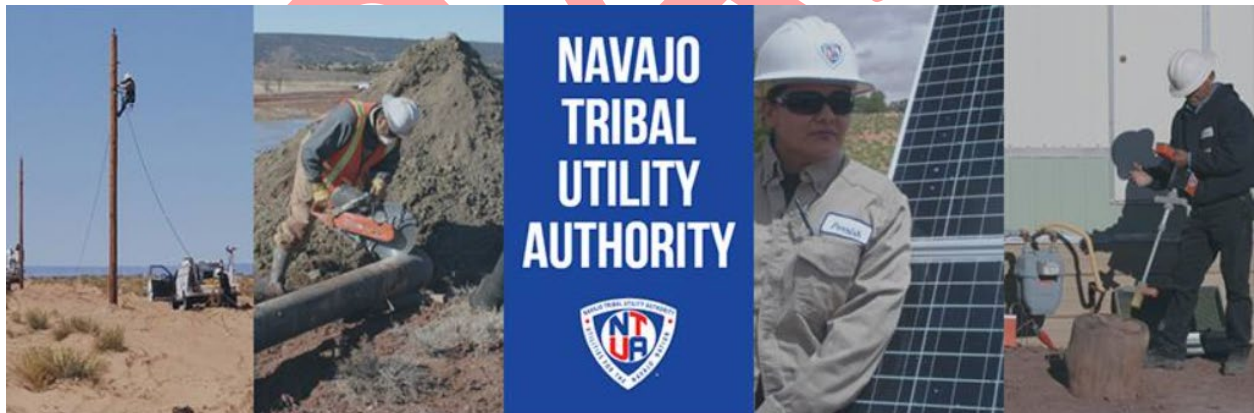




NAVAJO TRIBAL UTILITY AUTHORITY SANITARY SEWER EVALUATION SURVEY WORK PLAN TUBA CITY WASTEWATER COLLECTION SYSTEM, ARIZONA

May 30, 2025



PREPARED BY



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TECHNICAL REFERENCE DOCUMENTS CITED

USEPA: *Infiltration/Inflow - I/I Analysis and Certification*, May 1985

USEPA: *Handbook: Sewer System Infrastructure Analysis and Rehabilitation* (EPA/625/6-91/030, 1991)

USEPA: *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Collection Systems* (EPA 305-B-05-002, 2005)

Water Environment Federation (WEF): *Manual of Practice FD-6 - Existing Sewer Evaluation and Rehabilitation* – 3rd Edition 2009

WEF: *Manual of Practice FD-17 – Prevention and Control of Sewer System Overflows* – 3rd Edition 2011

National Association of Sewer Service Companies (NASSCO): *Manual of Practice* - most current version as of the date due for submittal of contractor proposals to perform the SSes work described in the Work Plan.

NASSCO: *Pipeline Assessment and Certification Program (PACP)* - most current version of the date due for submittal of contractor proposals to perform the SSes work described in the Work Plan.

NASSCO: *Manhole Assessment and Certification Program (MACP)* - most current version as of the date due for submittal of contractor proposals to perform the SSes work described in the Work Plan.

NASSCO: *Pipe Condition Assessment Using CCTV: Performance Specification Guideline* - most current version as of the date due for submittal of contractor proposals to perform the SSes work described in the Work Plan.

American Society of Civil Engineers (ASCE): *Manual of Practice 60 (ASCE): Manual of Practice 60 - Gravity Sewer Design and Construction* - 2nd Edition 2007 - Chapter 4 regarding an evaluation system for ranking and prioritizing repair of corrosion defects.

Indian Health Service (IHS) Publication: *A Sanitation Deficiency System (SDS) – Guide for Reporting Sanitation Deficiencies for American Indian and Alaska Native Homes and Communities (Guidance Document)* - September 2019.

Indian Health Care Improvement Act (IHCIA) (25 U.S.C. § 1632(g)): *IHCIA assessment of “the level of sanitation deficiency for each sanitation facilities project of each Indian tribe or community” as presented in Table 3 – Sanitation Deficiency Levels* [25 U.S.C § 1632(g)(4).

LIST OF ACRONYMS

AC – Asbestos Cement Pipe
AGOL – ArcGIS Online
CCTV – Closed-Circuit Television
CIP – Cured-In-Place
CWA – Clean Water Act
DIP – Ductile Iron Pipe
EPA – Environmental Protection Agency
Esri – Environmental Systems Research Institute
FOG – Fats, Oils, and Grease
GIS - Geographic Information System
GPD – Gallons Per Day
I/I – Infiltration/Inflow
IHCIA – Indian Health Care Improvement Act
IHS – Indian Health Service
MACP – Manhole Assessment Certification Program
NASSCO – National Association of Sewer Service Companies
NNEPA – Navajo Nation Environmental Protection Agency
NPDES – National Pollutant Discharge Elimination System
NTUA – Navajo Tribal Utility Authority
PACP – Pipeline Assessment and Certification Program
PCD – Partial Consent Decree
PPM – Parts Per Million
PVC – Polyvinyl Chloride Pipe
RDII - Rainfall Derived Infiltration/Inflow
RRR – Repair, Rehabilitation, and Replacement
QA/QC – Quality Assurance/Quality Control
SDL – Sanitation Deficiency Level
SDS – Sanitation Deficiency System
SSes(s) – Sanitary Sewer Evaluation Survey(s)
SSO(s) – Sanitary Sewer Overflow(s)
VCP – Vitrified Clay Pipe
WEF – Water Environment Federation
WWTP – Wastewater Treatment Plant

1. INTRODUCTION

In 2024, the NTUA entered into a Partial Consent Decree (PCD) with the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Justice. Paragraphs 28 through 30 of the PCD (refer to **Appendix A**) require NTUA to conduct sanitary sewer evaluation surveys (SSEs) for the wastewater collection systems serving the Tuba City, Kayenta, and Chinle, Arizona wastewater treatment facilities. Prior to conducting the SSEs, NTUA shall submit, for EPA review and approval, SSES Work Plans for each community describing how and under what schedule the SSEs will be performed. Following completion of each SSES, NTUA shall submit, for EPA review and approval, an SSES Report in accordance with the schedule in Section 7 of this Work Plan. Finally, Paragraph 31 of the PCD obligates NTUA to prepare, again for EPA review and approval, Repair, Rehabilitation, and Replacement (RRR) Plans based on the information obtained from the SSEs for Tuba City, Kayenta, and Chinle. The RRR Plans are not part of the scopes of the SSES Work Plans.

The information included in the SSES Reports shall be presented in formats that facilitate efficient development of the RRR Plans for Tuba City, Kayenta, and Chinle, Arizona wastewater collection systems. When ultimately developed, the RRR Plans shall identify and prioritize defects requiring remediation to prevent future sanitary sewer overflows (SSOs) and/or achieve/maintain compliance with NTUA National Pollutant Discharge Elimination System (NPDES) discharge permit of each community; develop, evaluate and recommend remediation methodologies for those defects whether repair, rehabilitation, replacement, or other approach; develop capital and operation/maintenance costs associated with the recommended remediation; and, present proposed schedules for completing the proposed construction in each community following a “worst first” remediation logic wherever practicable.

This Work Plan focuses on Tuba City, shown below in Exhibit 1 (Kayenta and Chinle are covered under separate but related Work Plans).

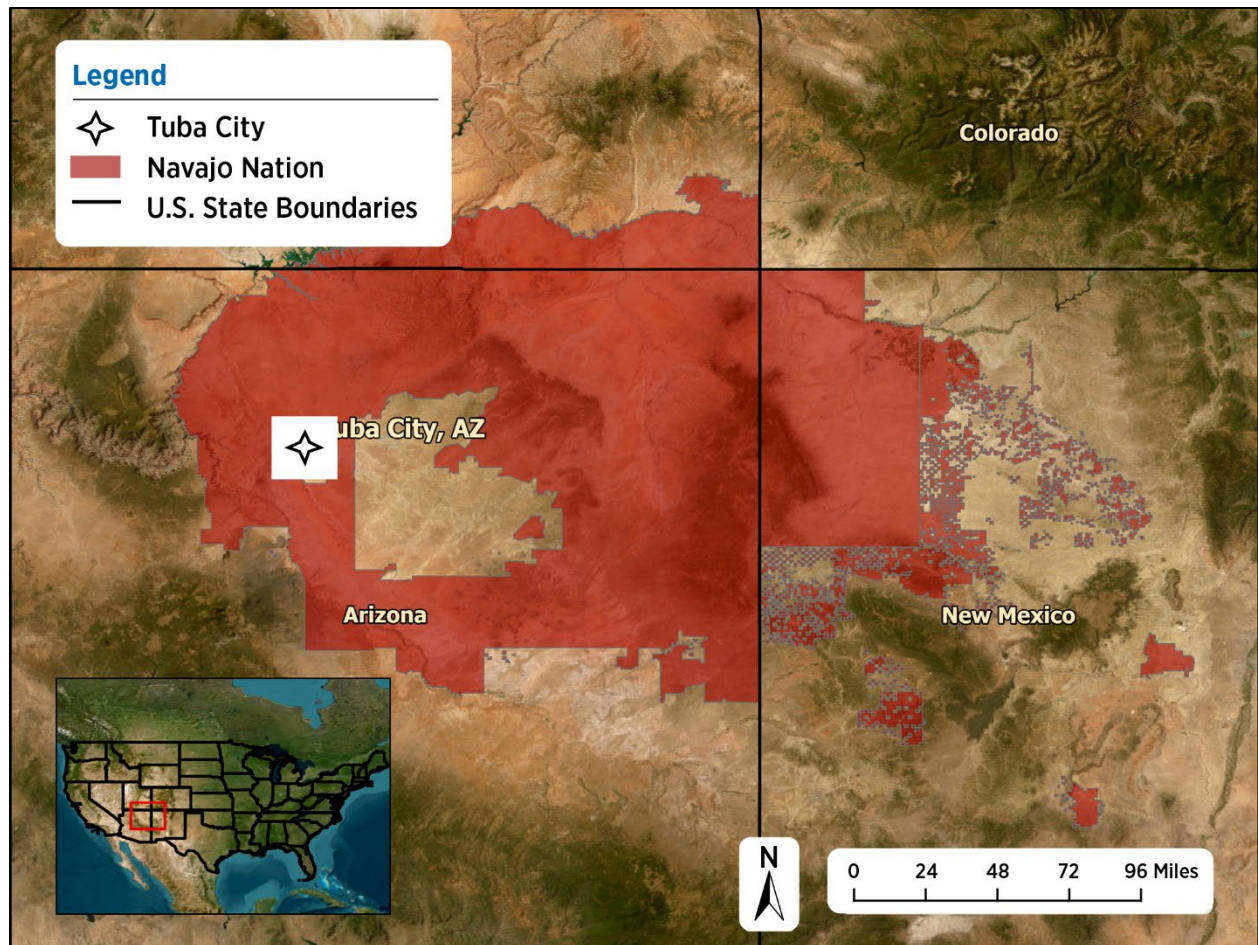


Exhibit created by ERG.

Exhibit 1. Vicinity Map

This Work Plan provides the framework and requirements for the SSES for Tuba City. It is intended to serve as part of a bid package for which qualified contractors can provide proposals to complete the SSES. As previously discussed, NTUA shall then use the SSES findings to develop an RRR Plan and designs for repairs, rehabilitation, replacements, and other wastewater collection system improvements found necessary to prevent future SSOs and/or achieve/maintain compliance with community NPDES permits. NTUA shall, in these subsequent construction projects, support access, promote sustainability, and ensure the provision of adequate sanitary waste disposal and treatment facilities.

The SSES shall characterize wastewater collection system flow response to precipitation and identify locations where SSOs and private property flooding have previously occurred. The SSES shall also identify the locations discovered and relative severity of: infiltration/inflow (I/I) contributing sanitary sewer system defects; sanitary sewer system structural and corrosion-related defects; system hydraulic flow restrictions caused by undersized downstream facilities; and, hydraulic restrictions caused by build-ups of grit, debris, FOG, or other obstructions.

This Work Plan provides the following expectations for the SSES and completion time requirements in accordance with the PCD:

- Field activities and data collection previously performed.
- Field activities for NTUA and/or its contractors to carry out in performing the SSES as required under the PCD.
- Data collection and quality assurance/quality control (QA/QC) procedures and how data will be stored for the project and afterward.
- Reporting requirements and how the information gathered during the SSES will support the upcoming wastewater collection system characterization and development of RRR Plans.

2. SSES INVESTIGATION AREAS

The SSES shall include all portions of the NTUA Tuba City wastewater collection system and shall identify:

- Locations where dry-weather SSOs have previously occurred; their associated tributary areas; and, the causes of these SSOs, if identified in NTUA records.
- Locations where wet-weather locations have previously occurred; their associated tributary areas; and, the causes of these SSOs, if identified in NTUA records.
- Locations discovered to have potentially excessive dry-weather and/or wet-weather I/I rates as determined in accordance with the USEPA publication: *I/I Analysis and Certification, May 1985*.
- Locations where structural defects or corrosion-related defects were discovered in the wastewater collection system that, upon failure, may cause future SSOs.
- Locations where undersized downstream assets were discovered in the wastewater collection system that reduce the hydraulic capacity of that system, and as such, may cause future SSOs.
- Locations where grit, debris, FOG, or other obstructions were discovered in the wastewater collection system that reduce the hydraulic capacity of that system, and as such, may cause future SSOs.

The investigation area is specifically defined as the NTUA-owned-and-operated wastewater collection system and the interconnections of private wastewater collection systems to the NTUA system. The SSES shall report locations of directly observed anomalies inconsistent with routine sanitary sewer operations, such as but not limited to:

- Unanticipated high flow rates;
- Unanticipated low flow rates;
- Discolorations of the wastewater, pipe, or manhole walls;
- Chemical odors; sewer and manhole structural defects and corrosion;
- Evidence of I/I entry into sewers and manholes;
- Grit build-ups greater than 20% of pipe diameter;

- Pieces of sewer pipe or manhole materials;
- Illegally disposed-of materials; and,
- FOG, or other unanticipated materials within the sewer pipe.

Evaluations of tributary private piping systems, private pump stations (if any), and operation/maintenance of private systems are not part of the SSES.

NTUA shall utilize its operation/maintenance records and the information collected as part of the SSES to identify wastewater collection system structural and hydraulic deficiencies that have caused or are likely to cause SSOs. Due to the relatively simple nature of the Tuba City wastewater collection system, consisting entirely of gravity-fed pipes, complex monitoring and hydraulic modeling will likely not be required as part of the SSES. Should the SSES identify sections of the wastewater collection system that potentially can become pressurized under peak dry-weather flow conditions or wet-weather flow conditions, NTUA shall develop a hydraulic model of those sections to assess the extent of surcharging and to develop options for system improvements as part of future SSO mitigation alternative development and evaluation efforts.

The proposed SSES study area and NTUA wastewater collection system are shown in **Exhibit 2** and **Exhibit 3**. The NTUA wastewater collection system with interconnected private sewer system locations is shown in **Exhibit 3**. Existing customers or connections to the NTUA wastewater collection system, as of fall 2024, consist of 151 commercial connections and 2,674 residential connections for a total of 2,825 connections. Flow data for five totes currently installed in the NTUA wastewater conveyance system and respective manholes are presented in **Appendix C**.

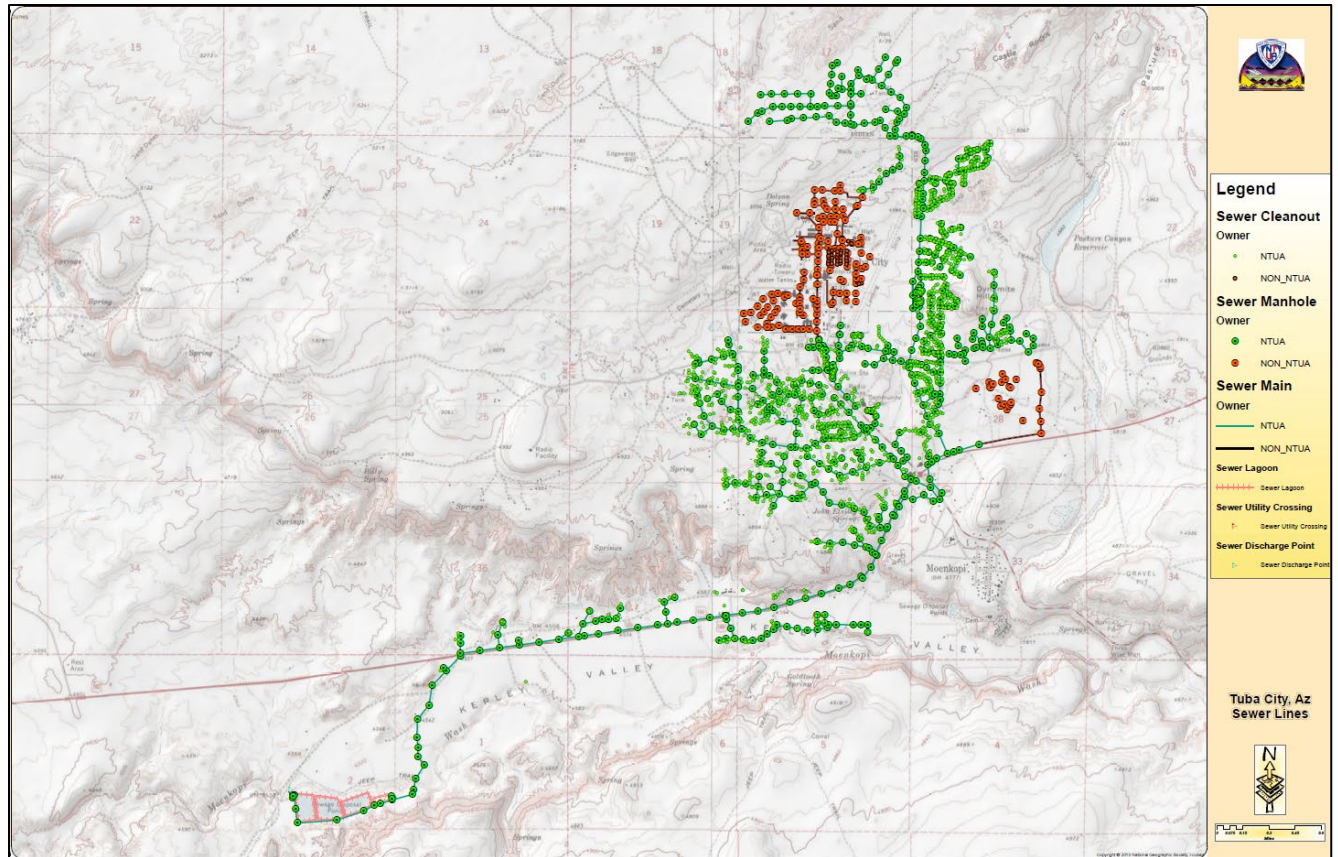


Exhibit created by NTUA.

Exhibit 2. NTUA Owned Tuba City Sanitary Sewer Lines with Manholes & Private Sewer Lines with Manholes

(Non-NTUA Sewer Lines and Manholes (in red) are Shown for Informational Purposes Only and are Excluded from SSES Investigations)

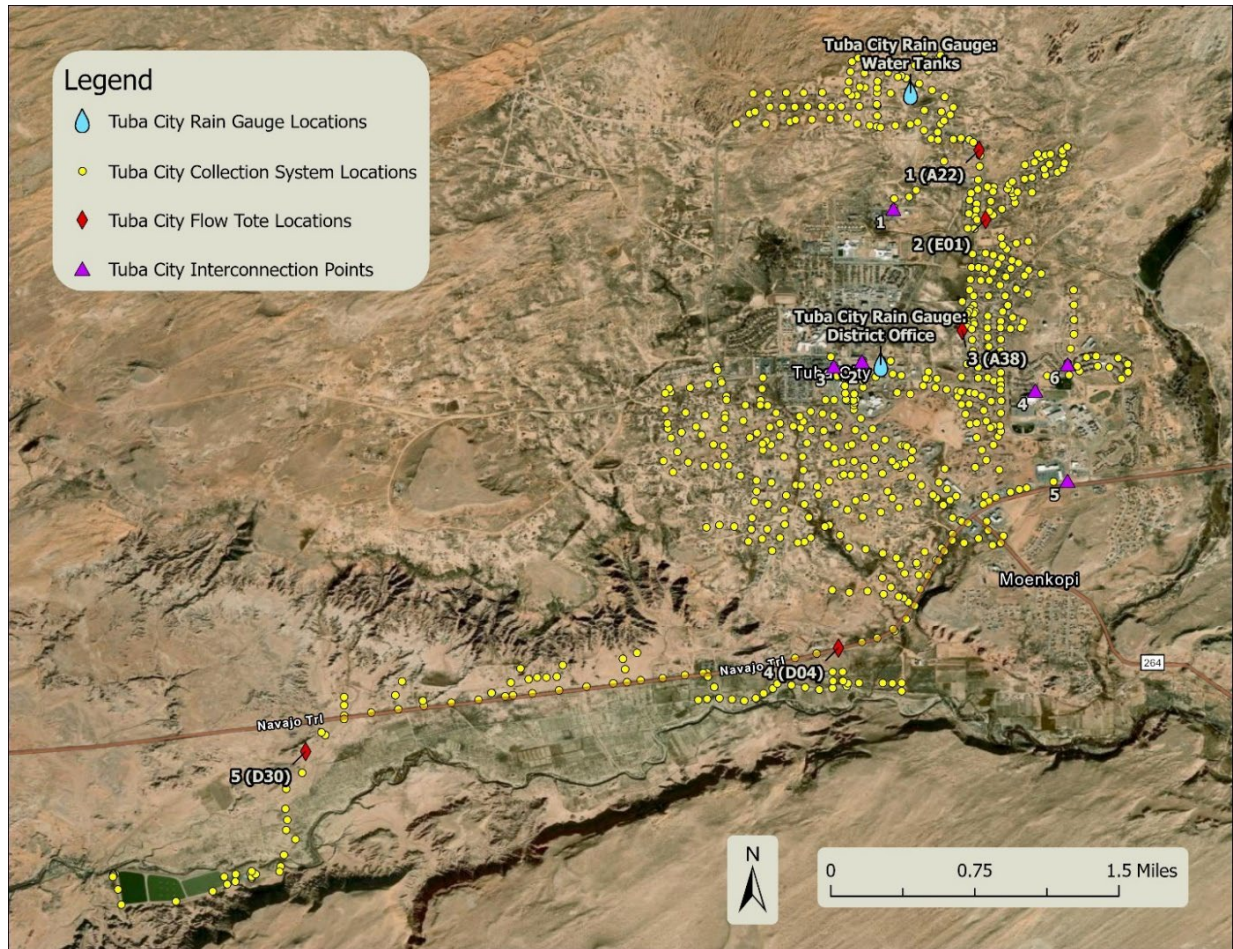


Exhibit created by ERG using GIS data from NTUA, available in Appendix B.

Exhibit 3. Proposed Tuba City SSES Investigation Area: Rain Gauge, Manhole, Interconnection Points, and Flow Monitoring Locations

The existing Tuba City wastewater collection system comprises approximately 37.92 miles of pipeline. Pipe diameters and materials are detailed in **Exhibit 4** and **Exhibit 5**, respectively. The majority of the NTUA public wastewater collection system consists of 8-inch diameter sewer mains, totaling approximately 23.31 miles. The shortest segment is a 0.11-mile stretch of 4-inch diameter pipe. The Tuba City public wastewater collection system also includes 1.77 miles of 6-inch pipe, along with larger sewer collector/trunk lines - 10-inch (4.90 miles), 12-inch (1.91 miles), 15-inch (4.17 miles), and 18-inch (0.74 miles) - to convey higher flow volumes to the WWTP. Approximately 1.01 miles of sewer pipe are of unknown diameter due to insufficient data in NTUA's records. The diameters and materials of construction of all NTUA sewers internally inspected by pole camera or CCTV shall be confirmed as part of the SSES.

According to NTUA records, 20.32 miles of the Tuba City sewer line is constructed of vitrified clay pipe (VCP), accounting for 54% of the total public sewer system. The second most commonly used pipe material is polyvinyl chloride (PVC), comprising 17.22 miles or 45% of the total public sewer system. The remaining 1% of the public sewer system includes 0.33 miles of ductile iron pipe (DIP) and 0.05 miles of asbestos cement (AC) pipe.

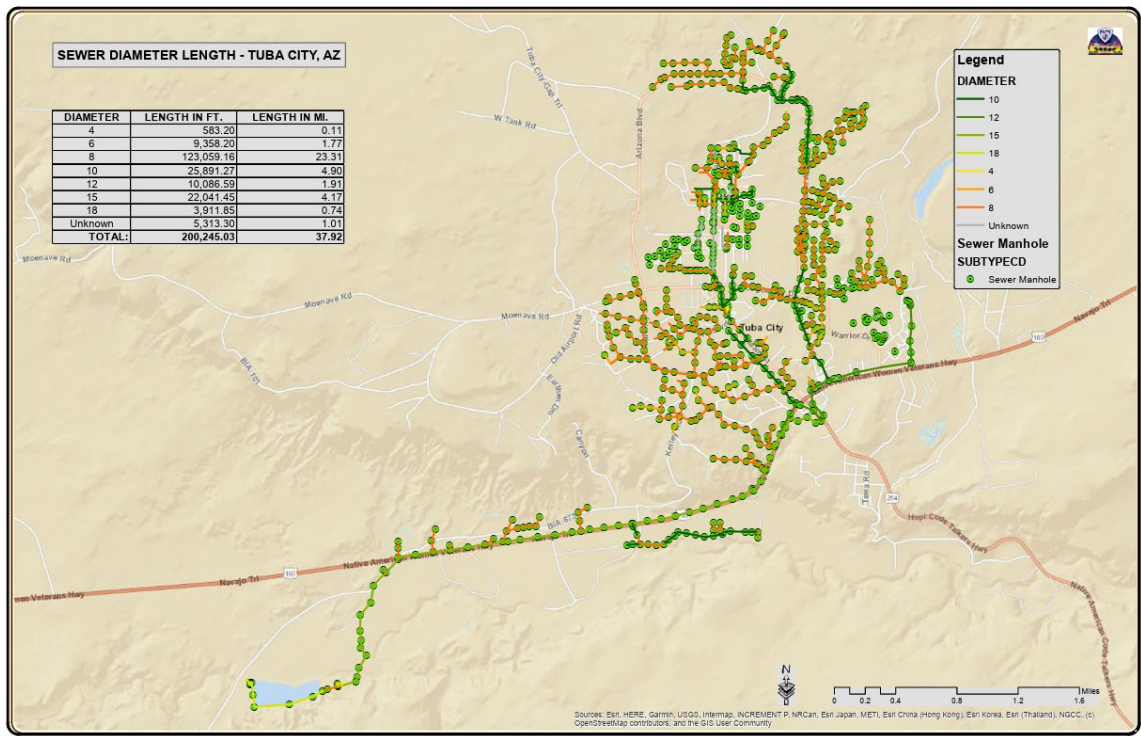


Exhibit created by NTUA.

Exhibit 4. Tuba City Sewer Diameter Distribution

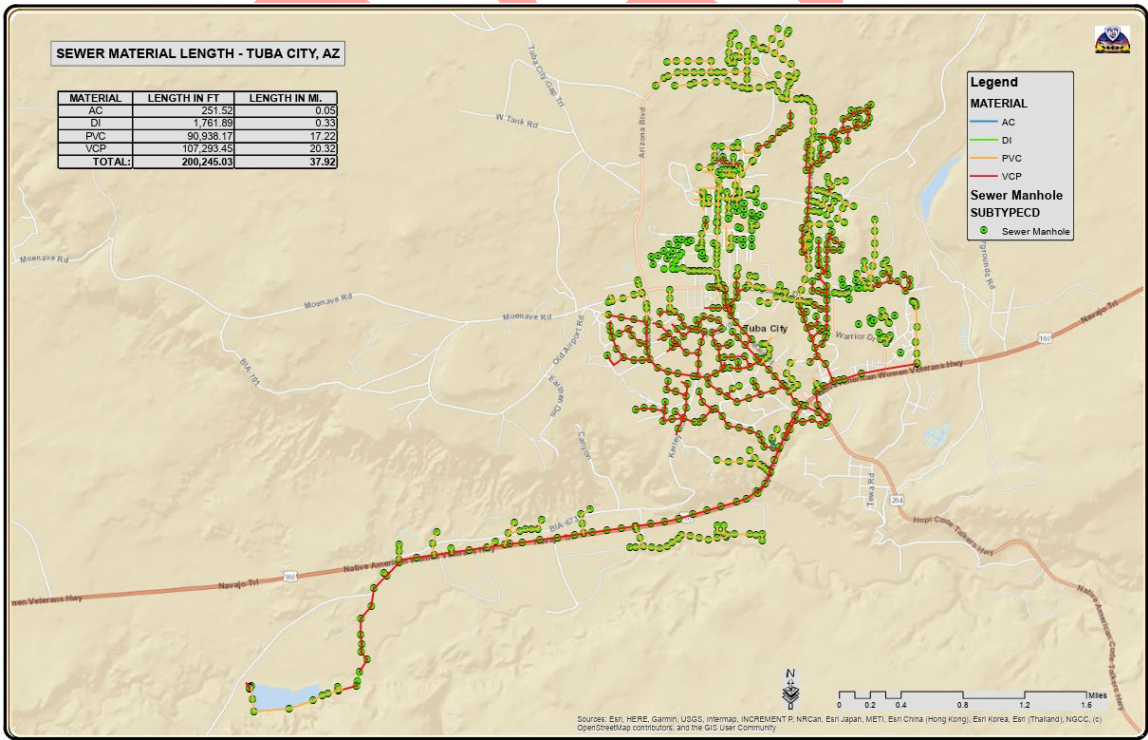


Exhibit created by NTUA.

Exhibit 5. Tuba City Sewer Material Distribution

Customer Category	Wastewater Sources	Estimated No. of Connections (NTUA data)	Lower Flow Estimate (GPD) ¹	Upper Flow Estimate (GPD) ¹	Assumptions ²
Commercial	Office/Business	92	15,263	34,886	Assuming 23.7 employees per business
	Gas Station	5	360	600	Assuming "auto service station" category for water usage
	Church	11	1,100	1,650	Assuming minimum of 100 GPD water usage per church
	Restaurant	4	3,288	4,932	Assuming an average minimum use of 300,000 gallons/year water per restaurant
	Grocery Store	1	1,550	2,450	Assuming 50 employees based on average employees in Tuba City grocery stores. Assuming total of 3 toilets for 36-55 employee
	Jail/Courthouse	7	25,375	51,975	Assuming 46 inmates, and 35 employees per Facility based on the data from Navajo Department of Corrections - Tuba City Facility
	Hospital/Clinic	2	31,000	72,480	Assuming 76 beds, and 1200 employees per Facility, based on the data from Tuba city regional hospital
	School	22	80,960	161,920	Assuming 6 schools and a total of 1,472 students, based on data from Tuba City Unified School District #15, an average of approximately 245 students per school. Each school is assumed to include a cafeteria, gymnasium, and shower facilities.
	Hotel	2	5,040	7,560	Assuming 80 rooms at 60% occupancy rate = estimated number of visitors is 48. Additionally, it is assumed there are 15 employees, based on data from the NavajoLand Hotel in Tuba City.
	Fire Station	1	35	80	Assuming 2 volunteers, 3 paid firefighters. Based on the data from The Navajo Nation Department of Fire & Rescue Services website.
Residential	Residential	2,674	371,700	743,400	Assuming Tuba City total residential population of 8260 and using GPD rates per person.
Theoretical average daily wastewater flows excluding I/I (GPD)			535,670	1,081,933	
Notes: GPD = Gallons Per Day ¹ Lower and upper flow estimates are calculated using sewage flow estimating guide provided by NTUA. Also available at: www.pollutioncontrolsystem.com/Uploads/Images/Pages/SEWAGE%20FLOW%20RATE%20ESTIMATING%20GUIDE%20Nov%202014_20170105.pdf ² The assumptions presented are based on a variety of sources. For detailed references and individual citations, please refer to Appendix D.					

Exhibit 6. Tuba City Flow Characterization

Based on the wastewater connection source estimates provided by NTUA, the average daily wastewater flows for Tuba City is estimated to range between 535,670 GPD and 1,081,933 GPD, excluding I/I. The majority of this flow (69% of the total flow)—between 371,700 and 743,400 GPD—is attributed to the residential sector, which includes 2,674 connections and is based on an estimated population of 8,260 residents (**Exhibit 6**). The second highest flow comes from a commercial source, schools, which contribute between 80,960 and 161,920 GPD. Fire stations and gas stations are the lowest contributing sources to the Tuba City sanitary sewer system in terms of wastewater flow. Flow estimates for residential and commercial sources are derived based on specific assumptions such as employee counts, facility usage, and typical occupancy rates, detailed calculations and assumptions are included in Appendix D.

As part of the SSES effort, NTUA and/or the Contractor shall obtain potable water usage data for Tuba City and perform a comparative analysis. This analysis shall include a side-by-side comparison of Tuba City's flow characterization data (as presented in **Exhibit 6**), potable water usage data, and average dry weather WWTP inflow data. The purpose of this analysis is to estimate seasonal groundwater infiltration rates and peak rainfall derived infiltration/inflow (RDII) rates. The analysis and any conclusions drawn therefrom shall be presented in the SSES Report. The Tuba City SSES Report shall also include information that may be available for the non-NTUA systems that convey sewage into the NTUA-owned wastewater collection system and eventually into the Tuba City WWTP, such as but not limited to: locations of tributary connecting sewers, connection configurations, connection flow data, and tributary wastewater classifications (domestic-commercial-industrial-institutional).

3. COMPLIANCE REQUIREMENTS

In accordance with the PCD, the SSES Work Plan and SSES Report are subject to EPA review and approval. NTUA shall submit its final SSES Work Plans for the three wastewater collection systems included in the PCD for EPA review and approval by no later than August 2, 2025, the one-year anniversary of the PCD's effective date, August 2, 2024. NTUA shall conduct and complete the SSESs by no later than 20 months after EPA approval of each SSES Work Plan. NTUA shall submit each SSES Report for EPA review and approval within 30 days after completion of each SSES. Thereafter, within 12 months after EPA approval of each SSES Report, NTUA shall submit for review and approval the RRR Plan for each of the three wastewater collection systems.

Each SSES Report shall:

- Be prepared by NTUA or by NTUA's contractor in consultation with NTUA;
- Include a certification from the contractor that performed SSES work, that the SSES work was completed in general accordance with the *NASSCO Manual of Practice*, *NASSCO PACP guidance*, and *NASSCO MACP guidance* in effect on the date due for submittal of contractor proposals to perform the SSES work.
- Document any major deviations from *NASSCO Manual of Practice* requirements that occurred in completing SSES tasks, and where practicable, such deviations shall have been pre-approved by NTUA prior to the contractor performing the respective SSES task.

- Present the results and findings of the SSES, including summaries of the methodologies utilized to obtain those results and findings.
- Categorize structural defects and I/I-contributing defects discovered in the sanitary sewers and manholes in accordance with NASSCO PACP and MACP scoring systems, respectively.
- Identify the locations and types of hydraulic constraints discovered in the NTUA wastewater collection system, such as physical constrictions or build-ups of grit, debris, and/or FOG.

NTUA shall achieve and maintain compliance with both the PCD and the Tuba City National Pollutant Discharge Elimination System (NPDES) discharge permit by implementing and adhering to the compliance requirements and schedules set forth therein. All SSES and RRR Plan activities shall be performed in accordance with the PCD and in compliance with all applicable federal, Navajo, and local laws, regulations, and permits, including, but not limited to, the Tuba City utility NPDES permits, the Clean Water Act (CWA), and the CWA's implementing regulations.

PCD Paragraph 11 sets the following public notification and involvement requirements for NTUA for the SSES Work Plans and the RRR Plans:

- Beginning on the Effective Date and continuing through termination of the PCD, NTUA shall prominently post on its website and social media the methods by which the public may request email notices of future deliverables, including the draft and final SSES Work Plans and RRR Plans.
- At least 60 days before submitting an SSES Work Plan or an RRR Plan to EPA, NTUA shall post copies of these documents on its website and social media, with each such plan identified as "draft". NTUA shall simultaneously provide a link to EPA, the Navajo Nation Environmental Protection Agency (NNEPA), and others formally requesting copies of deliverables.
- NTUA shall allow the public at least 30 days from the date of posting or mailing to review and submit comments on the deliverables posted or mailed.
- If NTUA receives public comments on draft deliverables that require more time to address than NTUA had anticipated, NTUA shall request an extension of the applicable PCD deadline from EPA.
- When NTUA submits deliverables to EPA, it shall attach public comments received and NTUA's explanations of how deliverables respond to those comments.
- Within seven days after EPA's approval of an SSES Work Plan or RRR Plan, NTUA shall post that approved plan on its website, clearly identifying the document as "Final."

The Tuba City SSES shall include - to the extent to which NTUA has obtained all necessary access and inspection rights - evaluations of how its wastewater collection system connects to conveys sewage from portions of wastewater collection systems owned and operated by others. Contingencies for lack of rainfall and the associated I/I investigations are provided in **Section 4.4.2**.

4. SSES FIELD ACTIVITIES

Field investigations for the Tuba City SSES shall confirm the wastewater collection system layout, sewer sizes, sewer materials, locations, manhole rim elevations, sewer invert elevations, connectivity, structural

conditions, observed I/I entry points (active and inactive), and other system physical property information deemed necessary by NTUA to support system characterization. Typical investigations and associated activities shall include: review of previous conveyance system operating records; micro-monitoring; smoke testing; dyed water testing; manhole elevation/location/depth-to-invert surveys; sewer system cleaning; manhole visual inspections; sewer pole camera inspections (PVC pipe only); sewer closed-circuit television (CCTV) inspections; and, visual inspections of other conveyance system assets.

The division in work responsibilities between NTUA staff and outside contractors shall be developed in detail through proposal and negotiation prior to beginning of SSS work in accordance with the PCD required schedule and shall be memorialized in writing.

The SSS shall be conducted in accordance with sound engineering judgment and with the guidance provided in the appropriate sections of EPA's *Handbook: Sewer System Infrastructure Analysis and Rehabilitation* (EPA/625/6-91/030, 1991); the Water Environment Federation's (WEF) *Manual of Practice FD-6 - Existing Sewer Evaluation and Rehabilitation – Third Edition 2009*; WEF's *Manual of Practice FD-17 – Prevention and Control of Sewer System Overflows – Third Edition 2011*; and, NASSCO's *Manual of Practice* (version in effect at the date due of contract proposal submission). Ratings of individual defects within each sewer segment and an overall rating for that segment shall be provided in the SSS in accordance with NASSCO Pipeline Assessment and Certification Program (PACP). Ratings of defects in sanitary sewer manholes shall be provided in the SSS in accordance with the NASSCO Manhole Assessment and Certification Program (MACP). Narrative descriptions in formats approved by NTUA shall be provided in the SSS regarding the defects discovered in NTUA wastewater collection system assets. The SSS shall involve field work in the specific areas described in the subsections below.

4.1 Corrosion Defect Identification

The SSS shall include procedures for inspecting and identifying already-corroded sanitary sewer infrastructure and infrastructure at risk for corrosion. Corrosion issues shall be identified during manhole and CCTV inspections in accordance with Section 4.4.5, during sewer gas monitoring in accordance with Section 4.4.6, and direct physical observations. NTUA shall include an evaluation system for ranking and prioritizing repair of corrosion defects consistent with Chapter 4 of the American Society of Civil Engineers' *Gravity Sewer Design and Construction* (MOP-60, 2007, 2nd edition).

One cause of corrosion in a sewer system is the elevated presence of hydrogen sulfide (H_2S), which can be a significant contributor to the gradual deterioration of sewer systems, particularly those constructed utilizing concrete or metal components. This type of corrosion is most commonly discovered in areas such as sewers having relatively flat slopes, manholes, junction chambers, and wetwells. Public Sewers in the Tuba City wastewater collection system consist primarily of vitrified clay and PVC pipe, which are resistant to H_2S . Therefore, H_2S corrosion is not expected to occur in the majority of Tuba City sewers. However, DIP/CIP and AC pipe are subject to H_2S corrosion, and as such, should undergo CCTV inspection. Concrete structures, such as manholes, junction chambers, and wetwells are also subject to H_2S corrosion, and as such, should be fully visually inspected.

While visual inspections should be adequate to identify moderate to severe corrosion defects, NTUA may also employ additional methods to detect corrosion if visual inspection is not sufficient. Color-sensitive pH paper to measure the pH level at a surface may be used, where pH values below 4 typically indicate active

corrosion. NTUA may also use a sonic caliper to measure the distance from the transmitter to pipe wall surface following sewer cleaning to determine if material is missing.

4.2 Fats, Oils, and Grease (FOG)

Areas with signs of significant FOG deposition shall be evaluated and documented in the SSES summary report. FOG issues can be identified through review of NTUA sewer system maintenance records; through the results of the SSES-associated pre-inspection cleaning - (i.e., if cleaning displaces grease to the downstream manhole); and, through CCTV in accordance with Section 4.4.5. As part of the future process of developing and evaluating SSO mitigation alternatives, NTUA shall identify probable sources of these substances, such as food service/processing establishments, industries, commercial operations, or petroleum distillate handling/processing facilities.

4.3 Unauthorized Connections

NTUA and/or its contractor shall use their best efforts during the sewer internal inspection phase of SSES activities into identifying and documenting those sanitary sewer service connections that appear to be active versus those connections that appear to be inactive. NTUA shall make final determinations regarding sanitary sewer service connections that are active versus inactive and eliminate as many inactive service connections as practicable as part of the RRR Plan.

4.4 Gravity Sewer Inspection and PACP Assessment

Gravity sewer inspection and assessment shall follow EPA's *Handbook: Sewer System Infrastructure Analysis and Rehabilitation* (EPA/625/6-91/030, 1991); EPA's *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Collection Systems* (EPA 305-B-05-002, 2005); the Water Environment Federation (WEF) *Manual of Practice FD-6 - Existing Sewer Evaluation and Rehabilitation* – Third Edition 2009); the NASSCO *Manual of Practice* (most current version as of the date due for submittal of contractor proposals to perform the SSES work); sound industry and engineering practices; and, the PCD. All sewer assessments shall follow NASSCO PACP guidelines and rating procedures. NTUA and/or its contractors performing the SSES shall be certified in accordance with NASSCO standards.

The primary investigative tools used for sewer system structural condition assessment shall be: sewer cleaning results; pole camera inspections; and CCTV inspections. The primary investigative tools used for I/I source identification shall be: NTUA flow/rainfall metering results; micro-monitoring, smoke testing, dyed water testing, and CCTV. If Tuba City's storm sewers and sanitary sewers are constructed in close proximity, dyed water flood testing may be more effective than smoke testing. Such construction often allows excessive crossflows between stormwater and sanitary wastewater utilities, particularly in dry granular sub-soils. Such crossflows can compromise the accuracy of smoke testing results, thus making dyed water testing a more reliable method for identifying locations of inflow sources into sanitary sewers. The following sections outline the gravity sewer information to be collected during each field activity, along with the resources required for each task.

4.4.1 Manhole Inspection and MCAP Assessment

Manhole inspection and assessment shall follow EPA's *Handbook: Sewer System Infrastructure Analysis and Rehabilitation* (EPA/625/6-91/030, 1991); EPA's *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Collection Systems* (EPA 305-B-05-002, 2005);

the Water Environment Federation (WEF) *Manual of Practice FD-6 - Existing Sewer Evaluation and Rehabilitation* – Third Edition 2009); the NASSCO *Manual of Practice* (most current version as of the date due for submittal of contractor proposals to perform the SSES work); sound industry and engineering practices; and, the PCD. All manhole assessments shall follow NASSCO MACP guidelines and rating procedures. NTUA and/or its contractors performing the SSES shall be certified in accordance with NASSCO standards.

The primary manhole investigative tool used for shall be visual inspection. Manholes shall be inspected for: structural defects, potential direct I/I sources into manholes, and potential direct cross-connections between storm sewers and the wastewater collection system. Visual inspections shall include: the cover, frame, chimney (adjustment), cone, walls, bench/channel, connecting conduits, and most importantly, the joints between these various manhole components. Additional investigation techniques may be required if suspected storm sewer cross-connections cannot be confirmed visually, including dye testing, pole cameras, and sewer pipe CCTV.

NTUA shall be notified within 24 hours of any manholes discovered to have missing or damaged manhole covers. NTUA shall be notified within five business days of any manholes discovered to have steps installed. **Installed manhole steps should NOT be utilized by NTUA or contractor staff.** Installed manhole steps have proven to be a safety hazard in that corrosion of their mountings may not be visible, and as such, steps may not fail until significant weight, such as the full weight of a worker, is placed upon them.

4.4.2 Infiltration/Inflow Survey

This characterization of I/I rates can inform NTUA of appropriate investigative and remedial measures to address defects and capacity limitations in the sanitary sewer. To facilitate that characterization, NTUA and/or its contractor shall carry out the following rainfall and flow monitoring throughout the wastewater collection system:

- Review previous sanitary sewer flow monitoring versus rainfall data for correlation with wet-weather SSO events.
- Perform continuous, accurate (measured value within +/-5% of actual value) influent flow monitoring at the wastewater treatment plant (WWTP). NTUA and/or its contractor shall record influent flow data for the duration of the SSES effort and maintain this influent flow meter data for no less than one calendar year following NTUA's delivery of the RRR Plan to EPA, pursuant to Paragraph 30 of the PCD. NTUA may also wish to maintain flow and rainfall data for longer periods so that these data may serve as the pre-construction baseline to demonstrate post-construction compliance with I/I and SSO reduction goals. NTUA shall also monitor and record:
 - Any wet-weather WWTP bypass events resulting from excessive influent flow volume.
 - Any wet-weather SSOs from the wastewater collection system, in accordance with the SSO response plan requirements of Paragraph 25 of the PCD.
 - Any dry-weather SSOs from the wastewater collection system, in accordance with the SSO response plan requirements of Paragraph 25 of the PCD.

NTUA and/or its contractor shall conduct temporary flow monitoring using depth/velocity flow meters at locations agreed upon by NTUA and EPA and documented in **Exhibit 3** of this Work Plan. The suggested locations for the four permanent flow monitoring locations are provided as latitude and longitude data in **Appendix B**. Upon field investigation of the flow monitoring sites shown in **Exhibit 3**, flow meters upstream or downstream one or more manholes if the manhole at an initially identified location has unfavorable hydraulic conditions, such as excessive turbulence or too steep a slope. If depth/velocity meters at locations other than those identified in **Exhibit 3**, NTUA shall notify EPA of these changes. All flow meters shall be installed and maintained in keeping with the manufacturers' recommendations, good industry practice, and WEF MOP FD-6.

NTUA and/or its contractor shall conduct temporary rainfall monitoring at the locations agreed upon by NTUA and EPA and documented in this **Exhibit 3** of this Work Plan. The precision, accuracy, and resolution of rainfall data are critical for I/I analyses performed for the SSES and ultimately for sewer modeling, if required for RRR Plan development. Accordingly, these gauges shall, at a minimum, provide electronically downloadable rainfall measurements at no greater than 5-minute time increments and shall meet the accuracy standards of the National Weather Service. The suggested gauge locations shown in **Exhibit 3** may be adjusted for accuracy and security. If rain gauges are identified at locations other than those in **Exhibit 3**, NTUA shall notify EPA of these new or different locations. All rain gauges shall be installed and maintained in keeping with the manufacturers' recommendations, good industry practice, and WEF MOP FD-6.

All collected flow and rainfall data shall be subjected to appropriate quality review in accordance with WEF MOP FD-6. This review shall include the identification of meter drift and data dropouts as well as any other anomalies. Data with quality issues should be excluded from use in subsequent analyses where practicable or should be used only with appropriate data qualifications noted.

The extent of the I/I survey shall include all parts of the NTUA wastewater collection system. The SSES shall characterize the I/I by flowmeter location and by micro-monitoring location in terms of: I/I in gallons per capita per day, I/I in gallons per acre per day, and in gallons per day per inch-mile of public sewer.

NTUA shall collect useable rainfall and flow data for all segments of its sanitary sewer for at least three appropriate rainfall events. Appropriate rainfall events are those with enough rainfall volume and rate to generate a meaningful system flow response (i.e., generally greater than 0.25 inches within 2 hours) without being so large as to generate significant surface flooding and entry of water into the sanitary sewer through otherwise unusual entry points. If necessary, and upon written authorization from EPA, NTUA and/or its contractor may use events that do not result in appropriate rainfall coverage for all segments of the sanitary sewer, so long as the events used enable NTUA and/or the contractor to understand how all segments of the sanitary sewer respond to rainfall.

If insufficient rainfall occurs to adequately assess I/I by the SSES completion deadline, EPA at its sole discretion may approve one or more extensions of the deadline to allow NTUA and/or its contractor to continue collecting I/I data.

Flow and rainfall data shall be utilized to focus other SSES investigations such as smoke testing and dyed water testing in areas displaying potentially excessive inflow as defined in the USEPA publication:

Infiltration/Inflow - I/I Analysis and Certification, May 1985. These testing techniques shall be employed as described in the reference documents cited in Paragraph 28 of the PCD.

4.4.3 Smoke Testing

Smoke testing of sanitary sewers is a method to quickly screen large areas for the presence of I/I sources in those portions of the system that have displayed higher wet weather response. Smoke testing can be successful in identifying cross-connections between public sanitary sewers and public storm sewers. Smoke testing may also be useful in locating I/I-contributing defects in manholes – particularly defective frame seals, chimney (adjustment) seals, and cone seals, which can be entry points for significant volumes of inflow.

Smoke testing may not be well suited for use in areas of where storm sewers and sanitary sewers are placed in close proximity in dry granular subsoils because the smoke can transfer rapidly from sanitary sewers to storm sewers and obscure individual source locations. Smoke testing may also not be successful in detecting mainline and lateral sewer I/I sources in areas having wet or dense cohesive subsoils. Finally, smoke-testing may not be successful in locating private storm drains having running traps. Private drains suspected of having traps should be tested with dyed water instead.

Priority zones for smoke testing include older residential neighborhoods with known aging infrastructure, high I/I, or low-lying or flood-prone areas. Locations previously flagged through flow monitoring, manhole inspections, or CCTV investigations as having elevated I/I should also be targeted.

4.4.4 Dyed Water Testing

Dyed water testing shall be used to locate direct and indirect cross-connections between sanitary and storm sewers. Dyed water testing shall be conducted by flooding ground surfaces above the sanitary sewers and/or filling storm sewer segments immediately adjacent to or crossing above sanitary sewers with dyed water to simulate stormwater runoff conditions. Dyed water testing is typically performed in conjunction with CCTV inspection of the adjacent or crossing sanitary sewer to observe I/I locations and classify levels of RDII. Dyed water testing is most commonly done the public right-of-way. However, private property storm drains may also benefit from dyed water testing to determine frequency and magnitude of private RDII sources, particularly in those portions of the system that have displayed higher wet-weather flows.

4.4.5 Closed-Circuit Television Inspection of Sewers

CCTV of the NTUA wastewater collection system shall be performed in accordance with the NASSCO publication *Pipe Condition Assessment Using CCTV: Performance Specification Guideline*; the NASSCO *Manual of Practice* and current industry best services and technologies. Sewer line defects shall be recorded and rated utilizing the NASSCO PACP defect coding/ranking system. The CCTV effort shall include a process for the retention of and access to all data by NTUA.

The SSES shall include a system-wide inspection and assessment of all NTUA gravity sanitary sewer segments using CCTV to identify pipe structural degradation, improper service connections, active versus inactive service connections, storm sewer cross-connections, illicit overland discharges, illicit discharges to private property, and non-stormwater discharges to the storm sewer system. Selected portions of the

storm sewer system as identified by NTUA shall also be televised to assess condition and confirm any suspected illicit discharges to or from the sanitary sewer system.

CCTV testing shall also be together with dye flood testing of storm sewers to assess I/I sources, including direct and indirect crossflows between storm and sanitary sewers, particularly where storm sewers lie close to or cross over sanitary sewers. These inspections will also help confirm pipe attributes and other system information in the Tuba City GIS, including:

- Location, size, and configuration of all sewers, manholes, and overflow points.
- Locations of suspected cross-connections between the wastewater collection system and the storm sewer system.

4.4.6 Sewer Gas Monitoring

The H₂S monitoring effort of the SSES shall follow current industry services and technologies. The contractor shall conduct H₂S monitoring utilizing detection devices meeting OSHA standards immediately prior to and continuously during personnel entry into sewers, manholes, hydraulic junction chambers, or other confined space wastewater assets. H₂S detection devices shall be periodically calibrated in accordance with the equipment manufacturer's instructions. The contractor shall also perform bump tests or calibration checks of H₂S detection devices before each day of use. The contractor shall submit the results of periodic H₂S detection device calibrations to NTUA within three business days of those calibrations and shall submit the results of daily bump tests and/or calibration checks to NTUA no less often than weekly. The contractor shall immediately discontinue work at any location where the H₂S concentrations are discovered to exceed 20 parts per million (20ppm) at any time during H₂S monitoring and shall advise NTUA of such locations as soon as is practicable, but not later than 4-hours after detection. NTUA and its contractor shall develop a plan for continuing SSES activities at such locations in accordance with OSHA standards.

4.4.7 Micro-Monitoring

Micro-monitoring is a field screening tool used to check sanitary sewer wet-weather flow responses and screen for suspected problems in high I/I areas. Micro-monitoring is performed utilizing short-term flow monitoring typically in place for only one or two appropriate rainfalls as defined in **Section 4.4.2**. Permanent or temporary rain gauges located within the tributary high I/I areas shall be used to record rainfalls during micro-monitoring. Depth/velocity flow meters and rain gauges shall conform to the requirements listed in **Section 4.4.2**. Quality control efforts regarding the flow and rainfall data collected via micro-monitoring shall be expedited as much as practicable to speed up deployment to successive monitoring locations. Micro-monitoring basin areas typically average about 25 to 50 acres.

4.4.8 Stormwater Cross-Connections

All storm/sanitary sewer cross-connections discovered shall be documented in the SSES Report.

4.5 Interconnected Private Sanitary Wastewater and Stormwater Collection Systems

Contributing peak dry-weather and wet-weather flows from interconnected private sanitary wastewater collection systems shall be measured where feasible and reported in the SSES. See **Exhibit 3** for the

locations of known interconnected systems. No data beyond flow rates need to be collected from interconnected private sanitary wastewater collection systems.

Locations where private stormwater collection systems are discovered to be connected to the NTUA wastewater collection system during the SSES shall be reported to NTUA within one workday of discovery and shall be documented in the SSES. NTUA and the contractor shall develop procedures for measuring stormwater flows from private storm water collection systems entering the NTUA wastewater collection system where feasible. The contractor shall implement such measurement procedures as directed by NTUA.

5. DATA COLLECTION AND STORAGE

To enhance efficiency, accuracy, and coordination during Tuba City SSES field data collection, NTUA shall use ArcGIS Online (AGOL) - a cloud-based platform developed by Environmental Systems Research Institute (Esri) for managing and sharing geographic information system (GIS) data. The following section outlines the key GIS components, tools, and workflows that could be employed to support field data collection and project tracking through AGOL.

Esri publishes a mobile app for Windows, iOS, and Android devices called Field Maps that can be used to view and edit map content published in AGOL. NTUA and/or its contractor field crews shall use Field Maps to capture deliverable project datasets using mobile devices and synchronize those datasets into an enterprise geodatabase via AGOL (or equivalent). However, NTUA should be aware that direct field-editing of NTUA databases poses some risk that the new information may not receive adequate QA/QC review. If NTUA elects to allow the contractor to field-edit its GIS database, NTUA and/or its contractor shall develop a formal field data entry process and relevant QA/QC data validation protocols to minimize data entry errors. The main dataset categories that could be used from AGOL are:

- Wastewater collection system GIS layers.
- SSES project-specific GIS layers, including: manhole horizontal/vertical location data; sewer invert elevation data for all sewers entering/leaving manholes, manhole condition data, sewer pipe size/material data, sewer pipe condition data, sewers showing positive/negative smoke test results, sewers showing positive/negative dyed water test results, sewer segments having non-FOG-related sediment build-ups, sewer segments having FOG-related build-ups, and other GIS layers deemed necessary by NTUA.
- Sanitary system mapping changes.

NTUA's Esri enterprise license agreement may allow it to create an organizational account with AGOL, which remote collectors could use to enter data in real time. If that is not possible, collected field data could be uploaded to an AGOL-based website. In either case, periodic data exports from the AGOL GIS would allow NTUA or its contractor update NTUA's GIS information while real-time field data collection continues, pursuant to the data entry QA/QC cautions previously discussed. Periodic data exports from the GIS would allow NTUA to update its GIS internally while allowing for continued real-time field data collection.

AGOL could be used on the Tuba City SSES project for:

- Aggregating field data collected using Esri apps on mobile devices. As noted above, ArcGIS Field Maps on mobile devices can sync real-time field data to AGOL.
- Tracking progress of field activities. The project team could regularly update fieldwork status GIS layers indicating crew, date, photo attachments, and inspection/installation report attachment as field work progresses for:
 - Pipe inspections.
 - Manhole inspections.
 - Smoke/dye testing and CCTV results.
 - Operation and maintenance issues discovered by field crews.

6. DATA ANALYSIS AND EVALUATION

Under the PCD (Section 29), NTUA is required to submit a detailed SSES Report to EPA that outlines several key findings about NTUA's wastewater collection system. This includes:

- The locations, severity of I/I entry, and structural defects in sewer pipes and manholes along with their condition ratings and prioritized repair plans based on the NASSCO *Manual of Practice*, the NASSCO PACP sewer pipe defect rating system, and the NASSCO MACP manhole defect rating system.
- Areas with significant buildup of FOG and their likely sources.
- Unauthorized or storm water connections to the system.
- Corrosion issues discovered in sewer pipes, manholes and other NTUA wastewater collection system assets.
- Manhole locations, rim elevations and depths to all mainline sewer inverts entering the manhole.
- I/I flowrate data and corresponding rainfall monitoring data.
- Smoke testing locations and results, including estimated I/I source contributions identified.
- Dyed water testing locations and results, including I/I source contributions identified.
- CCTV pipe inspection locations, sewer sizes, and sewer pipe materials.

Once the SSES data are collected, NTUA and/or its contractor shall conduct an appropriate quality review of the collected data in accordance with WEF MOP FD-6 as developed in accordance with Section 7. This review shall include the identification of meter drift and data dropouts, as well as any other anomalies. NTUA shall exclude all data with quality issues from use in subsequent analyses or noted only to be used with appropriate data qualifications identified in writing.

NTUA shall evaluate and analyze these collected data and information in accordance with the guidelines outlined in the IHS publication, *A Sanitation Deficiency System (SDS) – Guide for Reporting Sanitation Deficiencies for American Indian and Alaska Native Homes and Communities (Guidance Document)*.

The Indian Health Care Improvement Act (IHCA) requires an assessment of “the level of sanitation deficiency for each sanitation facilities project of each Indian tribe or community” (25 U.S.C. § 1632(g)(1)). To fulfill this mandate, each SDS project is assigned a Deficiency Level (DL), which reflects

the urgency and impact of the proposed improvements. Table 3 of the guidance document outlines the DL descriptions as defined by the IHCA (Exhibit 8), with Level V representing the highest priority demonstrating a lack of safe water supply and a sewage disposal system.

Table 3: Sanitation Deficiency Levels

Sanitation Deficiency Level		Sanitation Deficiency Levels [25 U.S.C. § 1632(g)(4)]
		Description
V	5	An Indian tribe or community that lacks a safe water supply and a sewage disposal system.
IV	4	An Indian tribe or community with a sanitation system which lacks either a safe water supply system or a sewage disposal system.
III	3	An Indian tribe or community with a sanitation system which has an inadequate or partial water supply and a sewage disposal facility that does not comply with applicable water supply and pollution control laws, or has no solid waste disposal facility.
II	2	An Indian tribe or community with a sanitation system which complies with all applicable water supply and pollution control laws, and in which the deficiencies relate to capital improvements that are necessary to improve the facilities in order to meet the needs of such tribe or community for domestic sanitation facilities.
I	1	An Indian tribe or community with a sanitation system which complies with all applicable water supply and pollution control laws, and in which the deficiencies relate to routine replacement, repair, or maintenance needs.
0	0	No deficiencies to correct.

Exhibit 8. Sanitation Deficiency Level (Source: Table 3, SDS Guidance Document)

Upon completion of the SSes, NTUA shall determine the current Sanitation Deficiency Level (SDL) for Tuba City wastewater collection system. NTUA shall evaluate the deficiencies identified through its own operation/maintenance program and the SSes to determine the appropriate wastewater collection system improvement measures, including repair, rehabilitation, replacement, and ongoing operation/maintenance activities. Appendix E of the guidance document provides additional details on project impact deficiency statements under each SDL. NTUA shall also assess how significantly the proposed repair/rehabilitation/replacement effort will improve sanitation conditions for Tuba City.

7. REPORTING AND QUALITY CONTROL

7.1 SSes Report

The SSes Report shall be submitted to EPA for review and approval within 30 days after completion of the evaluation. Because NTUA is subject to that submittal deadline, the contractor shall prepare and submit

to NTUA a final draft of the SSS Report to NTUA by no later than 25 calendar days after completion of the SSS.

7.2 Quality Control

NTUA shall be responsible for the overall performance of the SSS project. NTUA shall be responsible for quality control for the work efforts it provides toward completing the SSS. NTUA and its contractor shall develop a detailed quality control plan to ensure data collection is consistent and appropriate. The following guidelines provide an overview of the quality control procedures for the SSS and SSS Report:

- All field crews shall use the same inspection and data collection standards and protocols as adapted for the Tuba City SSS from other successful SSS projects. The contractor shall ensure that all personnel involved in performing the SSS and preparing the SSS Report are qualified to perform such activities.
- All field crews shall use the same inspection and data collection forms. Inspection form templates used by contractor crews will be reviewed by NTUA or their engineer for errors and omissions and shall be corrected by the contractor as required prior to initiation of any related SSS activities.
- Contractor submittals shall include a cover letter with a certification statement that verifies that all data have undergone a QA/QC check and that the data as presented is accurate and reliable within.
- All original inspection forms shall be filed to NTUA by its contractor for future reference. Any paper forms or notes/sketches shall be scanned to PDF format and linked to the relevant asset IDs in the GIS database. The contractor must retain scanned forms for a minimum of five (5) years. NTUA must retain copies of these scanned forms for at least two (2) years after the information has been uploaded to NTUA's asset database and the data entries have been verified. Any SSS form data or other related information not uploaded to NTUA's asset database must be retained for at least twenty-five (25) years or for two reinspection cycles, whichever is longer.
- Errors or omissions noted by the contractor's GIS analyst will be flagged and reported to NTUA for resolution.

8. SSS AND SSS REPORT

NTUA and its contractor shall complete an SSS for the Tuba City wastewater collection system no later than 20 months after EPA approval of this Work Plan. (Rain data delays are covered in **Section 4.4.2.**) Field activities for the SSS are expected to begin in the winter of 2025/2026. **Table 1** shows a schedule of SSS plan activities required by the PCD.

Table 1. Schedule of 2024 PCD Requirements for SSS Activities

PCD Requirement	Responsible Party	Submit for Review and Approval
Complete draft SSS Work Plan	ERG	May 30, 2025
Post draft SSS Work Plan on NTUA's website and social media	NTUA	May 30, 2025

PCD Requirement	Responsible Party	Submit for Review and Approval
Allowance for public review and comment for draft SSES Work Plan	-	June 1-30, 2025
Finalize draft SSES Work Plan	ERG	July 25, 2025
Submit draft SSES Work Plan to EPA	ERG	July 31, 2025
EPA approval of SSES Work Plan	EPA	TBD
Post final SSES Work Plan on website (finalized and EPA approved)	NTUA	7 calendar days after EPA approval ²
Complete SSES	NTUA and contractor	Within 20 months after EPA approval of the SSES Work Plan ¹
Submit SSES Report to EPA	NTUA and contractor	Within 30 calendar days after the completion of the SSES
EPA review of SSES Report	EPA	TBD
EPA approval of SSES Report	EPA	TBD

¹ Assuming no extensions of time for rainfall delays associated with I/I investigation.

² If NTUA receives public comments on draft deliverables that require more time to address than it has anticipated, it may ask EPA for an extension of the PCD deadline for submission of the final deliverables.

APPENDIX A 2024 PARTIAL CONSENT DECREE – (not available for draft version)

APPENDIX B GIS DATA – (not available for draft version)

APPENDIX C FLOW DATA – (not available for draft version)

APPENDIX D FLOW CHARACTERIZATION – (not available for draft version)

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