0410	0.0000	0.0040	0.0170	0.0620	0.1101
	703	0.0400	0.0000	0.0160	0.0030	0.0590	0.1039
	704	0.0440	0.0000	0.0180	0.0040	0.0660	0.1235
6/17/2016	701	0.1180	0.0000	0.0271	0.0059	0.1510	0.1162
	702	0.0720	0.0000	0.0259	0.0079	0.1058	0.1043
	703	0.0649	0.0000	0.0293	0.0118	0.1060	0.1029
	704	0.1110	0.0000	0.0309	0.0067	0.1486	0.1251

Tri County Joint Municipal Authority dbp reduction

- USEPA Operational Evaluation Guidance for the Stage 2 DBPR
  - Operational Evaluation Reporting
    - TTHM and HAA5 Sample Collection and Handling
    - Distribution System Evaluation
    - Treatment Process Evaluation
    - Source Water Evaluation

Tri County Joint Municipal Authority dbp reduction

- TTHM and HAA5 Sample Collection and Handling
  - 3rd Party Laboratory Service
  - EPA Approved Analytical Methods
  - *There is no reason to believe that the handling of samples contributed to any exceedance.*

Tri County Joint Municipal Authority dbp reduction

- Distribution System Evaluation
  - 100% Metered System
  - Pumping Facilities
    - SCI PS
    - Vestaburg PS
    - Ridgewood PS*
    - Fishpot PS
    - Deemston PS
    - Denbeau Heights PS

**Boost Chlorination facility*

Tri County Joint Municipal Authority dbp reduction

- Distribution System Evaluation
  - Storage Facilities
    - Milfred Terrace Ground Reservoir 2.50 MG
    - SCI Elevated Tank 1.00 MG
    - Vestaburg Standpipe 0.50 MG
    - Scenery Hill Elevated Tank 0.50 MG
    - Richeyville Elevated Leg Tank 0.25 MG
    - Malden Elevated Leg Tank 0.17 MG

Tri County Joint Municipal Authority dbp reduction

- Distribution System Evaluation
    - Scenery Hill
        - Designed to satisfy unrealized demand
            - Development
            - Cokeburg
            - Consol Energy Mine Facility
        - Flushing
        - Rice Energy Bulk Water Permits

Tri County Joint Municipal Authority dbp reduction

- Distribution System Evaluation
  - *The distribution system inherently contributes to the formation of disinfection byproducts. In addition to typical contributing factors, the lack of mixing in the water storage tanks is suspected to be an issue, particularly in the case of the Milfred Terrace Reservoir and Scenery Hill Tank.*
  - *The lack of demand in the Scenery Hill area is a major contributing factor. TCJMA is investigating measures to encourage development and consider possible service area reorganization to more efficiently and effectively move water through this area of the distribution system.*

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Pre-Oxidation
  - Pre-Disinfection
  - Coagulation
  - Solids Contact Clarification
  - Secondary Sedimentation
  - Filtration
  - Fluoridation
  - pH Adjustment
  - Disinfection

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Pre-Oxidation
    - Taste &Odor*
    - Iron & Manganese
    - Potassium Permanganate ($KMnO_4$)

**TCJMA also feeds powdered activated carbon (PAC) for T&O*

  - Pre-Disinfection
    - Chlorination
    - Minimize as much as possible

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Coagulation
    - DelPac 2020 (Aluminum Chloride Hydroxide Sulfate)
    - Monitor for optimum pH and dosage
  - Solids Contact Clarification
    - Manage solids accumulation
  - Secondary Sedimentation
    - Contact time for chemical reaction

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Filtration
    - Two (2) filters with two (2) beds per side
    - Dual Media - Sand & Anthracite
    - 2016 Filter Project
      - Filter #2 Reconstructed
      - Filter #1 Rehabilitated
    - Backwash
      - Pump replaced in 2014
      - Flow meter installed in 2016
    - Developing SOP for operation and inspection of filters.

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - pH Adjustment
    - Caustic soda (increase)
    - Injected at clearwell entry point
  - Disinfection
    - Free chlorine
    - Injected at clearwell entry point

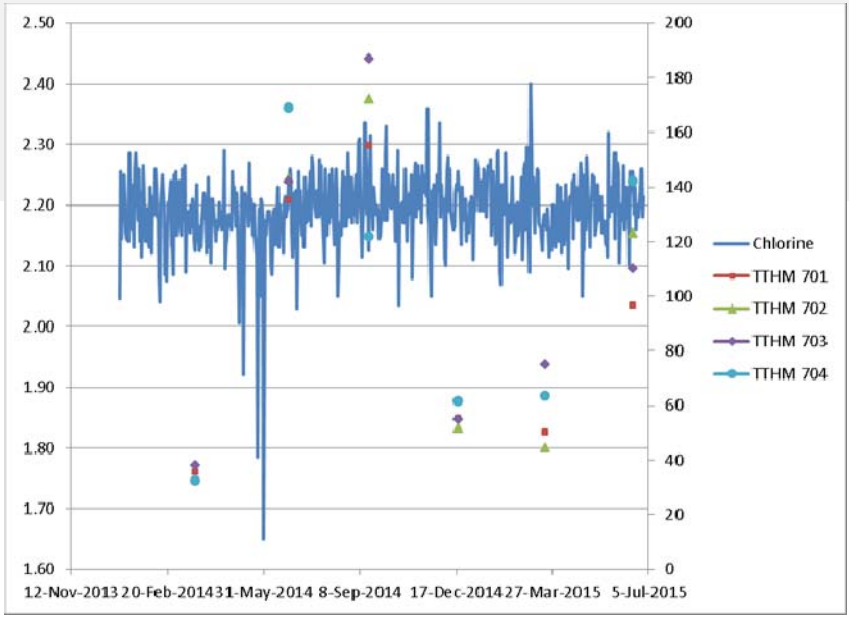
Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Disinfection
    - Clearwell
      - Minimum required contact time (CT)
      - Significant impact on efficiency & compliance
      - 2007 Tracer Study
      - Baffling Factor = 0.22 (“Unbaffled” to “Poor”)

Temperature	Flow Rate	pH	Residual Chlorine	Baffling Factor	Log Reduction (Giardia)
22 deg C	1200 gpm	8.0	2.0 mg/L	0.22	0.87
22 deg C	1200 gpm	8.0	2.0 mg/L	0.50	1.98
22 deg C	1200 gpm	8.0	1.0 mg/L	0.50	1.10
22 deg C	1200 gpm	8.0	1.0 mg/L	0.80	1.75

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Disinfection
    - Chlorine (mg/L)
    - TTHM (ppb)



Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation
  - Corrosion Control
    - Langlier Index (pH, TDS, Alkalinity, Calcium, Temperature)
      - Negative – Corrosive
      - Neutral – Ideal
      - Positive – Scaling
    - pH between 8.0-8.5

Tri County Joint Municipal Authority dbp reduction

- Treatment Process Evaluation

- *The treatment system seems to have contributed to the operational exceedance due to clearwell deficiencies and resulting chlorination practices. It is necessary for TCJMA operators to carefully monitor parameters related to chlorine feed and disinfection contact time in order to maintain minimum reasonable levels.*

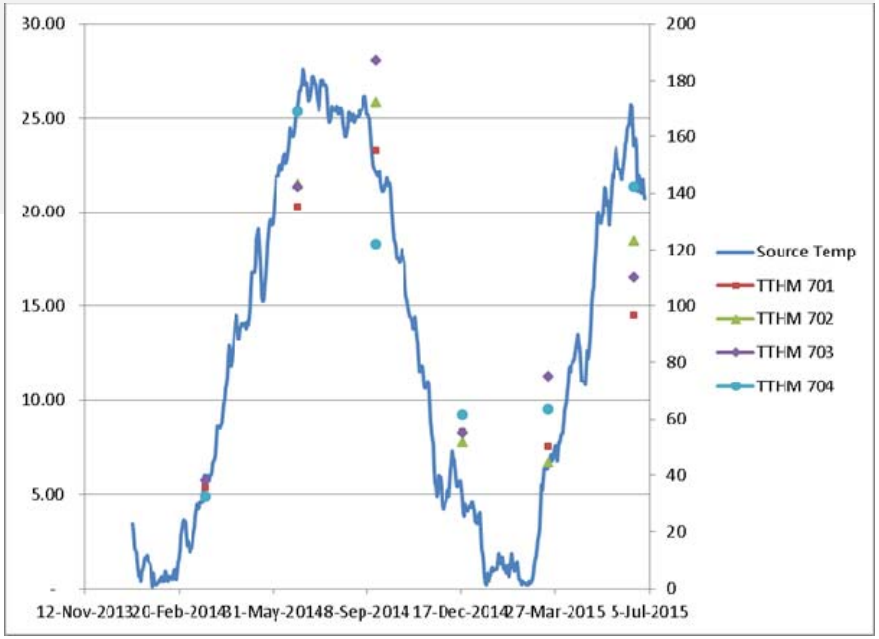
- *The adjustment of pH associated with corrosion control is further contributing to these difficulties.*

Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation
  - Temperature
  - Turbidity
  - Total Dissolved Solids (TDS)
  - pH
  - Alkalinity

Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation
  - Temperature
    - Temp (deg C)
    - TTHM (ppb)

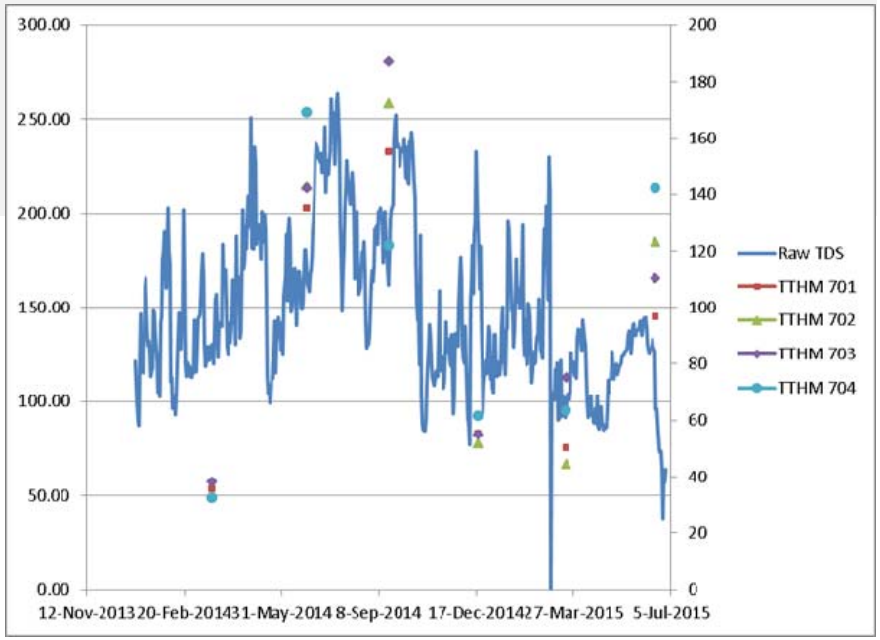


Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation
    - Turbidity
        - Influences
            - Upstream reservoir turnover
            - Wet weather
        - Dilution / concentration of precursors

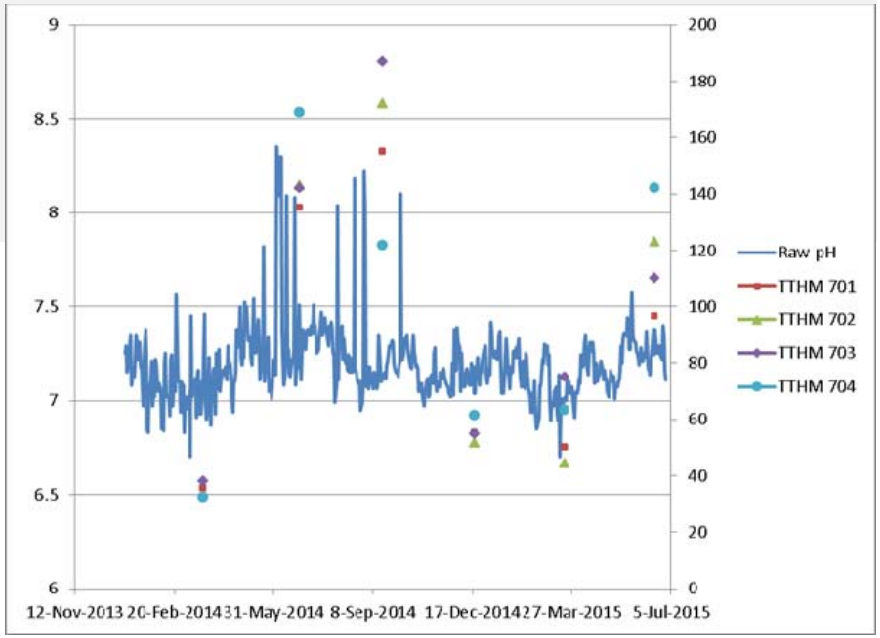
Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation
  - Total Dissolved Solids (TDS)
    - TDS (mg/L)
    - TTHM (ppb)



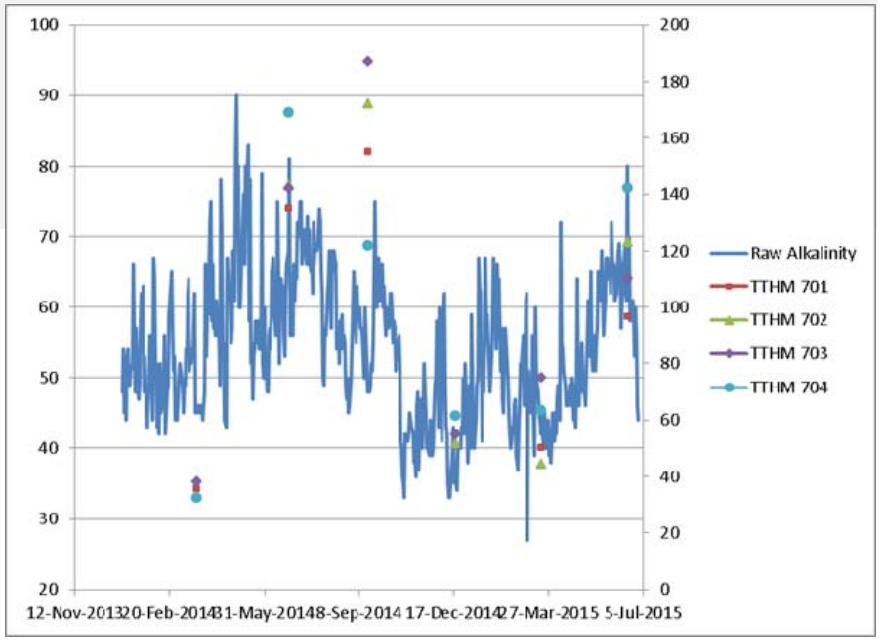
Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation
  - pH
    - pH (SU)
    - TTHM (ppb)



Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation
  - Alkalinity
    - Alkalinity (mg/L $CaCO_3$)
    - TTHM (ppb)



Tri County Joint Municipal Authority dbp reduction

- Source Water Evaluation

- *Several source water parameters appear to have contributed to the operational exceedance. Increased source temperature, raw water alkalinity and (to some extent) TDS parallel elevated TTHM results.*

Tri County Joint Municipal Authority dbp reduction

- Additional Upstream Water Quality Concerns
  - 2-methylisoborneol (MIB) and Geosmin
  - Mine drainage
  - Bromide
  - Radioactivity

Tri County Joint Municipal Authority dbp reduction

- Corrective Action Plan (CAP)
  - Categories
    - Water Treatment Plant
    - Distribution System

Tri County Joint Municipal Authority dbp reduction

- Proposed Corrective Actions – Water Treatment Plant
  - Adjust Potassium Permanganate dosage for greater reliance in regard to pre-oxidation of organics and algae control
  - Complete filter repair / rehabilitation project
  - Minimize pre-filtration chlorine dose
  - Install clearwell baffle system
  - Install post-clearwell THM removal system
  - Initiate follow-up tracer study
  - Reduce disinfection chlorine dose and rely upon boost chlorination to maintain residual at system extents
  - Relocate chemical injection point for pH adjustment to post-clearwell

Tri County Joint Municipal Authority dbp reduction

- Proposed Corrective Actions – Distribution System
  - Install mixing system at Milfred Terrace Reservoir
  - Install mixing system at Scenery Hill Tank
  - Reconstruct Beallsville PRV facility
  - Demolish Suzy Ln PS
  - Install chemical feed / monitoring equipment as-required for implementation of chloramines at the Ridgewood PS
  - Consider installation of automatic flushing devices at strategic locations
  - Continue discussions in regard to interconnections with other public drinking water systems in the Scenery Hill area

Tri County Joint Municipal Authority dbp reduction

- Summary
  - Status of Current Corrective Actions
    - CAP approved by PADEP
    - Permits issued for all proposed projects
    - WTP Meter Project – COMPLETE
    - Filter Repairs - COMPLETE
    - Milfred Terrace Reservoir – Notice to Proceed issued
    - THMR System – Notice to Proceed issued
  - Goal to complete late-2017

Questions?

Tri County Joint Municipal Authority

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