# NAVAJO TRIBAL UTILITY AUTHORITY
# SANITARY SEWER EVALUATION SURVEY WORK PLAN
# CHINLE WASTEWATER COLLECTION SYSTEM, ARIZONA

July 31, 2025


PREPARED BY

EASTERN RESEARCH GROUP
1113 Washington Avenue, Suite 300
Golden, CO 80401
www.erg.com

## TABLE OF CONTENTS

**1. Introduction ..... 1**

**2. SSES Investigation Areas ..... 3**

**3. Compliance Requirements ..... 13**

**4. SSES Field Activities ..... 14**

4.1 Corrosion Defect Identification ..... 15

4.2 Fats, Oils, and Grease ..... 16

4.3 Unauthorized Connections ..... 16

4.4 Gravity Sewer Inspection and Pipeline Assessment Certification Program Assessment ..... 16

4.4.1 Manhole Inspection and Manhole Assessment Certification Program Assessment ..... 16

4.4.2 Infiltration/Inflow Survey ..... 17

4.4.3 Smoke Testing ..... 18

4.4.4 Dyed Water Testing ..... 19

4.4.5 Closed-Circuit Television Inspection of Sewers ..... 19

4.4.6 Sewer Gas Monitoring ..... 20

4.4.7 Micro-Monitoring ..... 20

4.4.8 Storm Sewer Cross-Connections ..... 20

4.5 Interconnected Private Sanitary Wastewater and Stormwater Collection Systems ..... 20

4.6 Lift Station and Force Main Assessment ..... 21

**5. Data Collection and Storage ..... 21**

**6. Data Analysis and Evaluation ..... 22**

**7. Reporting and Quality Control ..... 23**

7.1 SSES Report ..... 23

7.2 Quality Control ..... 23

**8. SSES and SSES Report Schedule ..... 24**

## LIST OF EXHIBITSU

Exhibit 1. Vicinity Map ..... 2
Exhibit 2. NTUA-Owned Chinle Sanitary Sewer Lines with Manholes, Private Sewer Lines with Manholes, and Interconnection Points ..... 5
Exhibit 3. Proposed Chinle SSES Investigation Area: Sewer Line, Manhole, Rain Gauge, and Flow Monitoring Locations ..... 6
Exhibit 4. Proposed Chinle SSES Investigation Area: Known SSO Locations ..... 7
Exhibit 5. Chinle Sewer Diameter Distribution ..... 9
Exhibit 6. Chinle Sewer Material Distribution ..... 10
Exhibit 7. Chinle Flow Characterization ..... 12
Exhibit 8. Schedule of 2024 PCD Requirements for SSES Activities ..... 24

## APPENDICES

Appendix A: 2024 Partial Consent Decree

Appendix B: GIS Data

Appendix C: Flow Data

Appendix D: Chinle Flow Characterization

Appendix E: Schedule of Work

Appendix F: Additional Resources

## TECHNICAL REFERENCE DOCUMENTS CITED

American Society of Civil Engineers. (2007). Chapter 4: Corrosion processes and controls in municipal wastewater collections systems. In *Gravity sewer design and construction* (MOP 60, 2nd ed.). [Describes an evaluation system for ranking and prioritizing repair of corrosion defects.]

National Association of Sewer Service Companies. *Manhole Assessment Certification Program (MACP)* [most current version as of the due date for submittal of contractor proposals to perform the SSES work described in the Work Plan].

National Association of Sewer Service Companies. *Manual of practice* [most current version as of the due date for submittal of contractor proposals to perform the SSES work described in the Work Plan].

National Association of Sewer Service Companies. *Pipe condition assessment using CCTV: Performance specification guideline* [most current version as of the due date for submittal of contractor proposals to perform the SSES work described in the Work Plan].

National Association of Sewer Service Companies. *Pipeline Assessment Certification Program (PACP)* [most current version as of the due date for submittal of contractor proposals to perform the SSES work described in the Work Plan].

U.S. Environmental Protection Agency. (1991). *Handbook: Sewer system infrastructure analysis and rehabilitation* (EPA/625/6-91/030).

Water Environment Federation. (2022). *Design of wastewater and stormwater pumping stations* (MOP FD-4, 3rd ed.).

Water Environment Federation. (2009). *Existing sewer evaluation and rehabilitation* (MOP FD-6, 3rd ed.).

## LIST OF ABBREVIATIONS

| | |
|---|---|
| AC | asbestos cement |
| AGOL | ArcGIS Online |
| CCTV | closed-circuit television |
| DIP | ductile iron pipe |
| EPA | U.S. Environmental Protection Agency |
| Esri | Environmental Systems Research Institute |
| FD | facility design |
| FOG | fats, oils, and grease |
| GIS | geographic information system |
| GPD | gallons per day |
| $H_2S$ | hydrogen sulfide |
| I/I | infiltration/inflow |
| MACP | Manhole Assessment Certification Program |
| MOP | manual of practice |
| NASSCO | National Association of Sewer Service Companies |
| NPDES | National Pollutant Discharge Elimination System |
| NTUA | Navajo Tribal Utility Authority |
| OSHA | Occupational Safety and Health Administration |
| PACP | Pipeline Assessment Certification Program |
| PCD | Partial Consent Decree |
| PVC | polyvinyl chloride |
| QA/QC | quality assurance/quality control |
| RDII | rainfall derived infiltration/inflow |
| RRR | Repair, Rehabilitation, and Replacement |
| SSES | sanitary sewer evaluation survey |
| SSO | sanitary sewer overflow |
| VCP | vitrified clay pipe |
| WEF | Water Environment Federation |
| WWTP | wastewater treatment plant |

# 1. INTRODUCTION

In 2024, the Navajo Tribal Utility Authority (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 (SSESs) for the wastewater collection systems serving the Chinle, Kayenta, and Tuba City, Arizona, wastewater collection facilities. Before conducting the SSESs, NTUA shall submit, for EPA review and approval, an SSES Work Plan for each community describing how and under what schedule the SSESs 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 8 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 SSESs for Chinle, Kayenta, and Tuba City. The RRR Plans are not part of the scopes of the SSES Work Plans and resultant evaluations.

The information included in the SSES Reports shall be presented in formats that facilitate efficient development of the RRR Plans for the Chinle, Kayenta, and Tuba City wastewater collection systems. When ultimately developed, the RRR Plans shall identify and prioritize defects requiring repairs, rehabilitation, and replacements. Activities resulting from the SSESs are to prevent future sanitary sewer overflows (SSOs) and to maintain compliance with each community's National Pollutant Discharge Elimination System (NPDES) discharge permit. The RRR Plans resulting from the SSESs will serve as a tool to develop capital and operation/maintenance costs associated with the recommended remediation. They shall follow a "worst first" remediation logic wherever practicable.

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

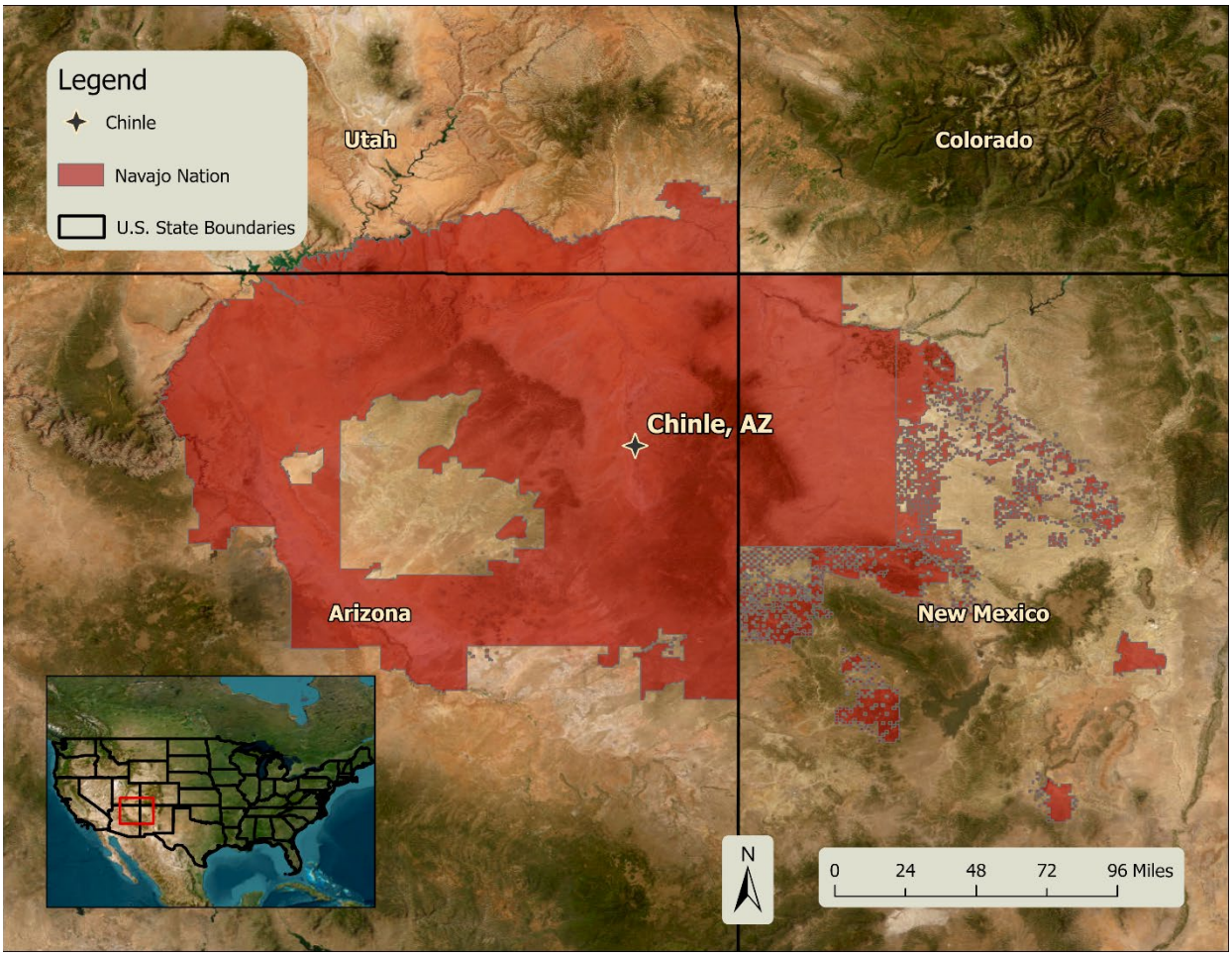



*Exhibit created by ERG.*

**Exhibit 1. Vicinity Map**

NTUA shall support access, promote sustainability, and ensure the provision of adequate sanitary waste disposal and treatment facilities for its citizens and the environment.

The Chinle SSES shall characterize the wastewater collection system flow response to precipitation and shall identify locations where SSOs and private property flooding have previously occurred. For the purposes of the SSES, SSOs include all releases either from the NTUA system or on private property that are the result of issues in the NTUA-owned system. The SSES shall also identify the discovered locations and relative severity of:

- Infiltration/inflow (I/I) contributing sanitary sewer system defects and inflow sources.
- Sanitary sewer system structural and corrosion-related defects.
- System hydraulic flow restrictions caused by undersized downstream facilities or defects.
- Hydraulic restrictions caused by buildups of grit; debris; fats, oils, and grease (FOG); or other obstructions.

Contributions of wastewater and I/I from private collection systems connected to the NTUA Chinle collection system are part of the SSES scope of work.

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

- Incorporation of the data from field activities and data collection previously performed.
- Field activities for NTUA and/or its contractor to carry out in performing the SSES.
- 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 the RRR Plan.

## 2. SSES INVESTIGATION AREAS

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

- Locations where dry-weather SSOs have previously occurred; their associated tributary areas; and the causes of these SSOs, as identified in NTUA records.
- Locations where wet weather SSOs have previously occurred; their associated tributary areas; and the causes of these SSOs, as identified in NTUA records.
- Locations discovered to have potentially excessive dry-weather and/or wet-weather I/I rates.
- 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 within the wastewater collection system that reduce the overall hydraulic capacity of that collection 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, including SSOs at the Chinle lift station.
- Connection points of consecutive private collection systems connected to the NTUA Chinle wastewater collection system and their contributions of wastewater and stormwater flow.

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 interconnection points shown in **Exhibit 2**, below, are based on NTUA's current understanding and will be confirmed during the SSES, as well as identifying any additional interconnection points (if present).

This 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 buildups greater than 20% of pipe diameter.
- Pieces of sewer pipe or manhole materials.
- Illegally disposed-of materials.
- FOG or other 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. Only the characterization of their contributions of wastewater and stormflow is to be considered in the scope of work.

NTUA shall use 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 Chinle wastewater collection system, which consists of gravity-fed pipes and one lift station, complex monitoring and hydraulic modeling will likely not be needed as part of the SSES. Should the SSES identify sections of the wastewater collection system that might become pressurized under peak dry-weather flow conditions or wet-weather flow conditions, NTUA shall consider developing 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.** Non-NTUA-owned collection system assets (shown in red in **Exhibit 2**) are not part of this scope of work and are excluded from SSES investigations. Only their contributions of wastewater and stormwater flow shall be evaluated at the connection point to the NTUA collection system. The NTUA wastewater collection system (with manholes, rain gauges, and flow collection locations) is shown in **Exhibit 3.** Existing customers or connections to the NTUA wastewater collection system, as of fall 2024, consist of 87 retail commercial connections and 647 residential connections for a total of 734 connections. Flow data for four totes currently installed in the NTUA wastewater collection system and respective manholes are presented in **Appendix C. Exhibit 4** displays the historically documented SSO locations within the SSES investigation area of Chinle.

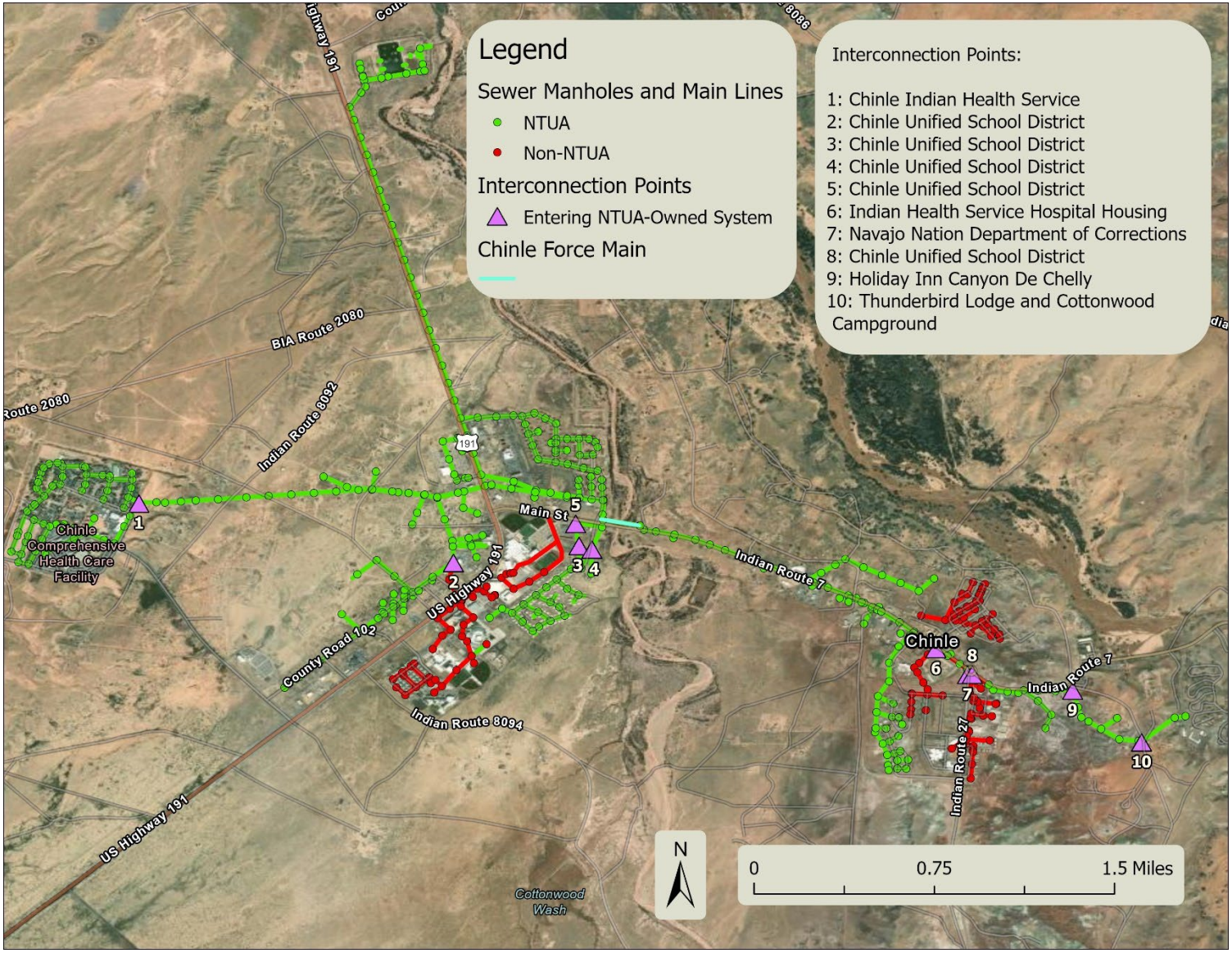



*Exhibit created by ERG using GIS data from NTUA, available in Appendix B.*

**Exhibit 2. NTUA-Owned Chinle Sanitary Sewer Lines with Manholes, Private Sewer Lines with Manholes, and Interconnection Points**

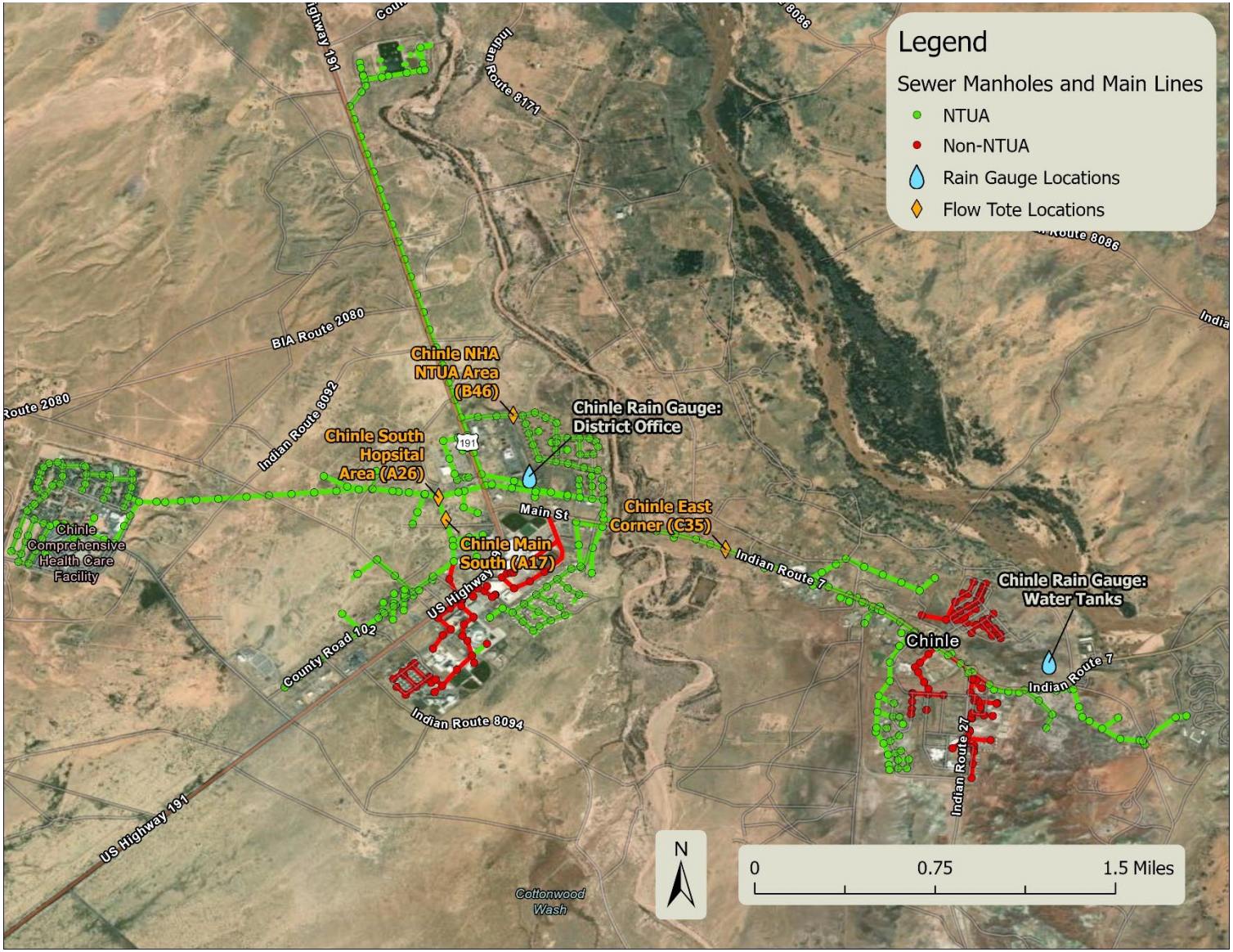



*Exhibit created by ERG using GIS data from NTUA, available in Appendix B.*

**Exhibit 3. Proposed Chinle SSES Investigation Area: Sewer Line, Manhole, Rain Gauge, and Flow Monitoring Locations**

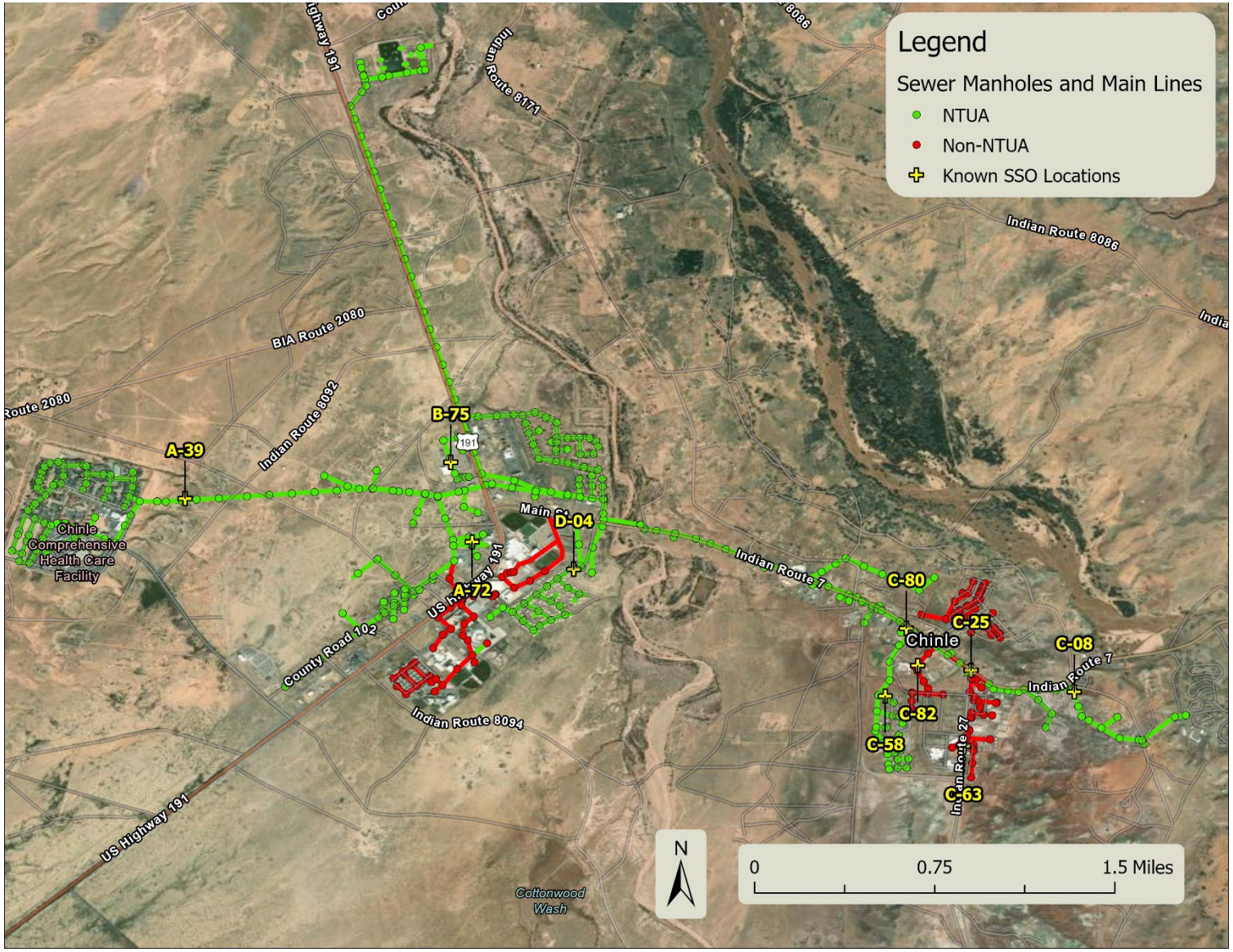



*Exhibit created by ERG using GIS data from NTUA, available in Appendix B.*

**Exhibit 4. Proposed Chinle SSES Investigation Area: Known SSO Locations**

The Chinle wastewater collection system comprises about 22.01 miles of pipe. Pipe diameters and materials are detailed in **Exhibit 5** and **Exhibit 6**, respectively. The majority of the system consists of 8-inch-diameter sewer mains, totaling about 13.48 miles. The system also includes 1.50 miles of 4-inch pipe, 0.29 miles of 6-inch pipe, as well as larger sewer collector/trunk lines—2.91 miles of 10-inch pipe, 0.07 miles of 12-inch pipe, 1.16 miles of 15-inch pipe, 0.80 miles of 18-inch pipe, and 1.79 miles of 21-inch pipe—to convey higher flow volumes to the wastewater treatment plant (WWTP). About 0.01 miles of sewer pipe are of unknown diameter due to insufficient data. The diameters and materials of construction of all NTUA sewers shall be internally inspected and confirmed by closed-circuit television (CCTV).

According to NTUA records, 12.17 miles of the Chinle sewer pipe is constructed of vitrified clay pipe (VCP), accounting for about 55% of the total public sewer system. The second-commonest pipe material is polyvinyl chloride (PVC), constituting 8.68 miles or about 39% of the total public sewer system. The remaining 6% of the public sewer system includes 0.12 miles of ductile iron pipe (DIP) and 1.04 miles of asbestos cement (AC) pipe.

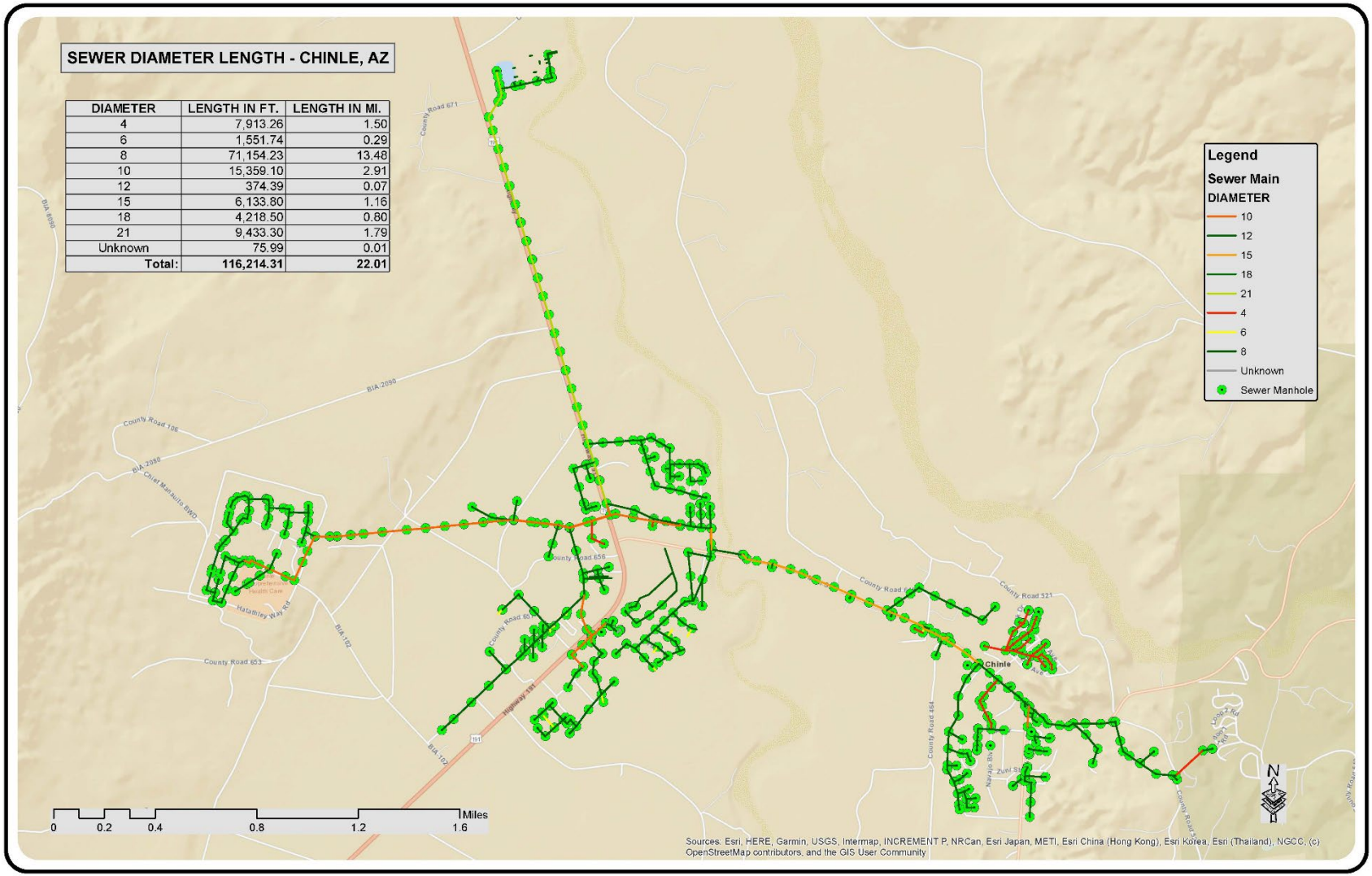



*Exhibit created by NTUA.*

**Exhibit 5. Chinle Sewer Diameter Distribution**

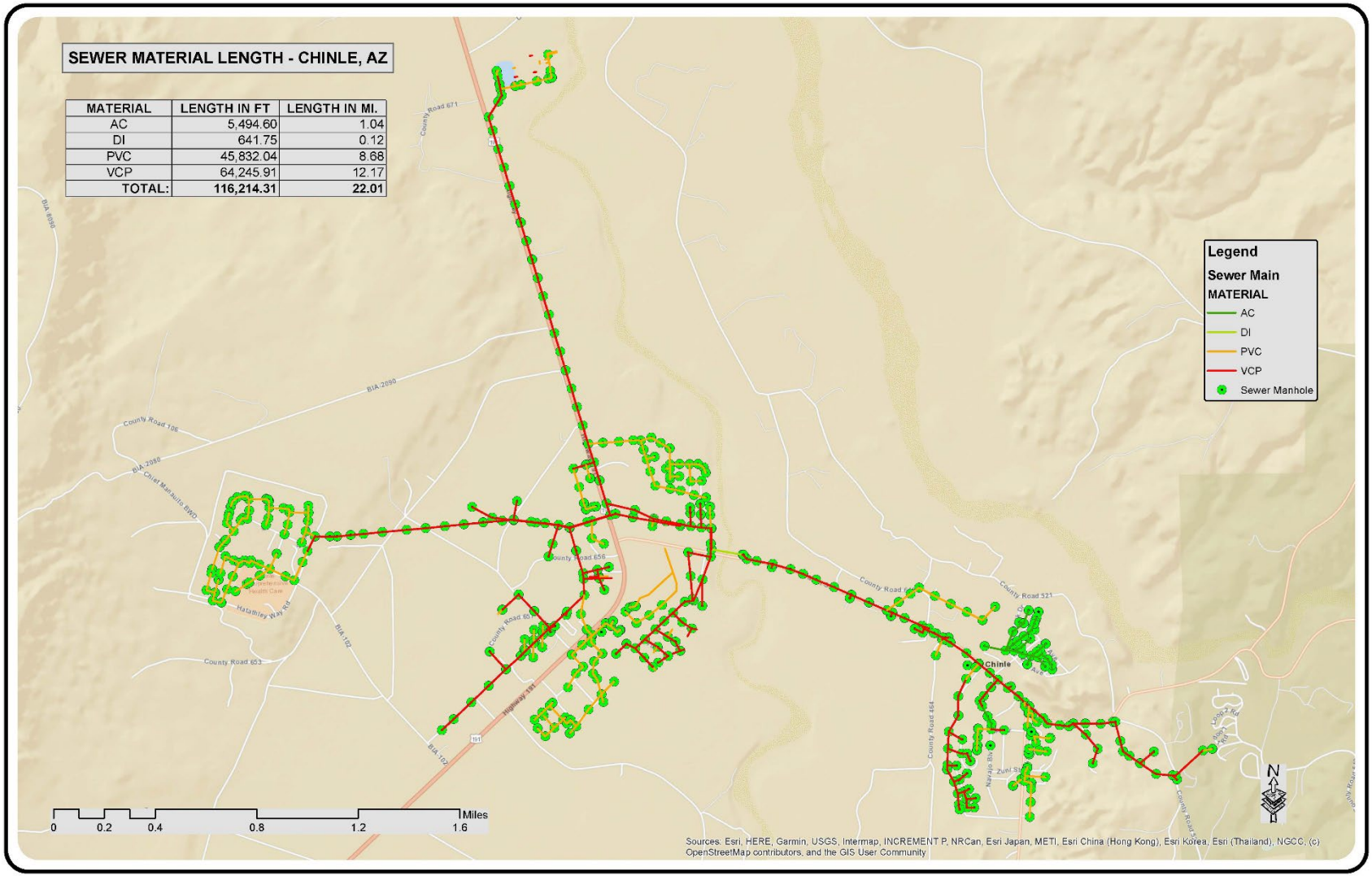



*Exhibit created by NTUA.*

**Exhibit 6. Chinle Sewer Material Distribution**

Based on the wastewater connection source estimates provided by NTUA, the average daily wastewater flows for Chinle are estimated to range between 399,379 and 791,544 gallons per day (GPD), excluding I/I. The majority of this flow (about 58% of the total)—between 230,480 and 457,520 GPD—is attributed to the residential sector, includes 647 connections, and is based on an estimated population of 4,300 residents (**Exhibit 7**). The second highest flow comes from a commercial source, schools; this contribution is between 100,853 and 201,705 GPD. Fire stations and gas stations are the lowest-contributing sources to the Chinle sanitary sewer system in terms of wastewater flow. Flow estimates for residential and commercial sources are 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 its contractor shall obtain detailed potable water usage data for Chinle and perform a comparative analysis. This analysis shall include a side-by-side comparison of Chinle's flow characterization data (as presented in **Exhibit 7**), potable water usage data, and average dry weather WWTP inflow data. The purpose of this analysis is to further validate the wastewater source assumptions upon which **Exhibit 7** is based and to estimate seasonal groundwater infiltration and exfiltration rates and peak rainfall derived infiltration/inflow (RDII) rates. The analysis and any conclusions drawn therefrom shall be presented in the SSES Report. The Chinle 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 Chinle WWTP, including but not limited to locations of tributary connecting sewers, connection configurations, connection flow data, and tributary wastewater classifications (domestic/commercial/industrial/institutional).

**Exhibit 7. Chinle Flow Characterization**

| Customer Category | Wastewater Source | Estimated No. of Connections (NTUA Data) | Lower Flow Estimate (GPD)[a] | Upper Flow Estimate (GPD)[a] | Assumptions[b] |
|---|---|---|---|---|---|
| Commercial | Office/business | 46 | 21,574 | 42,826 | Assuming 20 to 49 employees per business, 35 employees average. |
| | Gas station | 3 | 216 | 360 | Assuming "auto service station" category for water usage. |
| | Church | 4 | 6,566 | 13,034 | Assuming 350 people per church, based on the data from the Church of Our Lady of Fatima, Chinle. |
| | Restaurant | 5 | 2,753 | 5,466 | Assuming an average minimum use of 300,000 gallons/year per restaurant. |
| | Grocery store | 1 | 2,546 | 5,054 | Assuming an onsite staff of up to 50 employees and a retail space of 28,000 square feet. See Appendix D-2 for additional information. |
| | Jail/courthouse | 4 | 7,580 | 15,540 | Assuming 24 inmates and 19 employees per facility, based on data from the Navajo Department of Corrections' Chinle facility. |
| | Hospital/clinic | 2 | 20,100 | 39,900 | Assuming 60 beds per facility, based on data from Chinle Comprehensive Health Care Facility. |
| | School | 17 | 100,853 | 201,705 | Assuming 8 schools and 3,164 students, based on data from Chinle Unified School District (showing an average of about 396 students per school). Each school is assumed to include a cafeteria, a gymnasium, and shower facilities. |
| | Hotel | 2 | 6,560 | 9,840 | Assuming 104 rooms at 60% occupancy rate, yielding an estimated 62 visitors. Additionally, it is assumed there are 20 employees, based on data from the Best Western Canyon De Chelly Hotel, Chinle. |
| | Fire station | 1 | 151 | 299 | Assuming 2 volunteers, 3 paid firefighters. Based on data from the Navajo Nation Department of Fire and Rescue Services website. |
| | Water tank | 1 | NA | NA | Assuming minimal wastewater flow. |
| Residential | Residential | 647 | 230,480 | 457,520 | Assuming Chinle total residential population of 4,300 and using GPD rates per person. |
| **Total theoretical average daily flow (GPD)** | | | **399,379** | **791,544** | **Does not include I/I.** |

[a] Lower and upper flow estimates are calculated using sewage flow estimating guides from Pollution Control Systems (www.pollutioncontrolsystem.com/Uploads/images/Pages/SEWAGE%20FLOW%20RATE%20ESTIMATING%20GUIDE%20Nov%202014_20170105.pdf) and the Arizona Administrative Code (https://apps.azsos.gov/public_services/title_18/18-09.pdf).

[b] These assumptions are based on a variety of sources. For detailed references and individual citations, refer to Appendix D.

# 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 Plan for the Chinle collection system for EPA review and approval by no later than August 2, 2025, the one-year anniversary of the PCD's effective date. NTUA shall conduct and complete the SSES by no later than 20 months after EPA approval of the SSES Work Plan. NTUA shall submit each SSES Report for EPA review and approval within 30 days after completion of each SSES.

The SSES Report shall:

- Be prepared by NTUA and/or its contractor in consultation with NTUA.
- Include a certification from the contractor that performed the SSES work that that work was done in general accordance with the National Association of Sewer Service Companies (NASSCO) *Manual of Practice,* NASSCO Pipeline Assessment Certification Program (PACP) guidance, and NASSCO Manhole Assessment Certification Program (MACP) guidance in effect on the due date 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. (Where practicable, such deviations shall have been pre-approved by NTUA before the contractor performs the relevant SSES task.)
- Present the results and findings of the SSES, including summaries of the methodologies used 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 and characterize discovered inflow sources.
- Identify the locations and types of hydraulic constraints discovered in the NTUA wastewater collection system, such as physical constrictions or buildups of grit, debris, and/or FOG.
- Correlate the identified defects, inflow sources, and hydraulic constraints with the known SSO locations.

NTUA shall achieve and maintain compliance with both the PCD and the NPDES permit by implementing and adhering to the compliance requirements and schedules set therein. All SSES 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 Chinle utility NPDES permits and the Clean Water Act.

PCD Paragraph 11 sets the following public notification and involvement requirements to NTUA for the SSES Work 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, 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 it had anticipated, it shall request an extension of the applicable PCD deadline from EPA.
- When NTUA submits deliverables to EPA, it shall attach public comments received and its explanations of how deliverables respond to those comments. (Note that public posting was carried out in accordance with PCD requirements; no comments were received during the posting period.)
- 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 Chinle 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 and conveys sewage from portions of wastewater collection systems owned and operated by others and associated private collection system connected to the NTUA collection system. 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 Chinle 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 physical properties 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; lift station inspection; manhole elevation/location/depth-to-invert surveys; sewer system cleaning; manhole visual inspections; sewer CCTV inspections; and visual inspections of other collection system assets. A schedule of work to cross-reference SSES components and the relevant sections of this Work Plan is provided in **Appendix E**. The quantities are estimated based on NTUA information but may vary based on the findings of the SSES. The division in work responsibilities between NTUA staff and outside contractors shall be developed in detail through proposal and negotiations prior to award and the beginning of the SSES, in accordance with the PCD-required schedule, and shall be memorialized in writing.

The SSES shall be conducted in accordance with sound engineering judgement 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's) *Existing Sewer*

*Evaluation and Rehabilitation* (MOP FD-6, third edition, 2009), and NASSCO's *Manual of Practice* (version in effect at the due date for contract proposal submission). Additional resources for conduct of the SSES, not cited in the PCD, are included in **Appendix F**.

Capacity management and operation and maintenance inspections will be performed and documented in the SSES. Along with routine inspection reports, NTUA and/or its contractor will consider mechanical reliability issues, capacities, lift redundancy, and alterative power sources in the SSES. Lift station systems may be reviewed for potential force main televising as well.

The SSES Report shall provide:

- Ratings of individual defects within each sewer segment and an overall rating for that segment in accordance with the NASSCO PACP.
- Ratings of defects in sanitary sewer manholes in accordance with the NASSCO MACP.
- Narrative descriptions (in formats approved by NTUA) of the defects discovered in NTUA wastewater collection system assets.

The SSES shall involve field work in the specific areas described in the subsections below.

### 4.1 Corrosion Defect Identification

The SSES shall include procedures for inspecting and identifying 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 through 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, second edition, 2007).

One cause of corrosion in a sewer system is the elevated presence of hydrogen sulfide ($H_2S$) converting to sulfuric acid upon oxidation. This can significantly contribute to the gradual deterioration of sewer systems, particularly those built using concrete or metal components. This type of corrosion is most commonly discovered in areas of sewers with relatively flat slopes, manhole locations, junction chambers, and wet wells. Public sewers in the Chinle wastewater collection system consist primarily of VCP and PVC pipe, which are resistant to $H_2S$. Therefore, $H_2S$ corrosion is not expected to occur in the majority of Chinle sewers. However, DIP/cured-in-place and AC pipe are subject to $H_2S$ corrosion, and therefore should undergo CCTV inspection. Concrete structures, such as manholes, junction chambers, lift stations, and wet wells, are also subject to $H_2S$ corrosion, and should be inspected for corrosion with the tools detailed in this section.

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. NTUA may use color-sensitive pH paper to measure pH at a surface (with values below 4 typically indicating active corrosion of AC and DIP). For ferrous and AC pipes, NTUA may use a sonic caliper to measure the distance from the transmitter to the pipe wall surface following sewer cleaning to determine if material is missing.

### 4.2 Fats, Oils, and Grease

Areas with signs of significant FOG deposition shall be evaluated and documented in the SSES 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 observations 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 FOG commonly associated with food service 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 internal sewer inspection phase of the SSES to determine which sanitary sewer service connections appear to be active and inactive (and to document that determination).

### 4.4 Gravity Sewer Inspection and Pipeline Assessment Certification Program Assessment

Gravity sewer inspection and assessment shall follow EPA's *Handbook: Sewer System Infrastructure Analysis and Rehabilitation*, WEF MOP FD-6, NASSCO's *Manual of Practice* (most current version as of the due date 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 contractor performing the SSES shall be certified in accordance with NASSCO standards.

The primary investigative tools used to assess the sewer system's structural condition shall include sewer cleaning results, manhole inspections, and CCTV inspections. The primary investigative tools used for I/I source identification shall include NTUA flow/rainfall metering results, micro-monitoring, smoke testing, dyed water testing, and CCTV. There are no known storm sewers in Chinle, but if they are found during the conduct of the SSES, dyed water flood testing may be more effective than smoke testing. Crossflows between sanitary and storm sewers can compromise the accuracy of smoke testing results, 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 needed for each task. Stormwater contributions of the private collection systems' connection to the NTUA collection system are part of the scope of work.

#### *4.4.1 Manhole Inspection and Manhole Assessment Certification Program Assessment*

Manhole inspection and assessment shall follow EPA's *Handbook: Sewer System Infrastructure Analysis and Rehabilitation*, WEF MOP FD-6, NASSCO's *Manual of Practice* (most current version as of the due date 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 contractor performing the SSES shall be certified in accordance with NASSCO standards.

The primary investigative tool for manholes shall be visual inspection. Manholes shall be inspected for structural defects, potential direct sources of I/I into manholes, and potential direct cross-connections between storm sewers (if found) 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 manhole components. Additional investigation techniques may be required if suspected storm sewer cross-connections cannot be confirmed by visual inspection, dye testing, pole cameras, and sewer pipe CCTV.

NTUA shall be notified within 24 hours of any manholes discovered to have missing or damaged covers. NTUA shall be notified within five business days of any manholes discovered to have steps installed. **Installed manhole steps should NOT be used by NTUA or contractor staff.** Installed manhole steps have been proven to be a safety hazard: corrosion of their mountings may not be visible, meaning they 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 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, as well as identifying any areas with particularly high I/I.
- Perform continuous, accurate (measured value within +/-5% of actual value) influent flow monitoring at the WWTP. NTUA and/or its contractor shall record influent flow data for the duration of the SSES and maintain the 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 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, record, and report in NeT-Sewer Overflow:
    - 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 may be relocated upstream or downstream by one or more manholes if the manhole at an identified location has unfavorable hydraulic conditions such as excessive turbulence or too steep a slope. If depth/velocity meters are moved to 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 **Exhibit 3.** 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, the gauges shall, at a minimum, provide electronically downloadable rainfall measurements at no greater than five-minute time increments and shall meet the accuracy standards of the National Weather Service.[1] The suggested gauge locations shown in **Exhibit 3** may be adjusted for accuracy and security. If rain gauges are at locations other than those in **Exhibit 3**, NTUA shall notify EPA of these changes. 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[2] and data dropouts as well as any other anomalies. Data with quality issues shall be excluded from use in subsequent analyses where practical or shall 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 flow meter location and by micro-monitoring location in gallons per capita per day, gallons per acre per day, and 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 more than 1.0 inch within 1 hour) 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 its 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 used to focus other SSES investigations such as smoke testing and dyed water testing in areas displaying potentially excessive inflow. 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 is a method to quickly screen large areas of a sanitary sewer system for the presence of I/I sources in those portions of the system that have displayed higher wet weather response. Smoke testing can identify cross-connections between public sanitary sewers and public storm sewers (if found). Smoke

[1] For manually measured rainfall, the National Weather Service standard is that the measurements should be accurate to ±0.02 inches of the measured amount. For automated measurement, the accuracy level is ±0.1 inches, from 0 to 20 inches (https://www.weather.gov/media/directives/010_pdfs/pd01013002curr.pdf).

[2] Meter drift refers to a gradual and unintended change in the output of a flow meter over time, which is not due to actual changes in the flow rate itself. Meter drift in flow meters used for the SSES can occur due to various factors including wear and tear, fouling, and environmental factors.

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 where storm sewers and sanitary sewers are near each other 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 succeed in detecting mainline and lateral sewer I/I sources in areas having wet or dense cohesive subsoils. Finally, smoke testing may not succeed in locating private storm drains having running traps. Private drains, including those suspected of having traps, should be tested with dyed water instead.

Priority zones for smoke testing include older residential neighborhoods with known aging infrastructure and/or high I/I, areas with limited storm drainage, low-lying areas, 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 any direct and indirect cross-connections between sanitary sewers and any found storm sewers. This testing shall be conducted by flooding ground surfaces above the sanitary sewers and/or filling storm sewer segments (if found) 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. It is most commonly done in the public right-of-way, but 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 inspection of the NTUA wastewater collection system shall be performed in accordance with NASSCO's *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 using 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, any storm sewers or storm sewer cross-connections, illicit overland discharges, illicit discharges to private property, and non-stormwater discharges to the storm sewer system (if found). Selected portions of any storm sewer system as identified by NTUA shall also be televised to assess conditions and confirm any suspected illicit discharges to or from the sanitary sewer system.

CCTV testing shall also be used together with dye flood testing of any found 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 Chinle 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*

$H_2S$ monitoring for the SSES shall follow current industry practices and technologies. NTUA and/or its contractor shall conduct $H_2S$ monitoring using detection devices meeting Occupational Safety and Health Administration (OSHA) standards before, and continuously during, personnel entry into sewers, manholes, hydraulic junction chambers, or other confined space wastewater assets. $H_2S$ detection devices shall be periodically calibrated in accordance with the equipment manufacturer's instructions. The NTUA and/or its contractor shall also perform bump tests[3] or calibration checks of $H_2S$ detection devices before each day of use. NTUA and/or its contractor shall submit the results of periodic $H_2S$ 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 weekly. NTUA and/or its contractor shall immediately discontinue work at any location where the $H_2S$ concentrations are discovered to exceed 20 parts per million at any time during $H_2S$ monitoring and shall advise NTUA of such locations as soon as is practicable, but not later than four hours after detection. NTUA and/or 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 a sanitary sewer's wet-weather flow responses and screen for suspected problems in high I/I areas. Micro-monitoring is performed using 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 within the tributary high I/I areas are 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 for 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. NTUA and/or its contractor shall develop a plan for conducting micro-monitoring based on review of existing flow monitoring records, rainfall data, field observations, and NTUA operations and maintenance records.

#### *4.4.8 Storm Sewer Cross-Connections*

NTUA has indicated that there are no known engineered stormwater collection systems. All storm/sanitary sewer cross-connections that are 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 Report. See **Exhibit 2** for the

[3] A bump test (also called a function check or response check) is a quick test to confirm the proper operation of a device using a known concentration of test gas.

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

If private stormwater collection systems are found to be cross-connected to the NTUA wastewater collection system during the SSES, the interconnected locations shall be documented and reported to NTUA within one working day of discovery. NTUA and/or its contractor shall develop procedures for measuring stormwater flows from private stormwater collection systems entering the NTUA wastewater collection system where feasible. The contractor shall implement such measurement procedures as directed by NTUA.

### 4.6 Lift Station and Force Main Assessment

For this component of the SSES, NTUA shall establish procedures for evaluating the performance and adequacy of any lift station that may be added to the sanitary sewer in the future. This component shall include wet well pump-down procedures to establish actual current lift station capacities. Consistent with WEF's *Design of Wastewater and Stormwater Pumping Stations* (MOP FD-4, third edition, 2022), it may also include items such as the use of pump run time meters, pump start cycles, computation of nominal average operating time for each lift station pump, and root cause failure analysis protocols.

## 5. DATA COLLECTION AND STORAGE

To enhance efficiency, accuracy, and coordination during Chinle SSES field data collection, NTUA and/or its contractor 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 main AGOL dataset categories that shall be used are:

- Wastewater collection system GIS layers.
- Sanitary system mapping changes.
- SSES project-specific GIS layers:
    - 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 with non-FOG-related sediment buildups.
    - Sewer segments with FOG-related buildups.

- Other GIS layers deemed necessary by NTUA.

Esri's Field Maps, a mobile app for Windows, iOS, and Android devices, 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. If NTUA elects to allow the contractor to field-edit its GIS database, NTUA and/or its contractor shall avoid issues with inadequate QA/QC review by developing (and following) a formal field data entry process and relevant QA/QC data validation protocols.

If possible, NTUA shall create an organizational account with AGOL, which remote collectors shall use to enter data in real time. If that is not possible, collected field data shall be uploaded to an AGOL-based website. In either case, periodic data exports from the AGOL GIS will allow NTUA or its contractor to update NTUA's GIS information while real-time field data collection continues.

As well as real-time data collection and aggregation, NTUA shall use AGOL to track progress of field activities. NTUA and/or its contractor shall regularly update field work status GIS layers indicating crew, date, photo attachments, and inspection/installation report attachment as the following field efforts progress:

- 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), the SSES Report must outline 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 stormwater 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.
- Performance and condition of the lift station.

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 only used such data is a manner consistent with its appropriate data qualifiers.

NTUA will evaluate and analyze the collected data in accordance with the standards set forth in the NASSCO PACP and MACP protocols, including identifying what needs to be addressed to correct known SSOs, the structural defects that should be addressed near-term, and which areas require further monitoring. Following completion of the SSES, NTUA shall identify defects within each sewer segment and manhole in the Chinle wastewater collection system. Both the deficiencies identified through NTUA's ongoing operation and maintenance program, as well as those uncovered during the SSES, will be assessed to determine appropriate improvement measures including repair, rehabilitation, replacement, or continued operation and maintenance activities. All defect assessments will follow NASSCO PACP and MACP protocols, and condition ratings will be assigned to each segment to ensure alignment with industry standards.

In addition, NTUA shall assess the extent to which the areas identified—whether for repair, rehabilitation, or replacement—will enhance overall sanitation conditions in Chinle. A comprehensive SSES Report will be developed, prioritizing repairs and rehabilitation efforts based on both the likelihood and consequence of failure, as outlined in NASSCO PACP Appendix D, as described in the reference documents cited in Paragraph 29.b of the PCD.

# 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 a final draft of the SSES Report and submit it to NTUA by no later than 25 calendar days after completion of the SSES. The SSES Report shall be signed by an NTUA official in accordance with Section 53 of the PCD.

## 7.2 Quality Control

NTUA shall be responsible for the overall performance of the SSES project. NTUA shall be responsible for quality control for its own work toward completing the SSES. 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 SSES and SSES Report:

- All field crews shall use inspection and data collection standards and protocols adapted for the Chinle SSES from other successful SSES projects. The contractor shall ensure that all personnel involved in performing the SSES and preparing the SSES 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 and/or its engineer for errors and omissions and shall be corrected by the contractor as required prior to initiation of any related SSES activities.
- Each contractor submittal 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 are accurate and reliable.
- All original inspection forms shall be filed with 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 shall keep scanned forms for at least five years. NTUA shall keep copies of these scanned forms for at least two years after the information has been uploaded to NTUA's asset database and the data entries have been verified. Any SSES form data or other related information not uploaded to NTUA's asset database must be kept for at least 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. SSES AND SSES REPORT SCHEDULE

NTUA and its contractor shall complete an SSES for the Chinle 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 SSES are expected to begin in the winter of 2025/2026. **Exhibit 8** shows a schedule of SSES plan activities required by the PCD.

**Exhibit 8. Schedule of 2024 PCD Requirements for SSES Activities**

| PCD Requirement | Responsible Party | Submit for Review and Approval |
|---|---|---|
| Complete draft SSES Work Plan | ERG | May 30, 2025 |
| Post draft SSES Work Plan on NTUA's website and social media | NTUA | May 30, 2025 |
| 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 |
| Approve SSES Work Plan | EPA | TBD |
| Post final SSES Work Plan on website (finalized and EPA-approved) | NTUA | 7 calendar days after EPA approval[a] |
| Complete SSES | NTUA and contractor | Within 20 months after EPA approval of the SSES Work Plan[b] |

| PCD Requirement | Responsible Party | Submit for Review and Approval |
|---|---|---|
| Submit SSES Report to EPA | NTUA and contractor | Within 30 calendar days after the completion of the SSES |
| Review SSES Report | EPA | TBD |
| Approve SSES Report | EPA | TBD |

[a] If NTUA receives public comments on draft deliverables that need 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.

[b] Assuming no extensions for rainfall delays associated with I/I investigation.

**APPENDIX A 2024 PARTIAL CONSENT DECREE**

**APPENDIX B GIS DATA**

**APPENDIX C FLOW DATA**

**APPENDIX D CHINLE FLOW CHARACTERIZATION**

**APPENDIX E SCHEDULE OF WORK**

**APPENDIX F ADDITIONAL RESOURCES**

# APPENDIX A. 2024 PARTIAL CONSENT DECREE

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF ARIZONA
PRESCOTT DIVISION

| | |
|---|---|
| United States of America,<br>Plaintiff,<br>v.<br>Navajo Tribal Utility Authority,<br>Defendant. | No. 3:24-cv-08006-MTL<br><br>**PARTIAL CONSENT DECREE** |

TABLE OF CONTENTS


| | | |
|---|---|---|
| I. | JURISDICTION AND VENUE | 4 |
| II. | APPLICABILITY | 4 |
| III. | OBJECTIVE | 5 |
| IV. | DEFINITIONS | 6 |
| V. | COMPLIANCE REQUIREMENTS | 12 |
| VI. | REPORTING REQUIREMENTS | 43 |
| VII. | STIPULATED PENALTIES | 46 |
| VIII. | FORCE MAJEURE | 54 |
| IX. | DISPUTE RESOLUTION | 56 |
| X. | INFORMATION COLLECTION AND RETENTION | 58 |
| XI. | EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS | 60 |
| XII. | COSTS | 63 |
| XIII. | NOTICES | 63 |
| XIV. | EFFECTIVE DATE | 64 |
| XV. | MODIFICATION | 65 |
| XVI. | TERMINATION | 65 |
| XVII. | PUBLIC PARTICIPATION | 65 |
| XVIII. | SIGNATORIES/SERVICE | 66 |
| XIX. | INTEGRATION | 66 |
| XX. | NOT A FINAL JUDGMENT | 67 |
| XXI. | HEADINGS | 67 |
| XXII. | APPENDICES | 67 |

Plaintiff, United States of America, on behalf of the United States Environmental Protection Agency ("EPA"), has filed a complaint in this action concurrently with this Partial Consent Decree, alleging that Defendant, Navajo Tribal Utility Authority ("NTUA"), violated limitations and conditions established in the National Pollutant Discharge Elimination System ("NPDES") Permits issued to NTUA by EPA under Section 402 of the Clean Water Act ("Act"), 33 U.S.C. § 1342.

The Complaint alleges that NTUA has violated its NPDES Permits at three of its wastewater treatment plants ("WWTPs") and associated Collection Systems (each WWTP together with its Collection System is a "Facility," and collectively the "Facilities") by, among other things, (1) failing to comply with effluent limits in the NPDES Permits; (2) failing to comply with operation and maintenance requirements of the NPDES Permits; (3) failing to comply with terms requiring plan submissions in the NPDES Permits; and (4) failing to comply with reporting requirements of the NPDES Permits.

NTUA does not admit any liability to the United States arising out of the transactions or occurrences alleged in the Complaint.

The Parties desire to avoid further litigation and to work cooperatively on issues relating to NTUA's alleged violations.

To comply with the provisions of this Partial Consent Decree, NTUA is obligated to perform Work. To pay for the Work needed to comply with this Partial Consent Decree, NTUA intends to rely on grants, loans, fees and/or assessments.

The Parties recognize that, to address NTUA's noncompliance fully, further analysis of technical issues will first be needed. Therefore, the Parties recognize and agree that this Partial Consent Decree is a partial remedy for the civil claims of the United States for the violations

alleged in the Complaint. Further action may include, but is not limited to, additional litigation between the Parties. The Parties intend to resolve these civil claims in a subsequent final consent decree that includes further injunctive relief, including but not limited to work to address overflows emanating from the Collection Systems and civil penalties.

NOW, THEREFORE, before the taking of any testimony, without the adjudication, determination or admission of any issue of fact or law except as provided in Section I, and with the consent of the Parties, IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

## I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action, pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, and Section 309(b) of the Act, 33 U.S.C. § 1319(b), and over the Parties. Venue lies in this District pursuant to Section 309(b) of the Act, 33 U.S.C. § 1319(b), because NTUA is located in this judicial district. For purposes of this Partial Consent Decree, or any action to enforce this Partial Consent Decree, NTUA consents to the Court's jurisdiction over this Partial Consent Decree and any such action and over NTUA and consents to venue in this judicial district.

2. For purposes of this Partial Consent Decree, NTUA agrees that the Complaint states claims upon which relief may be granted pursuant to Section 309(b) of the Act, 33 U.S.C. § 1319(b).

## II. APPLICABILITY

3. The obligations of this Partial Consent Decree apply to and are binding upon the United States, and upon NTUA and any successors, assigns, or other entities or persons otherwise bound by law.

4. No transfer of ownership or operation of the Facilities, whether in compliance with the procedures of this Paragraph or otherwise, shall relieve NTUA of its obligation to ensure that the terms of the Partial Consent Decree are implemented. At least 30 Days prior to such transfer, NTUA shall provide a copy of this Partial Consent Decree to the proposed transferee and shall simultaneously provide written notice of the prospective transfer, together with a copy of the proposed written agreement, to EPA and DOJ, in accordance with Section XIII (Notices). Any attempt to transfer ownership or operation of the Facilities without complying with this Paragraph constitutes a violation of this Partial Consent Decree.

5. Within 10 Days after the Effective Date, NTUA shall provide a copy of this Partial Consent Decree to all officers, employees, and agents whose duties might reasonably include compliance with any provision of this Partial Consent Decree, as well as to any contractor retained to perform Work required under this Partial Consent Decree. NTUA shall condition any such contract entered into after the Effective Date upon performance of the Work in conformity with the terms of this Partial Consent Decree.

6. In any action to enforce this Partial Consent Decree, NTUA shall not raise as a defense the failure by any of its officers, directors, employees, agents, or contractors to take any actions necessary to comply with the provisions of this Partial Consent Decree.

## III. OBJECTIVE

7. It is the objective of the Parties in entering into this Partial Consent Decree to have NTUA perform the Work in Section V (Compliance Requirements), which the Parties agree is necessary for NTUA to achieve and maintain continuous, sustainable, and long-term compliance with the Act, the Act's implementing regulations, and the NPDES Permits at the Facilities. All obligations under this Partial Consent Decree shall be interpreted in a manner

consistent with this goal. The Parties recognize that the Work required by this Partial Consent Decree will not on its own achieve such compliance and that NTUA must perform additional work, particularly in its Collection Systems, to achieve and maintain compliance. It is the intent of the Parties to avoid litigation and to use information developed pursuant to this Partial Consent Decree to tailor a final consent decree that will have the objective of achieving and maintaining such compliance and will fully resolve the pending litigation.

## IV. DEFINITIONS

8. Terms used in this Partial Consent Decree, including the Appendices hereto, that are defined in the Act or in regulations promulgated pursuant to the Act have the meanings assigned to them in the Act or such regulations, unless otherwise provided in this Partial Consent Decree. Whenever the terms set forth below are used in this Partial Consent Decree, the following definitions apply:

"Abandoned" or "Abandoning" means to cease from maintaining and using, while complying with all applicable federal, Navajo, and local laws, regulations and permits;

"Act" or "CWA" means the Clean Water Act, 33 U.S.C. § 1251, *et seq.*;

"Administrative Orders on Consent" or "AOCs" shall mean EPA Administrative Orders on Consent Docket Nos. 309(a)-16-013 (*In re: Chinle WWTP*), 309(a)-16-011 (*In re: Kayenta WWTP*), and 309(a)-16-001 (*In re: Tuba City WWTP*), all issued to NTUA on September 29, 2016;

"Bypass" shall mean the intentional diversion of waste streams from any portion of a WWTP, as further defined in 40 C.F.R. 122.41(m)(1);

"Calendar Year" means the period starting January 1st through the ensuing December 31st;

"Capital Improvement Plan" means a plan adopted by NTUA for financing and constructing improvements to the Facilities;

"Collection Systems" means all parts of the Chinle, Kayenta, and Tuba City wastewater collection systems owned or operated by NTUA that are intended to convey domestic or commercial wastewater to the WWTPs, including, without limitation, Gravity Mains, Force Mains, Pump Stations, Manholes, and appurtenances to each of the above;

"Complaint" means the complaint filed by the United States in this action;

"Construction Completion" means when all construction work referenced by Paragraph 33 and Paragraph 38 to upgrade or replace a WWTP is complete, including punch list items, final cleanup, demobilization and submittal of final documentation, in accordance with the contract documents;

"Critical Asset" is an asset that is necessary for the proper and continuous operation and maintenance of the WWTPs and their Collection Systems in compliance with the NPDES Permits;

"Day," regardless of whether it is capitalized, means a calendar day unless expressly stated to be a business day. In computing any period of time for a deadline under this Partial Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period runs until the close of business of the next business day;

"Defendant" or "NTUA" means the Navajo Tribal Utility Authority;

"DOJ" means the United States Department of Justice and any of its successor departments or agencies;

"Effective Date" means the definition provided in Section XIV;

"Elected Community Leader" means: (i) any currently serving elected official of a chapter house located in Tuba City, Kayenta, Chinle, or Coalmine Canyon; and (ii) any currently serving elected official of Kayenta Township;

"EPA" means the United States Environmental Protection Agency and any of its successor departments or agencies;

"Facility" or "Facilities" means the wastewater treatment plants ("WWTP") providing sewer service to Chinle, Kayenta, and Tuba City in the Navajo Nation in Northeastern Arizona, and owned and operated by NTUA, and permitted under NPDES Permit Nos. NN0020265 (Chinle), NN0020281 (Kayenta), and NN0020290 (Tuba City). The Facilities include all components of such WWTPs, and the associated Collection Systems;

"Force Main" means any pipe that receives and conveys, under pressure, wastewater from the discharge side of a pump;

"Gravity Main" means a pipe that receives, contains and conveys wastewater not normally under pressure, but is intended to flow unassisted under the influence of gravity;

"Infiltration" means water other than wastewater that enters a sewer system during wet weather conditions from the ground through such means as defective pipes, pipe joints, connections, or Manholes;

"Inflow" means water other than wastewater that enters a sewer system during wet weather conditions from illicit or unpermitted sources other than Infiltration, such as, but not limited to, roof leaders, foundation drains, yard drains, area drains, Manhole covers, cooling towers, storm water, surface runoff, street wash waters, or drainage;

"Inflow and Infiltration" or "I/I" means all water from both Infiltration and Inflow without distinguishing the source;

"Lower Lateral" means the portion of the Sewer Lateral extending from the property line to the Sewer Main. The Lower Lateral includes the connection to the Sewer Main;

"Manhole" means any appurtenance or structure that allows direct access to a Sewer Main or Interceptor;

"NNEPA" means the Navajo Nation Environmental Protection Agency and any of its successor departments or agencies;

"NPDES Permits" means those permits issued to NTUA bearing NPDES Permit Nos. NN0020265 (Chinle), NN0020281 (Kayenta), and NN0020290 (Tuba City);

"Outfall" means any outfall authorized for discharge by an NPDES Permit;

"Paragraph" means a portion of this Partial Consent Decree identified by an Arabic numeral;

"Partial Consent Decree" means this consent decree and all appendices attached hereto (listed in Section XXII);

"Parties" means the United States and NTUA;

"Plaintiff" means the United States;

"Pump Station" or "Lift Station" means a facility that is comprised of pumps that lift wastewater to a higher hydraulic grade line, including all related electrical, mechanical, and structural systems necessary to the operation of that pump station;

"Rehabilitation" or "Rehabilitate" means work necessary to re-establish a target service life for a Collection System asset:

a. For Gravity Mains: the renewal or reconstruction of a Gravity Main from node to node, including all Manholes and Lower Laterals connected to the Gravity Main;

b. For Manholes: the renewal or reconstruction of a Manhole;

c. For Pump Stations: the renewal or reconstruction of a Pump Station;

d. For Force Mains: the renewal or reconstruction of a Force Main pipe segment;

"Repair" means to carry out Work necessary to return a Collection System asset to serviceable condition:

a. For Gravity Mains: the work of fixing a portion of a Gravity Main that does not result in Rehabilitation of the Gravity Main;

b. For Manholes: the work of fixing a portion of a Manhole that does not result in Rehabilitation of the Manhole;

c. For Pump Stations: the work of fixing a portion of a Pump Station that does not result in Rehabilitation of the Pump Station;

d. For Force Mains: the work of fixing a portion of a Force Main that does not result in Rehabilitation of the Force Main;

"Replace" or "Replacement" means:

a. For Gravity Mains: the work of removing or Abandoning a Gravity Main and installation of a new Gravity Main in its place, including all Manholes and Lower Laterals connected to the Gravity Main;

b. For Manholes: the work of removing or Abandoning a Manhole and installation of a new Manhole in its place;

c. For Pump Stations: the work of removing or Abandoning an entire Pump Station, including the wet well, and installation of a new Pump Station in its place;

d. For Force Mains: the work of removing or Abandoning a Force Main and installation of a new Force Main in its place;

"Replacement WWTPs" means the activated sludge treatment plants NTUA is required to construct under this Partial Consent Decree to replace the existing aerated lagoon treatment plants;

"Sanitary Sewer Overflow" or "SSO" means any overflow, spill, or release of wastewater from a Collection System, whether it reaches waters of the United States or not;

"Sanitary Sewer Evaluation Survey" or "SSES" means a systematic examination of a Collection System to determine the specific location, defect, flow rate, and Repair, Rehabilitation, or Replacement cost of structural condition, I/I, or SSO problems;

"Section" means a portion of this Partial Consent Decree (unless another document is specified) identified by an uppercase Roman numeral;

"Sewer Lateral" means a pipe or pipes and appurtenances that carry sewage and liquid waste to the Sewer Main, including a Lower Lateral;

"Sewer Main" means the portion of the Collection System that receives flows from Sewer Laterals. The Sewer Main does not include any portion of a Sewer Lateral;

"United States" means the United States of America, acting on behalf of EPA;

"Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee, as further defined in 40 C.F.R. 122.41(n)(1). An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation;

"Work" means the activities NTUA is required to perform under Section V (Compliance Requirements) of this Partial Consent Decree, as they may be modified from time to time pursuant to Section XV (Modification);

"WWTPs" means the existing wastewater treatment plants located at Chinle, Kayenta, and Tuba City in the Navajo Nation in Northeastern Arizona, and owned and operated by NTUA, and permitted under NPDES Permit Nos. NN0020265 (Chinle), NN0020281 (Kayenta), and NN0020290 (Tuba City).

## V. COMPLIANCE REQUIREMENTS

9. NTUA shall achieve and maintain compliance with this Partial Consent Decree and the Facilities' NPDES Permits by developing, implementing, and adhering to the compliance requirements and schedules set forth below.

10. Obligation to Perform Work. NTUA shall perform the Work required by this Partial Consent Decree in compliance with all applicable federal, Navajo, and local laws, regulations and permits, including, but not limited to, the Facilities' NPDES Permits, the CWA, and its implementing regulations. NTUA is responsible for ensuring that any contractors hired to perform Work pursuant to this Partial Consent Decree comply with all applicable laws and with this Partial Consent Decree.

11. Public Review Requirement for Specified Deliverables.

a. In accordance with the provisions of subparagraphs b–h of this Paragraph, NTUA shall seek public comment on the following deliverables required by this Partial Consent Decree:

(1) Sanitary Sewer Overflow Response Plan, required under Paragraph 25;

(2) Sanitary Sewer Evaluation Study Work Plan, required under Paragraph 29;

(3) Plan for Collection System Repair, Rehabilitation, and Replacement, required under Paragraph 31;

(4) Decommissioning Plans for the Chinle, Kayenta, and Tuba City WWTPs, required under Paragraphs 39.g, 40.g, and 41.f; and

(5) Sludge Assessment Reports and Management Plans for the Chinle, Kayenta and Tuba City WWTPs, required under Paragraphs 39.h, 40.h, and 41.g.

b. Beginning on the Effective Date and continuing through termination of this Partial Consent Decree, NTUA shall prominently post on its website and social media pages instructions for how the public may request email notices of the future deliverables listed in subparagraph a of this Paragraph.

c. At least 60 Days before submission to EPA of any deliverable listed in subparagraph a of this Paragraph, NTUA shall post a copy of such deliverable on its website and a link on its social media pages, with the deliverable clearly identified as "Draft." NTUA shall simultaneously provide the link to such deliverable by email to EPA and NNEPA and to anyone who requests deliverables in response to the posts required by Paragraph 11.b above. NTUA shall promptly provide a paper copy of the deliverable to any Elected Community Leader who requests such delivery.

d. NTUA shall allow the public at least 30 Days from the date of its posting or mailing of the deliverable to comment to NTUA on a deliverable.

e. If NTUA receives public comments on a draft deliverable that require

more time to address than NTUA had anticipated, NTUA may request from EPA an extension of the applicable Partial Consent Decree deadline for submission of the final deliverable. This request shall describe why more time is required to address the received comments. EPA may, at its sole discretion, grant or deny a requested extension.

f. When NTUA submits to EPA any deliverable listed in subparagraph a of this Paragraph, NTUA shall also submit all written comments received during the 30-Day period from NNEPA, any Elected Community Leader, and any member of the public on the deliverable, and an explanation of how the deliverable responds to such comments.

g. Within seven Days after EPA's approval, approval contingent upon conditions, or modification by EPA pursuant to this Section, NTUA shall publish that deliverable on its website in the same manner prescribed in Paragraph 11.c. The EPA-approved or EPA-modified version of the deliverable shall be clearly identified as "Final."

h. Until termination of this litigation by entry of a final consent decree or litigation to judgment, NTUA shall maintain on its website all deliverables listed in subparagraph a of this Paragraph and all written comments received from EPA, NNEPA, any Elected Community Leader, and any member of the public on any such deliverable through the process in this Paragraph.

12. EPA Approval of Deliverables. After review of any deliverable that is required to be submitted for approval by EPA pursuant to this Partial Consent Decree, EPA will in writing: (a) approve the submission; (b) approve the submission upon specified conditions; (c)

approve part of the submission and disapprove the remainder; or (d) disapprove the submission. EPA shall use its best efforts to timely respond to any deliverable and promptly communicate with NTUA at such time as it becomes aware of any constraint on timely response to a deliverable. A summary of all deliverables NTUA is required to submit and the required submission deadlines is included within Appendix A (Submission Schedule for Deliverables, Notices, and Required Reporting).

13. If the deliverable is approved pursuant to Paragraph 12(a), NTUA shall take all actions required by the plan, report, or other document, in accordance with the schedules and requirements of the plan, report, or other document, as approved. If the submission is conditionally approved or approved only in part pursuant to Paragraph 12(b) or (c), NTUA shall, upon written direction from EPA, take all actions required by the approved plan, report, or other item that EPA determines are technically severable from any disapproved portions.

14. If the submission is disapproved in whole or in part pursuant to Paragraph 12(c) or (d), NTUA shall, within 45 Days or such other time as the Parties agree to in writing, correct all deficiencies and resubmit the plan, report, or other item, or disapproved portion thereof, for approval, in accordance with the preceding Paragraphs. If the resubmission is approved in whole or in part, NTUA shall proceed in accordance with the preceding Paragraph.

15. If a resubmitted plan, report, or other item, or portion thereof, is disapproved in whole or in part, EPA may again require NTUA to correct any deficiencies, in accordance with the preceding Paragraphs, or may itself correct any deficiencies and finalize the deliverable with no further input from NTUA.

16. If NTUA elects to invoke Dispute Resolution as set forth in Section IX (Dispute Resolution) concerning a decision by EPA to disapprove, approve on specified conditions, or

modify a deliverable, NTUA shall do so by sending a Notice of Dispute in accordance with Paragraph 82 within 30 Days (or such other time as the Parties agree to in writing) after receipt of the applicable decision.

17. Any stipulated penalties applicable to the original submission, as provided in Section VII (Stipulated Penalties), accrue during the 45-Day period or other specified period, but shall not be payable unless the resubmission is untimely or is disapproved in whole or in part; provided that, if the original submission was so deficient as to constitute a material breach of NTUA's obligations under this Partial Consent Decree, the stipulated penalties applicable to the original submission shall be due and payable notwithstanding any subsequent resubmission.

18. Permits. Where any compliance requirement under this Section requires NTUA to obtain a federal, Navajo, or local permit or approval, NTUA shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. NTUA may seek relief under the provisions of Section VIII (Force Majeure) for any delay in the performance of any such obligation resulting from a failure to obtain, or a delay in obtaining, any permit or approval required to fulfill such obligation, if NTUA has submitted timely and complete applications and has taken all other actions necessary to obtain all such permits or approvals.

## A. BUDGETING AND PLANNING

19. Capital Improvement Plan ("CIP"). By the later of the 45th business day after NTUA Board approval of NTUA's annual capital budget or February 28, 2024, and annually thereafter, NTUA shall submit to EPA for review and comment a CIP to identify, project, plan, and finance all current and future capital improvement needs for the Facilities. The CIP shall use, at a minimum, a 5-year planning horizon, and shall be updated annually. The submittal

shall be in Excel spreadsheet form and shall include an itemization of the anticipated capital improvement projects, a description of each project, and the projected expenditures for each project over the planning period. The document shall also identify those projects which are necessary for the Work required.

20. Annual Budgets. By the later of the 45th business day after NTUA Board approval of NTUA's annual operations and maintenance and capital budgets or February 28, 2024, and annually thereafter, NTUA shall submit to EPA for review and comment a budget representing NTUA's best estimate of its annual financial forecast needed to pay for the Work and all other expenses of NTUA's wastewater utility. In estimating the cost of the Work, NTUA shall use any information generated through the Asset Management Programs (AMPs) and Sewer System Evaluation Surveys (SSESs) required by Paragraphs 22–32 below, among other inputs. The submittal shall be in Excel spreadsheet form and shall itemize operations and maintenance costs, allocated overhead costs, asset management costs, pay-as-you-go capital expenditures, and debt service costs.

21. Annual Revenue Requirements and Adequacy. By the later of the 45th business day after NTUA Board approval of NTUA's annual operations and maintenance and capital budgets or February 28, 2024, and annually thereafter, NTUA shall submit to EPA for review and comment its best estimate of all wastewater revenues and an evaluation of whether these revenues are sufficient to fund both the Work and the wastewater utility's ongoing activities as identified in Paragraph 20 above. The submittal shall be in Excel spreadsheet form and shall include estimates of revenues from ratepayers, grants, debt financing proceeds, and any other sources of revenue that support NTUA's wastewater activity. If the data show that wastewater revenues are not estimated to fund the Work and ongoing activities, NTUA shall submit to EPA

within 90 Days a document identifying additional expected funding sources and amounts. Beginning with the second annual submission to EPA pursuant to this Paragraph, NTUA shall compare the revenues anticipated in its submission for the year prior with actual revenues realized and provide an assessment of the reasons for any shortfall, as well as NTUA's plan for addressing the shortfall and avoiding similar shortfalls in the future.

## B. ASSET MANAGEMENT

22. Asset Management Programs (AMPs). By January 12, 2024, NTUA shall submit to EPA for approval an AMP Plan for each of the Facilities, including a schedule for implementation that does not extend beyond 270 Days after EPA approval, as described in the following paragraphs. Until such time as EPA approves an AMP Plan for a Facility, NTUA shall continue to implement for that Facility the existing work order program described in the Asset Management Programs previously submitted by NTUA to EPA on February 25, 2022 (Chinle WWTP); July 30, 2021 (Kayenta WWTP); and December 30, 2022 (Tuba City WWTP).

23. Upon EPA approval of the AMP Plan, NTUA shall implement each AMP Plan. Each AMP shall include, at a minimum:

a. Asset Management Software. Each AMP shall require NTUA to use asset management software at least as capable as SAP's enterprise resource planning software SAP Business Suite 4 SAP HANA ("S4/HANA").

b. Asset Management Database. Using Asset Management Software, NTUA shall create and maintain an inventory of all Critical Assets and any assets valued over $5,000 in a single database. Such assets include, but are not limited to Sewer Mains, Manholes, Pump Stations, Force Mains, Outfalls and WWTP assets. For

each entry in the database, NTUA shall identify an asset's (1) name and identification number, (2) location, by GPS coordinates or other equivalent identifier, (3) current performance and condition, (4) purchase and installation date, (5) purchase price, and (6) replacement cost.

c. Automated Work Order Production and Tracking. Using Asset Management Software, NTUA shall automate its production and tracking of work orders for all assets in the Asset Management Database. Such tracking shall include details of the work that must be performed under each work order, personnel assigned to complete the work under each work order, deadlines for completion, status updates, and actual completion dates.

d. Maintenance Task Catalogue. Using Asset Management Software, NTUA shall catalogue and track daily, weekly, monthly, annual, and other routine maintenance for each of the assets in the Asset Management Database. NTUA shall adopt standard operating procedures, create maintenance checklists, and issue notices of required maintenance for all routine maintenance in the Maintenance Task Catalogue. NTUA shall also use the Maintenance Task Catalogue to generate maintenance tasks and checklists, manage asset inspections, document the completion of all inspections, capture inspection results, document failures and root cause analyses, and document the completion of all routine and reactive maintenance.

e. Training. NTUA shall train all personnel who are responsible for managing and maintaining the assets in the Asset Management Database on the purposes, capabilities, and proper use of the Asset Management Database, Automated Work Order Production and Tracking, and Maintenance Task Catalogue ("Systems").

Each user shall be tested annually on their proper use of the Systems, and NTUA shall audit annually the personnel inputs to each of these Systems for accuracy.

f. Accessibility. NTUA shall provide sufficient electronic means, such as a tablet, laptop, or cellphone, for all employees and contractors who have responsibility for operation or maintenance of a Facility or Collection System to access and enter data gathered in the field into the Asset Management Database, Automated Work Order Production and Tracking, and Maintenance Task Catalogue. EPA acknowledges that NTUA's ability to comply with the requirement of this Paragraph 23.f is dependent upon the availability of sufficient bandwidth, connectivity, and network security at the WWTP or Collection System to enable employees and contractors to upload and download such data to/from the internet while in the field. Employees and contractors shall upload and download such data to/from the internet as soon as possible, including no less frequently than once per day when bandwidth, connectivity, and network security are sufficient. When bandwidth, connectivity, or network security are insufficient for daily uploads and downloads, employees and contractors shall upload and download such data to/from the internet no less frequently than once per week.

24. Inventory of Replacement Parts for Critical Assets. Within 270 Days of EPA approval of the AMP Plan, NTUA shall identify all parts necessary for timely repair of Critical Assets. NTUA shall acquire and maintain an adequate inventory of all such replacement parts. NTUA shall perform a monthly inventory of replacement parts and shall submit to EPA for review and comment a report of its inventories, along with a log of replacement parts ordered and received, on a quarterly basis. NTUA shall review and update the list of replacement parts for Critical Assets on an annual basis.

## C. COLLECTION SYSTEMS

25. SSO Response Plan. By December 21, 2023, NTUA shall submit for EPA approval a SSO Response Plan to establish timely and effective methods and means of: (1) responding to, cleaning up, and minimizing the impact of all SSOs; (2) reporting the location, volume, cause, and impact of all SSOs to EPA; and (3) notifying the potentially impacted public. Upon EPA approval, NTUA shall implement the SSO Response Plan. The SSO Response Plan shall include, at a minimum:

a. A map that shows the location of all known SSOs having occurred since July 2018 in the Collection Systems. The map shall include the areas and sewer lines that serve as tributary to each SSO. Smaller maps of individual tributary areas may also be included to show the lines involved in more detail;

b. A requirement to respond to an SSO within an average of four hours after NTUA becomes aware of the SSO, but not longer than eight hours;

c. A requirement to report an SSO via telephone or email to EPA within 24 hours of the time NTUA becomes aware of the SSO;

d. A requirement of a written submission (by email, and via the NPDES eReporting Tool at https://usepa.servicenowservices.com/oeca_icis?id=net_homepage) received by EPA within five (5) Days of the time NTUA becomes aware of an SSO that includes:

(1) the location of the SSO, including GPS coordinates;

(2) a description of the SSO, including estimated volume;

(3) the duration of the SSO, including dates and times;

(4) the cause(s) of the SSO;

(5) if the SSO has not been abated, the date and/or time it is expected to be abated;

(6) steps taken and/or plans to reduce, eliminate, and prevent reoccurrence of the SSO; and

(7) steps taken and/or plans to mitigate any harm to public health or the environment from the SSO; and

e. A plan for notifying the public of the SSO, its cause(s), the potential for harm to public health or the environment, and steps NTUA is taking to mitigate harm.

26. Bypass Reporting. NTUA shall submit notice to EPA for all anticipated and unanticipated Bypasses, in accordance with the requirements of each Facility's NPDES Permit.

27. Agreements with Interconnected Collection System Operators. NTUA shall use best efforts to secure written agreements with the operators of the two interconnected collection systems in Tuba City that are not owned or operated by NTUA but that convey sewage to and from portions of the Collection System owned and operated by NTUA. By February 29, 2024, NTUA shall submit to EPA for review and comment a proposed draft Memorandum of Agreement ("MOA") to present to the owners and operators of the two interconnected collection systems for signature. Within 90 Days after receiving EPA comments, NTUA shall present the proposed MOA to the owners and operators of the two interconnected systems and request their signatures. These agreements, if signed by the owners and operators of the interconnected systems, shall provide NTUA with reasonable access to the two interconnected collection systems to address conditions and issues, such as blockages in those systems, that are impacting the conveyance of sewage from the upstream portions of NTUA's Collection System.

28. Sewer System Evaluation Surveys ("SSESs"). NTUA shall conduct an SSES for each of the Collection Systems as provided in the Paragraphs below. Each SSES shall be conducted in accordance with sound engineering judgment and with the guidance provided in the appropriate sections of the *Handbook: Sewer System Infrastructure Analysis and Rehabilitation,* EPA/625/6-91/030, 1991; *Existing Sewer Evaluation and Rehabilitation,* Water Environment Foundation ("WEF") MOP FD-6, 2009; and the National Association of Sewer Service Companies ("NASSCO") *"Manual of Practice."*

29. SSES Work Plan and Reports. By 12 months from the Effective Date, NTUA shall submit for EPA's review and approval an SSES Work Plan for the Collection Systems that provides the anticipated activities, implementation schedules and completion dates, and work to be performed. NTUA shall complete an SSES for each Collection System no later than 20 months after EPA approval of the SSES Work Plan. If insufficient rainfall occurs to adequately assess Inflow and Infiltration (I/I) by this deadline, EPA at its sole discretion may approve one or more extensions of the SSES completion deadline to allow NTUA to continue collecting I/I data. The Tuba City SSES shall include, to the extent that NTUA has obtained all necessary access and inspection rights, evaluation of the two interconnected collection systems in Tuba City that convey sewage to and from portions of the Collection System owned and operated by NTUA. Within 30 Days after the completion of an SSES for a Collection System, NTUA shall submit to EPA for review and approval an SSES Report for that Collection System that is (a) prepared by or in consultation with NTUA's SSES contractor(s); (b) contains all results of the SSES; and (c) analyzes structural defects documented in that Collection System. Each SSES shall specifically identify:

a. the extent of Inflow and Infiltration (I/I) in all parts of each Collection

System. The report shall characterize the I/I in gallons per acre per day, and in gallons per day per inch-mile, and shall rank the areas based upon these metrics;

b. defects within each sewer segment and Manhole, as well as an overall segment rating as per the NASSCO PACP and MACP protocols. The report shall then prioritize the Repair of defects and Rehabilitation of sewer segments and Manholes based upon both the risk and consequence of failure per NASSCO PACP Appendix D;

c. areas with signs of significant Fats, Oils, and Grease ("FOG") deposition. The report should also identify likely sources of the FOG, such as nearby food service facilities; and

d. storm water cross-connections and unauthorized connections.

30. SSES Components. Each SSES shall include the assessments set forth in subparagraphs (a) through (e) below.

a. Corrosion Defect Identification. The Corrosion Defect Identification component of the SSES shall establish procedures for inspecting and identifying Collection System infrastructure that is either corroded or at risk of corrosion. NTUA shall include a system consistent with Chapter 4 of ASCE's "MOP-60 Gravity Sewer Design and Construction," 2nd Ed., for ranking and prioritizing repair of corrosion defects.

b. Manhole Inspection. The Manhole Inspection component of the SSES shall establish procedures for inspection of all Manholes within the Collection System. The Manhole Inspection component shall be consistent with NASSCO's Manhole Assessment Certification Program ("MACP") and shall use the defect coding system established in the NASSCO MACP.

c. Inflow and Infiltration ("I/I") Detection. To facilitate the characterization of Inflow and Infiltration (I/I) rates in each of the three collection systems, NTUA shall carry out rainfall and flow monitoring at locations in the Kayenta, Chinle and Tuba City Collection Systems and Facilities as described below. This characterization of I/I rates will inform NTUA's identification of appropriate remedial measures to address any defects and capacity limitations in the three Collection Systems. NTUA shall carry out the following monitoring:

(1) Continuous, accurate (to within +/-5%) influent flow monitoring at each of the three WWTPs. NTUA shall record and maintain this influent flow meter data for no less than one Calendar Year following NTUA's delivery of the Repair, Rehabilitation, or Replacement ("RRR Plan") to EPA pursuant to Paragraph 31 below. NTUA shall also monitor and record: (i) any wet-weather WWTP bypass events resulting from excessive influent flow volume; and (ii) any wet-weather SSOs from the Collection Systems in accordance with the SSO Response Plan requirements of Paragraph 25.

(2) Temporary flow monitoring using area/velocity meters at locations agreed upon by NTUA and EPA and documented in the SSES Work Plan. The locations are approximate, as it may be necessary to move up-stream or downstream one or more manholes at any given location if the manhole at the initially identified location has unfavorable hydraulic conditions such as

excessive turbulence or too steep a slope. If NTUA installs an area/velocity meter at a location other than as identified in the SSES Work Plan, NTUA shall provide EPA notice of this change.

(3) Temporary rainfall monitoring using temporary rain gauges at locations agreed upon by NTUA and EPA and documented in the SSES Work Plan. The precision, accuracy, and resolution of rainfall data are critical for rainfall-derived infiltration and inflow analyses and sewer modeling. As such, these gauges shall, at a minimum, meet NWS criteria for measurement of daily rainfall/event totals. As with the meters, these locations are approximate and may be adjusted to provide appropriate gauge siting regarding both accuracy and security. If NTUA installs a rain gauge at a location other than as identified in the SSES Work Plan, NTUA shall provide EPA notice of this change.

(4) All meters and rain gauges shall be installed and maintained per the manufacturers' recommendations and good industry practice, and in the case of temporary meters and rain gauges, in accordance with WEF MOP FD-6.

(5) Smoke testing and dye water testing, in accordance with standard industry practice, to identify sources of inflow in areas displaying high inflow flow patterns (i.e., rapid flow rate increase in response to rainfall). These testing techniques shall be employed

as described in the reference documents cited in Paragraph 28.

(6) All collected 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 must be excluded from use in subsequent analyses, or only be used with appropriate data qualifications noted.

NTUA shall collect useable rainfall and flow data for all segments of each Collection System for a minimum of three (3) 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), without being so large as to generate significant surface flooding and entry of water into the Collection System through otherwise unusual entry points. If necessary, and upon written authorization from EPA, NTUA may utilize events that do not result in appropriate rainfall coverage for all segments of a Collection System, so long as the events utilized enable NTUA to understand how all segments of each of the three Collection Systems respond to rainfall.

d. Closed Circuit Television ("CCTV"). The CCTV component of the SSES shall establish procedures for use of CCTV to support sewer assessment activities. The CCTV component shall use current industry services and technologies and shall use the defect coding system established in the NASSCO Pipeline Assessment and Certification Program ("PACP"). The CCTV component shall be consistent with the NASSCO publication, *"Pipe Condition Assessment Using CCTV Performance Specification Guideline,"* October 2014 ("PACP Guidance"). The CCTV component

shall include a process for the retention of and access to all CCTV data.

e. Pump Station Performance and Adequacy. The Pump Station Performance and Adequacy component of the SSES shall establish procedures for the evaluation of the performance and adequacy of the Chinle Pump Station and any other Pump Station that may be added to a Collection System in the future. The Pump Station Performance and Adequacy component shall include wet well pump down procedures to establish current actual pump capacities. Consistent with WEF *"Design of Wastewater and Stormwater Pumping Stations,"* MOP FD-4, 2022, 3d Edition, NTUA may include items such as the use of pump run time meters; pump start cycles; computation of Nominal Average Pump Operating Time ("NAPOT"); and root cause failure analysis protocols.

31. Plan for Collection System Repair, Rehabilitation, and Replacement. Within 12 months after EPA approval of all SSES Reports pursuant to Paragraph 29 above, NTUA shall submit to EPA a plan for Repair, Rehabilitation, or Replacement of the Collection Systems. Such RRR Plan shall include:

a. Ranking of all identified defects using NASCCO PACP and MACP standards;

b. Categorization of each defect requiring RRR;

c. Estimated cost of RRR;

d. Schedule for RRR of defects that takes into account estimated costs and the ranking of defects; and

e. A plan for funding all RRR.

32. Upon receipt of a Collection System RRR Plan, EPA will review it. EPA may, during its review, request additional information and a meeting or meetings with NTUA to discuss the RRR Plan. EPA may in its discretion approve the RRR Plan pursuant to Paragraph 12(a) of this Partial Consent Decree. If EPA elects not to approve the RRR Plan pursuant to Paragraph 12(a), the Parties agree that Section IX (Dispute Resolution) will not apply to EPA's decision. Rather, the Parties shall meet within 30 Days of EPA's decision to begin negotiating revisions to the RRR Plan and the terms of a final consent decree. Thereafter, the Parties will continue to negotiate on an expeditious schedule until (a) the Parties agree on revisions to the RRR Plan as part of a proposed modification of this Partial Consent Decree pursuant to Section XV (Modification) to incorporate all terms of a final consent decree, including but not limited to an appropriate civil penalty, or (b) until one Party elects to terminate negotiations and commence litigation.

## D. INTERIM UPGRADES TO EXISTING WWTPs

33. NTUA has submitted and EPA has approved a Compliance Plan ("CP") for each of the WWTPs (attached as Appendices B, C, and D). Once implemented, the CPs will enable the WWTPs to meet effluent limits in the NPDES Permits, except for the Ammonia Impact Ratio. The interim upgrades specified below are expected to improve ammonia compliance, but not to fully meet the Ammonia Impact Ratio. NTUA represents that each CP identifies and addresses all factors which are reasonably known to NTUA and which limit or could limit a WWTP's operating efficiency and the ability to achieve NPDES Permit compliance. Ultimately, each WWTP will be replaced pursuant to Section V.E below. Until then, as set forth in the CPs, NTUA shall:

a. For the Chinle WWTP:

(1) NTUA shall design, construct, build, and operate the approved continuous flow intermittent discharge ("CFID") system.

(2) NTUA shall complete the startup and initiation of operation of CFID at the Chinle WWTP by April 1, 2025.

(3) Prior to removing sewage sludge for use or disposal, NTUA shall submit a sludge removal plan to EPA for approval, in accordance with the requirements of the Chinle WWTP NPDES Permit.

b. For the Kayenta WWTP:

(1) NTUA shall design, construct, build, and operate the approved CFID system.

(2) NTUA shall complete the startup and initiation of operation of CFID at the Kayenta WWTP by April 1, 2025.

(3) Prior to removing sewage sludge for use or disposal, NTUA shall submit a sludge removal plan to EPA for approval, in accordance with the requirements of the Kayenta WWTP NPDES Permit.

c. For the Tuba City WWTP:

(1) NTUA shall design, construct, build, and operate the approved high-performance pond ("HPP") system with an aerated lagoon system with solids removal.

(2) NTUA shall complete the startup and initiation of operation of HPP at the Tuba City WWTP by February 27, 2025.

(3) Prior to removing sewage sludge for use or disposal, NTUA shall submit a sludge removal plan to EPA for approval, in accordance

with the requirements of the Tuba City WWTP NPDES Permit.

34. By December 1, 2023, NTUA shall submit for EPA approval: (i) a risk assessment describing the risks posed by the Moenkopi Wash to the sewer bridge and the lagoon cell walls at the Tuba City WWTP; and (ii) a plan for mitigating these risks.

35. By November 30, 2023, NTUA shall submit for EPA approval a plan for promptly dewatering any lagoon cells not needed for the Tuba City HPP (or potential CFID) system, to reduce the risk of potential erosion from the Moenkopi Wash leading to failure of the lagoon walls.

36. Once a WWTP's CP has been implemented, NTUA shall monitor treatment performance and, if needed, shall make operational and technological adjustments to meet its NPDES Permit compliance objective. If, after six months of operating an upgraded WWTP, NTUA violates an effluent limit in the NPDES Permit, within 30 Days, NTUA shall submit to EPA an analysis of additional measures that can be taken to further optimize treatment performance at the WWTP. EPA shall have discretion, subject only to NTUA's right to dispute EPA's determination under Section IX (Dispute Resolution), to require NTUA to perform additional upgrades on a schedule agreed upon by EPA and NTUA, including but not limited to installing a CFID system for the Tuba City WWTP, and pH adjustment at any of the WWTPs.

37. If there are changes in the law or any NPDES Permit that require modifications to the CPs before or during implementation of the CPs, NTUA shall submit such modifications to EPA for approval within a reasonable time to be determined by NTUA and EPA. Upon EPA approval, NTUA shall implement the modified CPs under the deadlines established therein.

## E. REPLACEMENT OF THE WWTPs

38. NTUA shall replace each of the WWTPs with activated sludge systems ("Replacement WWTPs") as set forth below and as described in the CPs (attached as Appendices B, C, and D). NTUA has designed the Replacement WWTPs for Chinle and Kayenta, and EPA has reviewed and provided comment on the 100% design packages for Chinle and Kayenta dated November 4, 2022. NTUA has not yet designed the Replacement WWTP for Tuba City.

39. For the Chinle Replacement WWTP:

a. Outfall. The Replacement WWTP will continue to discharge through the existing Outfall.

b. Location. The Replacement WWTP will be partially located within the footprint of Cell 1. If NTUA determines that it must relocate the Replacement Plant for any reason, NTUA shall submit its relocation proposal to EPA for approval.

c. Permit Modification. NTUA shall submit to EPA all proposed modifications to the NPDES Permit for the Replacement WWTP in accordance with EPA regulations on the modification or revocation and reissuance of NPDES permits found in 40 C.F.R. Parts 122 and 124.

d. Deadlines for Construction Completion and Operation. NTUA shall achieve Construction Completion of the Chinle Replacement WWTP by February 1, 2027, and shall achieve full operation of the Chinle Replacement WWTP by January 14, 2028.

e. Construction. NTUA shall retain a construction firm with a record of constructing similar-sized water/wastewater plants within budget and on schedule,

unless prevented from doing so by applicable competitive bidding laws and regulations.

f. Startup. To shorten the startup period, NTUA will seed the Replacement Plant with bacteria from an existing operational activated sludge plant.

g. Decommission. By February 1, 2026, NTUA shall submit for EPA approval a plan for decommissioning the existing WWTP. NTUA shall complete the decommissioning of the existing WWTP within 180 Days of Construction Completion of the Replacement WWTP. The decommissioning plan shall describe how NTUA will decommission the existing WWTP as follows:

(1) Concrete structures that are not needed and are above ground will be broken up or Abandoned in place. Unneeded concrete structures, greater than two feet below the surface, will be backfilled and left in place.

(2) All debris may be temporarily stockpiled on the site and must be hauled to a permitted landfill.

(3) Pits and vaults shall be filled.

(4) Any lagoon cells NTUA does not plan to use for emergency retention when operating the Replacement WWTP shall be dewatered and regraded to remove any steep slopes that would pose a safety hazard. NTUA shall also remove any synthetic lining from these cells.

(5) Bottom sludge will be disposed of in accordance with EPA's *A Plain English Guide to the EPA Part 503 Biosolids Rule*, and with 40 C.F.R. Part 503.

h. Sludge Management. In accordance with the NPDES Permit, NTUA shall submit to EPA for review and approval a Sludge Assessment Report and Management Plan for the Replacement Plant.

i. Emergency Retention. NTUA may use an existing cell for emergency retention in the event of an Upset at the Replacement Plant if authorized by the NPDES Permit. EPA has not waived, and expressly reserves, its right to prohibit or restrict such use in the NPDES Permit. The fact that NTUA's EPA-approved CP mentions use of an existing cell for emergency retention in no way alters EPA's reservation of rights.

40. For the Kayenta Replacement WWTP:

a. Outfall. The Replacement WWTP will continue to discharge through the existing permitted Outfall.

b. Location. The Replacement WWTP will be located immediately north of Cell 1. If NTUA determines that it must relocate the Replacement Plant for any reason, NTUA shall submit its relocation proposal to EPA for approval.

c. Permit Modification. NTUA shall submit to EPA all proposed modifications to the NPDES Permit for the Replacement WWTP in accordance with EPA regulations on the modification or revocation and reissuance of NPDES permits found in 40 C.F.R. Parts 122 and 124.

d. Deadlines for Construction Completion and Operation. NTUA shall achieve Construction Completion of the Kayenta Replacement WWTP by February 1, 2027, and shall achieve full operation of the Kayenta Replacement WWTP by January 14, 2028.

e. Construction. NTUA shall retain a construction firm with a record of

constructing similar-sized water/wastewater plants within budget and on schedule, unless prevented from doing so by applicable competitive bidding laws and regulations.

f. Startup. To shorten the startup period, NTUA will seed the Replacement WWTP with bacteria from an existing operational activated sludge plant.

g. Decommission. By February 1, 2026, NTUA shall submit for EPA approval a plan for decommissioning the existing WWTP. NTUA shall complete the decommissioning of the existing WWTP within 180 Days of Construction Completion of the Replacement WWTP. The decommissioning plan shall describe how NTUA will decommission the existing WWTP as follows:

(1) Concrete structures that are not needed and are above ground will be broken up or Abandoned in place. Unneeded concrete structures, greater than two feet below the surface, will be backfilled and left in place.

(2) All debris may be temporarily stockpiled on the site and must be hauled to a permitted landfill.

(3) Pits and vaults shall be filled.

(4) Any lagoon cells NTUA does not plan to use for emergency retention when operating the Replacement WWTP shall be dewatered and regraded to remove any steep slopes that would pose a safety hazard. NTUA shall also remove any synthetic lining from these cells.

(5) Bottom sludge will be disposed of in accordance with EPA's *A Plain English Guide to the EPA Part 503 Biosolids Rule*, and

with 40 C.F.R. Part 503.

h. Sludge Management. In accordance with the NPDES Permit, NTUA shall submit to EPA for review and approval a Sludge Assessment Report and Management Plan for the Replacement WWTP.

i. Emergency Retention. NTUA may use an existing cell for emergency retention in the event of an Upset at the Replacement WWTP if authorized by the NPDES Permit. EPA has not waived, and expressly reserves, its right to prohibit or restrict such use. The fact that NTUA's EPA-approved CP mentions use of an existing cell for emergency retention in no way alters EPA's reservation of rights.

41. For the Tuba City Replacement WWTP:

a. Location and Deadlines. NTUA has identified its preferred site for the Replacement WWTP and has submitted a lease application for the site to the Navajo Nation.

(1) If the Navajo Nation grants NTUA's submitted lease application for the site, NTUA shall:

(a) submit, within 15 months of lease approval, a complete application to the Navajo Nation for authorization to construct the Replacement WWTP on the site;

(b) achieve Construction Completion of the Replacement WWTP within 48 months of lease approval; and

(c) achieve full operation of the Replacement WWTP within 58 months of lease approval.

(2) If the Navajo Nation denies NTUA's submitted lease application

for the site, or if the Navajo Nation does not grant or deny the lease application by March 31, 2024, NTUA shall:

(a) submit a lease application for an alternate site to the Navajo Nation by December 31, 2024;

(b) submit, by December 31, 2025, a complete application to the Navajo Nation for authorization to construct the Replacement WWTP on the alternate site;

(c) achieve Construction Completion of the Replacement WWTP on the alternate site by December 31, 2028; and

(d) achieve full operation of the Replacement WWTP on the alternate site by October 30, 2029.

(3) If the Navajo Nation denies or otherwise does not approve the lease application for the alternate site by June 30, 2025, NTUA shall notify EPA by the earlier of 10 Days after the lease is denied or July 10, 2025. The Parties shall meet within 30 Days of this notification to begin negotiating appropriate next steps, and will continue to negotiate on an expeditious schedule until (a) the Parties agree on a revised plan and timeline for the Tuba City Replacement WWTP as part of a proposed modification of this Partial Consent Decree pursuant to Section XV (Modification), or (b) until one Party elects to terminate negotiations and commence litigation.

b. Design. NTUA shall submit all designs for the Replacement WWTP to

EPA for review and comment.

c. Permit Modification. NTUA shall submit to EPA all proposed modifications to the NPDES Permit for the Replacement WWTP in accordance with EPA regulations on the modification or revocation and reissuance of NPDES permits found in 40 C.F.R. Parts 122 and 124.

d. Construction. NTUA shall retain a construction firm with a record of constructing similar-sized water/wastewater plants within budget and on schedule, unless prevented from doing so by applicable competitive bidding laws and regulations.

e. Startup. To shorten the startup period, NTUA will seed the Replacement Plant with bacteria from an existing operational activated sludge plant.

f. Decommission. No later than 10 months after starting construction of the Replacement WWTP, NTUA shall submit for EPA approval a plan for decommissioning the existing WWTP. NTUA shall complete the decommissioning of the existing WWTP within 180 Days of Construction Completion of the Replacement WWTP. The decommissioning plan shall describe how NTUA will decommission the existing WWTP as follows:

(1) Concrete structures that are not needed and are above ground will be broken up or Abandoned in place. Unneeded concrete structures, greater than two feet below the surface, will be backfilled and left in place.

(2) All debris may be temporarily stockpiled on the site and must be hauled to a permitted landfill.

(3) Pits and vaults shall be filled.

(4) Any lagoon cells NTUA does not plan to use for emergency retention when operating the Replacement WWTP shall be dewatered and regraded to remove any steep slopes that would pose a safety hazard. NTUA shall also remove any synthetic lining from these cells.

(5) Bottom sludge will be disposed of in accordance with EPA's *A Plain English Guide to the EPA Part 503 Biosolids Rule*, and with 40 C.F.R. Part 503.

g. Sludge Management. In accordance with the NPDES Permit, NTUA shall submit to EPA for review and approval a Sludge Assessment Report and Management Plan for the Replacement WWTP.

h. Emergency Retention. NTUA may use an existing cell for emergency retention in the event of an Upset at the Replacement WWTP if authorized by the NPDES Permit and upon written authorization from EPA. If, based upon the findings of the risk assessment and risk mitigation plan required under Paragraph 34, EPA grants NTUA this authorization, and NTUA elects to use an existing cell for emergency retention, NTUA must return any water it diverts to the cell back to the mechanical plant for dewatering as soon as possible after a diversion event. EPA has not waived, and expressly reserves, its right to prohibit such use in a future NPDES Permit for the Facility. The fact that NTUA's EPA-approved CP mentions use of an existing cell for emergency retention in no way alters EPA's reservation of rights.

42. Until such Replacement WWTPs are fully operational, and until the existing WWTPs are no longer discharging, NTUA will continue to operate and maintain the existing WWTPs pursuant to Section V.D above, to meet effluent limits in the NPDES Permits.

## F. EXISTING, UPGRADED, AND REPLACEMENT WWTP OPERATION AND MAINTENANCE

43. For the existing WWTPs, both before and after their interim upgrades pursuant to Section V.D, NTUA shall meet all requirements of the following subparagraphs:

a. Proper Operation and Maintenance. Until an existing WWTP is replaced pursuant to Section V.E above, NTUA shall continue to operate and maintain the WWTPs in compliance with the NPDES Permits. NTUA shall inspect the WWTPs on a routine basis pursuant to Section V.B above (Asset Management). NTUA shall contract with a consulting firm to provide on-call technical guidance for proper operation and maintenance of the WWTPs no later than May 31, 2024. NTUA shall make this contractor available to all WWTP operators.

b. Reporting. On the schedule established in Section VI below (Reporting Requirements), NTUA shall report to EPA on WWTP inspections performed, results of inspections, replacement parts ordered, replacement parts received, replacement parts installed, and any changes to WWTP operation or maintenance that NTUA is considering.

c. Training. NTUA shall require all operators tasked with operation and/or maintenance of one or more of the WWTPs to attend NTUA's existing wastewater pond operation and maintenance training program, which shall be modified at least 30 Days prior to each WWTP upgrade pursuant to Section V.D of this Partial Consent Decree to include instruction on how to operate and maintain the upgraded WWTPs in compliance

with the NPDES Permits.

d. Operation & Maintenance ("O&M") Manuals. The O&M manuals for the existing WWTPs shall be modified and submitted for EPA review and approval at least 30 Days prior to Construction Completion of each WWTP upgrade pursuant to Section V.D of this Partial Consent Decree to include the additional or different tasks needed to operate and maintain the upgraded WWTPs in compliance with the NPDES Permits.

44. O&M Plan and Procedures for Replacement WWTPs. By at least 90 Days before the scheduled start-up of a Replacement WWTP, NTUA shall submit to EPA for review and approval a proposed plan for complete and continuous implementation of all tasks identified in the supplier-provided O&M manual for the Replacement WWTP. This Plan shall include, but not be limited to, the following elements:

a. schedules and staff assignments for each task in the O&M manual for that Replacement WWTP;

b. The development of monthly operating reports to demonstrate regulatory compliance;

c. Staffing levels and training plans to ensure that each Replacement WWTP is fully staffed with qualified personnel, including the number of management and staff, position titles, required experience, and wastewater treatment or other certification levels required for all operation and maintenance personnel. NTUA shall dedicate a direct supervisor in charge for each of the Replacement WWTPs, who shall work full-time at their respective Facilities.

45. Operations Assessment and Operator Training. By at least 60 Days before the scheduled Construction Completion of a Replacement WWTP, NTUA shall submit to EPA for review and approval a plan to perform an operations assessment and provide operator training and start-up procedures for the Replacement WWTP. This plan shall include the name and qualifications of a contractor, with experience in wastewater treatment plant operation, who is qualified to assess the operation of the Replacement WWTP and assist NTUA in start-up procedures. This contractor shall serve as the lead operator of the WWTP for a period of at least six months following start-up, or until an NTUA operator is available and properly certified to serve as the lead operator, whichever is longer. NTUA may retain the same contractor used in Paragraph 43.a. The operations assessment and operator training program shall commence upon start-up of the Replacement WWTP and continue for at least six months. NTUA shall ensure that contractor assistance is available throughout the start-up period of each Replacement WWTP, and for a period of at least one year following start-up or until operation can proceed without external assistance, whichever is longer.

46. Wastewater Collection and Treatment Operator Certification. By December 31, 2023, and annually thereafter, NTUA shall submit documentation of all wastewater collection and treatment operator certifications for Facility operators to EPA in accordance with Section XIII (Notices) of the Partial Consent Decree. NTUA shall submit such documentation for any individual who has operated in the past year, or who is expected to operate in the coming year, a Facility's Collection System, WWTP, or Replacement WWTP for any amount of time. If, after the Effective Date, a wastewater treatment operator's employment or contract with NTUA, or certification, terminates for any reason, NTUA shall have 30 Days from the date of such termination to replace that employee with a wastewater operator meeting the above-

outlined certification criteria. The replacement operator may be a permanent NTUA employee or a contractor retained by NTUA to serve as a temporary operator until a permanent replacement operator is hired. NTUA shall submit documentation of certification for any subsequently certified, hired, or temporarily retained operator to EPA in accordance with Section XIII (Notices) of the Partial Consent Decree within 14 Days of certifying, hiring, or retaining the services of that operator.

47. Retention of Wastewater Treatment Operators. Annually by December 31 of each year, beginning in 2023, NTUA shall survey the pay and other compensation available to wastewater treatment operators employed elsewhere in the region, including but not limited to those in Gallup, Flagstaff, and Farmington. To the extent officials in Gallup, Flagstaff and Farmington are not responsive to NTUA's request for compensation-related information, NTUA may rely upon compensation-related information that the American Water Works Association publishes for the southwestern region of the United States. Thereafter, within 60 Days of completion of each survey, NTUA shall evaluate its own compensation package for wastewater treatment operators and make adjustments necessary to recruit and retain properly certified operators. NTUA shall submit each survey and compensation evaluation, along with a description of the compensation adjustments NTUA has made or will make, to EPA as part of the next quarterly report required by Section VI below. Upon written authorization from EPA, NTUA may conduct the pay and compensation survey required by this Paragraph less frequently than annually.

## VI. REPORTING REQUIREMENTS

48. NTUA shall submit to EPA the reports required in this Section VI (Reporting Requirements) in addition to the monitoring, reporting and recordkeeping required by the

NPDES Permits and other submittals required by this Partial Consent Decree. A summary of the following reporting requirements and related deadlines is also included within Appendix A (Submission Schedule for Deliverables, Notices, and Required Reporting).

49. Emergency Response Reporting and Recordkeeping. NTUA shall report any unauthorized discharge which may endanger human health or the environment in accordance with the Facilities' NPDES Permits and NTUA's SSO Response Plan developed in accordance with this Partial Consent Decree. This includes, but may not be limited to, 24-hour and 5-day follow-up reporting required by the NPDES Permits and SSO Response Plan.

50. Quarterly Progress Reports. Within 30 Days after the end of each Calendar Year quarter (*i.e.*, by January 30, April 30, July 30, and October 30) after the Effective Date, until termination of the Partial Consent Decree, NTUA shall submit a Quarterly Report for the preceding Calendar-Year quarter that shall include:

a. the status of any construction or compliance measures; completion of milestones; identification of all compliance deadlines from the reporting period and whether they have been achieved; problems encountered or anticipated, together with implemented or proposed solutions; status of permit applications; and status of operator certifications; and

b. a description of any non-compliance with the requirements of this Partial Consent Decree (including its Appendices and all EPA-approved deliverables implemented under this Partial Consent Decree) and an explanation of the likely cause of the non-compliance and of the remedial steps taken, or to be taken, to prevent or minimize such non-compliance.

Upon written authorization from EPA, NTUA may submit reports semi-annually or annually.

51. If NTUA violates, or has reason to believe that it may violate, any requirement of this Partial Consent Decree, NTUA shall notify DOJ and EPA of such violation and its likely duration, in writing, within 10 business days of the Day NTUA first becomes aware of the violation, with an explanation of the violation's likely cause and of the remedial steps taken, or to be taken, to prevent or minimize such violation. If the cause of a violation cannot be fully explained at the time the report is due, NTUA shall so state in the report. NTUA shall investigate the cause of the violation and shall then submit an amendment to the report, including a full explanation of the cause of the violation, within 30 Days of the Day NTUA becomes aware of the cause of the violation. Nothing in this Paragraph or the following Paragraph relieves NTUA of its obligation to provide the notice required by Section VIII (Force Majeure).

52. Whenever any violation of this Partial Consent Decree or of any applicable permits or any other event affecting NTUA's performance under this Partial Consent Decree may pose an immediate threat to the public health or welfare or the environment, NTUA shall notify EPA by telephone at (415) 947-4222 or by email at R9NPDES@epa.gov as soon as possible, but no later than 24 hours after NTUA first knew of the violation or event. This procedure is in addition to the requirements set forth in the preceding Paragraph.

53. Each report submitted by NTUA under this Section shall be signed by an official of the submitting party and include the following certification:

> I certify under penalty of perjury that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware

that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

54. This certification requirement does not apply to emergency or similar notifications where compliance would be impractical.

55. The reporting requirements of this Partial Consent Decree do not relieve NTUA of any reporting obligations required by the Act or implementing regulations, or by any other federal, Navajo, or local law, regulation, permit, or other requirement.

56. Any information provided pursuant to this Partial Consent Decree may be used by the United States in any proceeding to enforce the provisions of this Partial Consent Decree and as otherwise permitted by law.

## VII. STIPULATED PENALTIES

57. NTUA shall be liable for stipulated penalties to the United States for violations of this Partial Consent Decree as specified below, unless excused under Section VIII (Force Majeure). A violation includes failing to perform any obligation required by the terms of this Partial Consent Decree, including any deliverable approved under this Partial Consent Decree, according to all applicable requirements of this Partial Consent Decree and within the specified time schedules established by or approved under this Partial Consent Decree.

58. Failure to Meet Effluent Limit in an NPDES Permit Other Than the Ammonia Impact Ratio. For each violation of an NPDES Permit effluent limit other than the Ammonia Impact Ratio that occurs:

a. after the Effective Date of this Partial Consent Decree through the twelfth month following completion of each individual WWTP interim upgrade required by Section V.D, a stipulated penalty of $100 per violation per Day may be assessed against NTUA;

b. more than twelve months after completion of each individual WWTP interim upgrade required by Section V.D, a stipulated penalty may be assessed against NTUA as follows:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $100 | 1st through 14th Day |
| $200 | 15th through 30th Day |
| $300 | 31st Day and beyond |

59. Failure to Meet the Ammonia Impact Ratio in the Tuba City NPDES Permit. For each violation of the Ammonia Impact Ratio in the Tuba City NPDES Permit that occurs after the Effective Date, a stipulated penalty may be assessed against NTUA as follows:

a. For an Ammonia Impact Ratio below 4.4 but above the NPDES Permit limit of 1.0 that occurs before completion of the Work required by Section V.E for the Tuba City Replacement WWTP, $25 per violation per Day;

b. For an Ammonia Impact Ratio at or in excess of 4.4 that occurs before completion of the Work required by Section V.E for the Tuba City Replacement WWTP, $100 per violation per Day;

c. For an Ammonia Impact Ratio above the NPDES Permit limit of 1.0 that occurs after completion of the Work required by Section V.E for the Tuba City Replacement WWTP:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $100 | 1st through 14th Day |
| $200 | 15th through 30th Day |
| $300 | 31st Day and beyond |

60. Failure to Meet the Ammonia Impact Ratio in the Chinle or Kayenta NPDES Permits. For each violation of the Ammonia Impact Ratio in the Chinle or Kayenta NPDES Permits that occurs after the Effective Date, a stipulated penalty may be assessed against NTUA as follows:

a. For an Ammonia Impact Ratio below 3.5 but above the NPDES Permit limit of 1.0 that occurs between December 1 and May 31, and before completion of the Work required by Section V.E for the relevant Replacement WWTP, $25 per violation per Day;

b. For an Ammonia Impact Ratio at or in excess of 3.5 that occurs between December 1 and May 31, and before completion of the Work required by Section V.E for the relevant Replacement WWTP, $100 per violation per Day;

c. For an Ammonia Impact Ratio above the NPDES Permit limit of 1.0 that occurs either: (i) between June 1 and November 30 and before completion of the Work required by Section V.E for the relevant Replacement WWTP; or (ii) at any time after completion of the Work required by Section V.E for the relevant Replacement WWTP:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $100 | 1st through 14th Day |
| $200 | 15th through 30th Day |
| $300 | 31st Day and beyond |

61. SSOs. For each SSO that occurs after the Effective Date, a stipulated penalty may be assessed as follows:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $100 | Any SSO occurring in Calendar Years 2023–2024 |
| $500 | Any SSO occurring in Calendar Year 2025 or later |

62. Completion of Interim Upgrades to Existing WWTPs. For each violation of the requirement in Paragraph 33 that NTUA complete the startup and initiation of operation of CFID at the Chinle and Kayenta WWTPs by April 1, 2025, and that NTUA complete the startup and initiation of operation of HPP at the Tuba City WWTP by February 27, 2025, a stipulated penalty may be assessed as follows:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $500 | 1st through 90th Day |
| $2,000 | 91st through 180th Day |
| $5,000 | 181st Day and beyond |

63. Compliance Milestones.

a. For each violation of a Compliance Milestone identified in subparagraph 63.b a stipulated penalty may be assessed as follows:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $500 | 1st through 30th Day |
| $1,000 | 31st through 60th Day |
| $2,000 | 61st through 180th Day |
| $5,000 | 181st Day and beyond |

b. Compliance Milestones.

(1) Completion of an SSES for each Collection System pursuant to the deadline in Paragraph 29;

(2) Submission of a plan for Repair, Rehabilitation, or Replacement of the Collection Systems pursuant to Paragraph 31;

(3) Submission to Navajo Nation of a complete application to

construct the Tuba City Replacement WWTP pursuant to Paragraph 41.a;

(4) Construction Completion of the Chinle and Kayenta Replacement WWTPs required in Section V.E by February 1, 2027, pursuant to Paragraphs 39–40;

(5) Full operation of the Chinle and Kayenta Replacement WWTPs by January 14, 2028, pursuant to Paragraphs 39–40;

(6) Construction Completion of the Tuba City Replacement WWTP pursuant to Paragraph 41.a; and

(7) Full operation of the Tuba City Replacement WWTP pursuant to Paragraph 41.a.

64. Failure to Timely Submit a Deliverable. For each Day NTUA fails to timely submit any deliverable required by Section V for EPA review and comment or for EPA approval, other than a deliverable listed as a Compliance Milestone under Paragraph 63.b, a stipulated penalty may be assessed as follows:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $500 | 1st through 30th Day |
| $1,000 | 31st through 60th Day |
| $2,000 | 61st Day and beyond |

65. Failure to Timely Implement Any Other Component of the Work. For each Day NTUA fails to timely perform any Work other than that identified in Paragraphs 58–64 above, a stipulated penalty may be assessed as follows:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $250 | 1st through 30th Day |
| $500 | 31st through 60th Day |
| $1,000 | 61st through 180th Day |
| $2,000 | 181st Day and beyond |

66. Reporting Requirements. The following stipulated penalties may be assessed per violation per Day for each violation of the reporting requirements of Section VI:

| Penalty Per Violation Per Day | Period of Noncompliance |
|---|---|
| $100 | 1st through 14th Day |
| $200 | 15th through 30th Day |
| $500 | 31st Day and beyond |

67. Stipulated penalties under this Section shall begin to accrue on the Day after performance is due or on the Day a violation occurs, whichever is applicable, and shall continue to accrue until performance is satisfactorily completed or until the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Partial Consent Decree.

68. NTUA shall pay any stipulated penalty within 30 Days of receiving the United States' written demand.

69. The United States may in the unreviewable exercise of its discretion, reduce or waive stipulated penalties otherwise due it under this Partial Consent Decree.

70. Stipulated penalties shall continue to accrue as provided in Paragraph 67, during any Dispute Resolution, but need not be paid until the following:

a. If the dispute is resolved by agreement of the Parties or by a decision of EPA that is not appealed to the Court, NTUA shall pay accrued penalties determined to be owing, together with interest at the rate specified in 28 U.S.C. § 1961, to the United States within 30 Days of the effective date of the agreement or the receipt of EPA's

decision or order.

b. If the dispute is appealed to the Court and the United States prevails in whole or in part, NTUA shall pay all accrued penalties determined by the Court to be owing, together with interest at the rate specified in 28 U.S.C. § 1961, within 60 Days of receiving the Court's decision or order, except as provided in subparagraph c, below.

c. If any Party appeals the District Court's decision, NTUA shall pay all accrued penalties determined to be owing, together with interest at the rate specified in 28 U.S.C. § 1961, within 15 Days of receiving the final appellate court decision.

71. NTUA shall pay stipulated penalties, together with interest at the rate specified in 28 U.S.C. § 1961, to the United States by FedWire Electronic Funds Transfer ("EFT") to the DOJ account, in accordance with instructions provided to NTUA by the Financial Litigation Unit ("FLU") of the United States Attorney's Office for the District of Arizona. The payment instructions provided by the FLU will include a Consolidated Debt Collection System ("CDCS") number, which NTUA shall use to identify all payments required to be made in accordance with this Consent Decree. The FLU will provide the payment instructions to:

Gerard Curley, CFO
Navajo Tribal Utility Authority
P.O. Box 170
Fort Defiance, AZ 86504
gerardc@ntua.com

on behalf of NTUA. NTUA may change the individual to receive payment instructions on its behalf by providing written notice of such change to DOJ and EPA in accordance with Section XIII (Notices). At the time of payment, NTUA shall send notice that payment has been made: (i) to EPA via email at cinwd_acctsreceivable@epa.gov or via regular mail at EPA Cincinnati Finance Office, 26 W. Martin Luther King Drive, Cincinnati, Ohio 45268; and (ii) to

DOJ via email or regular mail in accordance with Section XIII. Such notice shall state that the payment is for stipulated penalties owed pursuant to the Consent Decree in *United States v. Navajo Tribal Utility Authority* and shall reference the civil action number, CDCS Number and DOJ case number 90-5-1-1-12527, and shall state for which violation(s) the penalties are being paid.

72. If NTUA fails to pay stipulated penalties according to the terms of this Partial Consent Decree, NTUA shall be liable for interest on such penalties, as provided for in 28 U.S.C. § 1961, accruing as of the date payment became due. Nothing in this Paragraph shall be construed to limit the United States from seeking any remedy otherwise provided by law for NTUA's failure to pay any stipulated penalties.

73. The payment of penalties and interest, if any, shall not alter in any way NTUA's obligation to complete the performance of the requirements of this Partial Consent Decree.

74. Non-Exclusivity of Remedy. Stipulated penalties are not the United States' exclusive remedy for violations of this Partial Consent Decree. Subject to the provisions of Section XI (Effect of Settlement/Reservation of Rights), the United States expressly reserves the right to seek any other relief it deems appropriate for NTUA's violation of this Partial Consent Decree or applicable law, including but not limited to an action against NTUA for statutory penalties, additional injunctive relief, mitigation or offset measures, and/or contempt. However, the amount of any statutory penalty assessed for a violation of this Partial Consent Decree shall be reduced by an amount equal to the amount of any stipulated penalty assessed and paid pursuant to this Partial Consent Decree.

## VIII. FORCE MAJEURE

75. "Force majeure," for purposes of this Partial Consent Decree, means any event arising from causes beyond the control of NTUA, of any entity controlled by NTUA, or of NTUA's contractors, that delays or prevents the performance of any obligation under this Partial Consent Decree despite NTUA's best efforts to fulfill the obligation. Given the need to protect public health and welfare and the environment, the requirement that NTUA exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure and best efforts to address the effects of any potential force majeure (a) as it is occurring and (b) following the potential force majeure, such that any delay or non-performance is, and any adverse effects of the delay or non-performance are, minimized to the greatest extent possible. "Force majeure" does not include financial inability to perform any obligation under this Partial Consent Decree.

76. If any event occurs for which NTUA will or may claim a force majeure, NTUA shall provide notice by email to EPA. The deadline for the initial notice is three Days after NTUA first knew or should have known that the event would likely delay or prevent performance. NTUA shall be deemed to know of any circumstance of which any contractor of, subcontractor of, or entity controlled by NTUA knew or should have known.

77. If NTUA seeks to assert a claim of force majeure concerning the event, within seven Days after the notice under Paragraph 76, NTUA shall submit a further notice to EPA that includes (a) an explanation and description of the event and its effect on NTUA's completion of the requirements of the Partial Consent Decree; (b) a description and schedule of all actions taken or to be taken to prevent or minimize the delay and/or other adverse effects of the event; (c) if applicable, the proposed extension of time for NTUA to complete the

requirements of the Partial Consent Decree; (d) NTUA's rationale for attributing such delay to a force majeure; (e) a statement as to whether, in the opinion of NTUA, such event may cause or contribute to an endangerment to public health or welfare or the environment; and (f) all available proof supporting the claim that the delay was attributable to a force majeure.

78. Failure to submit a timely or complete notice or claim under Paragraph 76 or 77 regarding an event precludes NTUA from asserting any claim of force majeure regarding that event, provided, however, that EPA may, in its unreviewable discretion, excuse such failure if it is able to assess to its satisfaction whether the event is a force majeure, and whether NTUA has exercised its best efforts, under Paragraph 75.

79. After receipt of any claim of force majeure, EPA will notify NTUA of its determination whether NTUA is entitled to relief under Paragraph 75, and, if so, the excuse of, or the extension of time for, performance of the obligations affected by the force majeure. An excuse of, or extension of the time for performance of, the obligations affected by the force majeure does not, of itself, excuse or extend the time for performance of any other obligation.

80. If NTUA elects to invoke the dispute resolution procedures set forth in Section IX (Dispute Resolution), it shall do so no later than 15 Days after receipt of EPA's notice. In any such proceeding, NTUA has the burden of proving that it is entitled to relief under Paragraph 75, that its proposed excuse or extension was or will be warranted under the circumstances, and that it complied with the requirements of Paragraphs 76–77. If NTUA carries this burden, the delay or non-performance at issue shall be deemed not to be a violation by NTUA of the affected obligation of this Partial Consent Decree identified to EPA and the Court.

## IX. DISPUTE RESOLUTION

81. Unless otherwise expressly provided for in this Partial Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Partial Consent Decree. NTUA's failure to seek resolution of a dispute under this Section concerning an issue of which it had notice and an opportunity to dispute under this Section prior to an action by the United States to enforce any obligation of Defendant arising under this Decree precludes Defendant from raising any such issue as a defense to any such enforcement action.

82. Informal Dispute Resolution. Any dispute subject to Dispute Resolution under this Partial Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when NTUA sends DOJ and EPA a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed 20 Days from the date the dispute arises, unless that period is modified by written agreement. If the Parties cannot resolve a dispute by informal negotiations, then the position advanced by the United States shall be considered binding unless, within 20 Days after the conclusion of the informal negotiation period, NTUA invokes formal dispute resolution procedures as set forth below.

83. Formal Dispute Resolution. NTUA shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by sending DOJ and EPA a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting NTUA's position and any supporting documentation relied upon by NTUA.

84. The United States will send NTUA its Statement of Position within 45 Days of receipt of NTUA's Statement of Position. The United States' Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the United States. The United States' Statement of Position is binding on NTUA, unless NTUA files a motion for judicial review of the dispute in accordance with the following Paragraph. The motion may not raise any issue not raised in informal dispute resolution pursuant to Paragraph 82, unless the United States raises a new issue of law or fact in the Statement of Position.

85. Judicial Dispute Resolution. NTUA may seek judicial review of the dispute by filing with the Court and serving on the United States a motion requesting judicial resolution of the dispute. The motion (a) must be filed within ten Days of receipt of the United States' Statement of Position pursuant to the preceding Paragraph; (b) may not raise any issue not raised in informal dispute resolution pursuant to Paragraph 54, unless the Plaintiffs raise a new issue of law or fact in the Statement of Position; (c) shall contain a written statement of NTUA's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and (d) shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Partial Consent Decree.

86. The United States shall respond to NTUA's motion within the time period allowed by the Local Rules of this Court. NTUA may file a reply memorandum, to the extent permitted by the Local Rules.

87. Standard of Review

a. Disputes Concerning Matters Accorded Record Review. Except as otherwise provided in this Partial Consent Decree, in any dispute brought under

Paragraph 83 pertaining to the adequacy or appropriateness of plans, procedures to implement plans, schedules or any other items requiring approval by EPA under this Partial Consent Decree; the adequacy of the performance of work undertaken pursuant to this Partial Consent Decree; and all other disputes that are accorded review on the administrative record under applicable principles of administrative law, NTUA shall have the burden of demonstrating, based on the administrative record, that the position of the United States is arbitrary and capricious or otherwise not in accordance with law.

b. Other Disputes. Except as otherwise provided in this Partial Consent Decree, in any other dispute brought under Paragraph 83, NTUA shall bear the burden of demonstrating that its position complies with this Partial Consent Decree and better furthers the objectives of the Partial Consent Decree.

88. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation of NTUA under this Partial Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter shall continue to accrue from the first Day of noncompliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 70. If NTUA does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section VII (Stipulated Penalties).

## X. INFORMATION COLLECTION AND RETENTION

89. The United States and its representatives, including attorneys, contractors, and consultants, shall have the right of entry into any Facility covered by this Partial Consent Decree, at all reasonable times, upon presentation of credentials, to:

a. monitor the progress of activities required under this Partial Consent

Decree;

b. verify any data or information submitted to the United States in accordance with the terms of this Partial Consent Decree;

c. obtain samples and, upon request, splits of any samples taken by NTUA or its representatives, contractors, or consultants;

d. obtain documentary evidence, including photographs and similar data; and

e. assess NTUA's compliance with this Partial Consent Decree.

90. Upon request, NTUA shall provide EPA or its authorized representatives splits of any samples taken by NTUA. Upon request, EPA shall provide NTUA splits of any samples taken by EPA.

91. NTUA shall retain, and shall instruct its contractors and agents to preserve, all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) in its or its contractors' or agents' possession or control, or that come into its or its contractors' or agents' possession or control, and that relate in any manner to NTUA's performance of its obligations under this Partial Consent Decree. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. Upon request by the United States, NTUA shall provide copies of any documents, records, or other information required to be maintained under this Paragraph.

92. NTUA may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal law. If NTUA asserts such a privilege, it shall provide the following: (a) the title of the document,

record, or information; (b) the date of the document, record, or information; (c) the name and title of each author of the document, record, or information; (d) the name and title of each addressee and recipient; (e) a description of the subject of the document, record, or information; and (f) the privilege asserted by NTUA. However, no documents, records, or other information created or generated pursuant to the requirements of this Partial Consent Decree shall be withheld on grounds of privilege.

93. NTUA may also assert that information required to be provided under this Section is protected as Confidential Business Information ("CBI") under 40 C.F.R. Part 2. As to any information that NTUA seeks to protect as CBI, NTUA shall follow the procedures set forth in 40 C.F.R. Part 2.

94. This Partial Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States pursuant to applicable federal laws, regulations, or permits, nor does it limit or affect any duty or obligation of NTUA to maintain documents, records, or other information imposed by applicable federal laws, regulations, or permits.

## XI. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

95. This Partial Consent Decree is a partial remedy for the civil claims of the United States for the violations alleged in the Complaint. This Consent Decree resolves these claims only with respect to the injunctive relief set forth in Section V (Compliance Requirements). The Parties recognize that final resolution of these claims will require further injunctive relief. This Partial Consent Decree is without prejudice of the United States to seek further relief to address these claims or future claims, including, but not limited to, further injunctive relief, and civil penalties. The United States specifically reserves all rights to seek civil penalties for each

of the violations alleged in the Complaint and further injunctive relief for those alleged violations, including but not limited to repair, rehabilitation and/or replacement of the Collection Systems, and programs to ensure proper management, operation, and maintenance of the Collection Systems. This Partial Consent Decree is without prejudice to the Parties' positions as to the merits of any such further relief.

96. The Parties intend to negotiate a final consent decree to resolve the civil claims of the United States for the violations alleged in the Complaint. However, the Parties recognize that such negotiations may not result in a final consent decree and that the United States reserves the right to take such actions as it deems appropriate and necessary to resolve these claims and any future claims.

97. The United States reserves all legal and equitable remedies available to enforce the provisions of this Partial Consent Decree. This Partial Consent Decree shall not be construed to limit the rights of the United States to obtain penalties or injunctive relief under the Act or implementing regulations, or under other federal laws, regulations, or permit conditions, except as expressly stated in Paragraph 95.

98. The United States reserves all legal and equitable remedies to address any conditions if there is or may be an imminent and substantial endangerment to the public health or welfare or the environment arising at, or posed by, any Facility covered by this Partial Consent Decree, whether related to the violations addressed in this Partial Consent Decree or otherwise.

99. In any subsequent administrative or judicial proceeding initiated by the United States for injunctive relief, civil penalties, other appropriate relief relating to the Facilities or NTUA's violations, NTUA shall not assert, and may not maintain, any defense or claim based

upon the principles of waiver, claim preclusion (*res judicata*), issue preclusion (collateral estoppel), claim-splitting, or other defenses based upon any contention that the claims raised by the United States in the subsequent proceeding were or should have been brought in the instant case, except with respect to claims that have been specifically resolved pursuant to Paragraph 95.

100. This Partial Consent Decree is not a permit, or a modification of any permit, under any federal, Navajo, or local laws or regulations. NTUA is responsible for achieving and maintaining complete compliance with all applicable federal, Navajo, and local laws, regulations, and permits; and NTUA's compliance with this Partial Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits, except as set forth herein. The United States does not, by its consent to the entry of this Partial Consent Decree, warrant or aver in any manner that NTUA's compliance with any aspect of this Partial Consent Decree will result in compliance with provisions of the Act, 33 U.S.C. § 1251, *et seq*., or with any other provisions of federal, Navajo, or local laws, regulations, or permits. Application for construction grants, or any other grants or loans, or other delays caused by inadequate facility planning or plans and specifications on the part of NTUA shall not be cause for extension of any required compliance date in this Partial Consent Decree.

101. This Partial Consent Decree does not limit or affect the rights of NTUA or of the United States against any third parties, not party to this Partial Consent Decree, nor does it limit the rights of third parties, not party to this Partial Consent Decree, against NTUA, except as otherwise provided by law.

102. This Partial Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Partial Consent Decree.

103. Upon entry of this Partial Consent Decree, the Administrative Orders on Consent are terminated without any further action on the part of EPA. Any submissions by NTUA pursuant to the terms of its above-referenced Administrative Orders on Consent that have not yet been approved, or have been approved subject to conditions by EPA, shall be treated as deliverables pursuant to the terms of this Partial Consent Decree.

## XII. COSTS

104. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States shall be entitled to collect the costs (including attorneys' fees) incurred in any action necessary to collect any portion of the civil penalty or any stipulated penalties due but not paid by NTUA.

## XIII. NOTICES

105. Unless otherwise specified in this Partial Consent Decree, whenever notifications, submissions, or communications are required by this Partial Consent Decree, they shall be made in writing and sent by mail or email, with a preference for email, addressed as follows:

| | |
|---|---|
| As to DOJ by email (preferred): | eescdcopy.enrd@usdoj.gov<br>Re: DJ # 90-5-1-1-12527 |
| As to DOJ by mail: | EES Case Management Unit<br>Environment and Natural Resources Division<br>U.S. Department of Justice<br>P.O. Box 7611<br>Washington, D.C. 20044-7611<br>Re: DJ # 90-5-1-1-12527 |
| As to EPA by email (preferred): | Susanne Perkins<br>CWA Inspector<br>Water Section I<br>Enforcement Division (ENF-3-1)<br>U.S. Environmental Protection Agency – Region 9<br>perkins.susanne@epa.gov |

| | |
|---|---|
| | Ellen Bannon<br>CWA Inspector<br>Water Section I<br>Enforcement Division (ENF-3-1)<br>U.S. Environmental Protection Agency – Region 9<br>bannon.ellen@epa.gov |
| As to EPA by mail: | Beth Aubuchon<br>Section Manager<br>Water Section I<br>Enforcement Division (ENF-3-1)<br>U.S. Environmental Protection Agency – Region 9<br>75 Hawthorne Street<br>San Francisco, CA 94105 |
| As to NTUA by email: | walterh@ntua.com<br>chalmerb@ntua.com<br>laverneg@ntua.com |

106. Any Party may, by written notice to the other Parties, change its designated notice recipient or notice address provided above.

107. Notices submitted pursuant to this Section shall be deemed submitted upon mailing or transmission by email, unless otherwise provided in this Partial Consent Decree or by mutual agreement of the Parties in writing.

## XIV. EFFECTIVE DATE

108. The Effective Date of this Partial Consent Decree shall be the date upon which this Partial Consent Decree is entered by the Court or a motion to enter the Partial Consent Decree is granted, whichever occurs first, as recorded on the Court's docket; provided, however, that NTUA hereby agrees that it shall be bound to perform duties scheduled to occur prior to the Effective Date. In the event the United States withdraws or withholds consent to this Partial Consent Decree before entry, or the Court declines to enter the Partial Consent Decree, then the preceding requirement to perform duties scheduled to occur before the Effective Date shall terminate.

## XV. MODIFICATION

109. The terms of this Partial Consent Decree, including any attached appendices, may be modified only by a subsequent written agreement signed by all the Parties. Where the modification constitutes a material change to this Partial Consent Decree, it shall be effective only upon approval by the Court. NTUA shall provide a report on the status of its compliance with this Partial Consent Decree to accompany any such joint motion to modify.

110. Unless otherwise specified, any disputes concerning modification of this Partial Consent Decree shall be resolved pursuant to Section IX (Dispute Resolution), provided, however, that, instead of the burden of proof provided by Paragraph 87, the Party seeking the modification bears the burden of demonstrating that it is entitled to the requested modification in accordance with Federal Rule of Civil Procedure 60(b).

## XVI. TERMINATION

111. This Partial Consent Decree shall remain effective until entry of a final consent decree or entry of a final judgment after litigation.

112. Notwithstanding Paragraph 111, the Parties may jointly move to terminate this Partial Consent Decree with the approval of the Court. The Parties shall provide a report on the status of NTUA's compliance with this Partial Consent Decree to accompany any such motion to terminate.

## XVII. PUBLIC PARTICIPATION

113. This Partial Consent Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Partial Consent Decree disclose facts or considerations indicating that the Partial Consent

Decree is inappropriate, improper, or inadequate. NTUA consents to entry of this Partial Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Partial Consent Decree by the Court or to challenge any provision of the Partial Consent Decree, unless the United States has notified NTUA in writing that it no longer supports entry of the Partial Consent Decree.

## XVIII. SIGNATORIES/SERVICE

114. Each undersigned representative of NTUA, and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice identified on the DOJ signature page below, certifies that he or she is fully authorized to enter into the terms and conditions of this Partial Consent Decree and to execute and legally bind the Party he or she represents to this document.

115. This Partial Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis. NTUA agrees to accept service of process by mail with respect to all matters arising under or relating to this Partial Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons. NTUA need not file an answer to the complaint in this action unless or until the Court expressly declines to enter this Partial Consent Decree, in which case NTUA's answer is due 30 Days following the Court's order.

## XIX. INTEGRATION

116. This Partial Consent Decree, including deliverables that are subsequently approved by EPA pursuant to this Partial Consent Decree, constitutes the entire agreement among the Parties regarding the subject matter of the Partial Consent Decree and supersedes all

prior representations, agreements, and understandings, whether oral or written, concerning the subject matter of the Partial Consent Decree herein.

## XX. NOT A FINAL JUDGMENT

117. This Partial Consent Decree is not a final judgment of the Court. The Parties recognize that final resolution of the claims set forth in the Complaint will require further injunctive relief.

## XXI. HEADINGS

118. Headings to the Sections and Subsections of this Partial Consent Decree are provided for convenience and do not affect the meaning or interpretation of the provisions of this Partial Consent Decree.

## XXII. APPENDICES

119. The following Appendices are attached to and part of this Partial Consent Decree:

"Appendix A" is the Submission Schedule for Deliverables, Notices, and Required Reporting.

"Appendix B" is the EPA-approved Compliance Plan for the existing Chinle WWTP.

"Appendix C" is the EPA-approved Compliance Plan for the existing Kayenta WWTP.

"Appendix D" is the EPA-approved Compliance Plan for the existing Tuba City WWTP.

Dated and entered this 2nd day of August, 2024.

Michael T. Liburdi

UNITED STATES DISTRICT JUDGE

FOR THE UNITED STATES OF AMERICA:

TODD KIM
Assistant Attorney General
Environment and Natural Resources Division
U.S. Department of Justice

s/ *Brian Schaap*
BRIAN SCHAAP
PATRICIA HURST
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, DC 20044-7611
Tel. (202) 305-1167 (Schaap)
Email: Brian.Schaap@usdoj.gov
Tel. (202) 307-1242 (Hurst)
Email: Patricia.Hurst@usdoj.gov

FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY:

JOSEPH THEIS Digitally signed by JOSEPH THEIS Date: 2024.01.04 15:49:24 -05'00'

JOSEPH G. THEIS
Acting Director
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

OF COUNSEL:

MEGAN KNIGHT Digitally signed by MEGAN KNIGHT Date: 2024.01.02 12:30:50 -05'00'

MEGAN KNIGHT
Attorney Advisor
Municipal Enforcement Branch
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., NW
Washington, DC 20460
Telephone: (202) 564-8942
Email: Knight.Megan@epa.gov

FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY:

SYLVIA QUAST Digitally signed by SYLVIA QUAST
Date: 2023.12.26 15:02:41 -08'00'

SYLVIA QUAST
Regional Counsel
Office of Regional Counsel
U.S. Environmental Protection Agency, Region IX

OF COUNSEL:

RICH CAMPBELL
Attorney Advisor
Office of Regional Counsel
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105
Telephone: (415) 972-3870
Email: Campbell.Rich@epa.gov

FOR NAVAJO TRIBAL UTILITY AUTHORITY:

Date: 11/21/2023

Walter W. Haase, P.E.
General Manager

# APPENDIX A:

# SUBMISSION SCHEDULE FOR DELIVERABLES, NOTICES, AND REQUIRED REPORTING

| Paragraph | Requirement | Approve/ Comment | Public Notice | Timeframe Required | Specified Due Date (if applicable) |
|---|---|---|---|---|---|
| **Compliance Requirements** | | | | | |
| 11.f | Submit the written comments and NTUA's responses to the Public Noticed deliverables | | | Following the 30-day Public Notice Period for specified deliverables | |
| **Budgeting and Planning** | | | | | |
| 19 | Capital Improvement Plan | Comment | | By the later of the 45th business day after NTUA Board Approval of the Annual Capital Budget or Wednesday, February 28, 2024. Annually thereafter. | |
| 20 | Annual Budgets | Comment | | By the later of the 45th business day after NTUA Board Approval of the Annual Operations & Maintenance and Capital Budgets or Wednesday, February 28, 2024. Annually thereafter. | |
| 21 | Annual Revenue Requirements and Adequacy Report | Comment | | By the later of the 45th business day after NTUA Board Approval of the Annual Operations & Maintenance and Capital Budgets or Wednesday, February 28, 2024. Annually thereafter. | |
| 21 | Submit document identifying additional expected funding sources (if necessary) | | | 90 days after submittal of the Annual Revenue Requirements and Adequacy Report if wastewater revenues are not estimated to fund work and ongoing activities | |
| 22 | Asset Management Plan (AMP) | Approval | | Specified due date | January 12, 2024 |

| | | | | | |
|---|---|---|---|---|---|
| 24 | Inventory of Replacement Parts for Critical Assets Report | Comment | | Quarterly starting 270 days after EPA Approval of AMP | Jan 30, Apr 30, Jul 30, Oct 30 |
| **Collection Systems** | | | | | |
| 25 | Sanitary Sewer Overflow (SSO) Response Plan | Approval | Yes | Specified due date | December 21, 2023 |
| 25.c | Telephone or email SSO Report | | | Within 24 hours of NTUA becoming aware of the SSO | |
| 25.d | Written SSO Report | | | Within 5 days of NTUA becoming aware of the SSO | |
| 26 | Anticipated and Unanticipated Bypass Reporting | | | In accordance with NPDES Permit | |
| 27 | Draft Memorandum of Agreement with Interconnected Collection System Operators | Comment | | Specified due date | February 29, 2024 |
| 29 | Sanitary Sewer Evaluation Study (SSES) Work Plan | Approval | Yes | 12 months after effective date | |
| 29 | Sanitary Sewer Evaluation Study Reports | Approval | | Each report due 30 days after completion of its corresponding SSES | |
| 31 | Repair, Rehabilitation, and Replacement Plan | Approval | Yes | 12 months after EPA approval of SSES Reports | |
| **Interim Upgrades to Existing WWTPs** | | | | | |
| 33.a(3) | Sludge Removal Plan for Chinle | Approval | Yes | In accordance with NPDES Permit requirement and prior to removing sewage sludge for use or disposal | |
| 33.b(3) | Sludge Removal Plan for Kayenta | Approval | Yes | In accordance with NPDES Permit requirement and prior to removing sewage sludge for use or disposal | |

| | | | | | |
|---|---|---|---|---|---|
| 33.c(3) | Sludge Removal Plan for Tuba City | Approval | Yes | In accordance with NPDES Permit requirement and prior to removing sewage sludge for use or disposal | |
| 34 | Risk Assessment for Moenkopi Wash | Approval | | Specified due date | December 1, 2023 |
| 35 | Tuba City Dewatering Plan | Approval | | Specified due date | November 30, 2023 |
| 36 | Optimization of Treatment Performance Analysis | | | Compliance dependent | |
| 37 | Modifications to Compliance Plans (if necessary) | Approval | | Timeline to be determined if modifications are necessary | |
| **Replacement of the WWTPs** | | | | | |
| 39.b | Relocation Proposal for Chinle (if necessary) | Approval | | No specified due date | |
| 39.c | Permit Modification for Chinle | | | In accordance with 40 C.F.R. Parts 122 and 124. | |
| 39.g | Decommissioning Plan for Chinle | Approval | Yes | Specified due date | February 1, 2026 |
| 39.h | Sludge Assessment Report and Management Plan for Chinle | Approval | Yes | In accordance with NPDES Permit | |
| 40.b | Relocation Proposal for Kayenta (if necessary) | Approval | | No specified due date | |
| 40.c | Permit Modification for Kayenta | | | In accordance with 40 C.F.R. Parts 122 and 124. | |
| 40.g | Decommissioning Plan for Kayenta | Approval | Yes | Specified due date | February 1, 2026 |
| 40.h | Sludge Assessment Report and Management Plan for Kayenta | Approval | Yes | In accordance with NPDES Permit | |
| *If Lease Application for Identified Tuba City Site is Approved* | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 41.a(1)(a) | Submit application to Navajo Nation for authorization to construct the replacement WWTP at Tuba City site | Approval (Navajo Nation) | | Within 15 months of lease approval | |
| *If Lease Application for Identified Tuba City Site is Denied or Not Approved by March 31, 2024* | | | | | |
| 41.a(2)(a) | Submit lease application for an alternate Tuba City site to Navajo Nation | Approval (Navajo Nation) | | Specified due date | December 31, 2024 |
| 41.a(2)(b) | Submit application to Navajo Nation for authorization to construct the replacement WWTP at alternate Tuba City site | Approval (Navajo Nation) | | Specified due date | December 31, 2025 |
| *If Lease Application for Alternate Tuba City Site is Denied or Not Approved by June 30, 2025* | | | | | |
| 41.a(3) | Notify EPA that the alternate Tuba City site lease was denied or not approved | | | By the earlier of 10 Days after the lease is denied or July 10, 2025 | |
| 41.b | Submit all designs for replacement Tuba City WWTP | Comment | | No specified due date | |
| 41.c | Permit modification for Tuba City | | | In accordance with 40 C.F.R. Parts 122 and 124. | |
| 41.f | Decommissioning Plan for Tuba City | Approval | Yes | No later than 10 months after starting construction of the Replacement WWTP | |
| 41.g | Sludge Assessment Report and Management Plan for Tuba City | Approval | Yes | In accordance with NPDES Permit | |
| **Existing, Upgraded, and Replacement WWTP Operation and Maintenance** | | | | | |
| 43.b | Report to EPA on operation and maintenance | | | Quarterly | Jan 30, Apr 30, Jul 30, Oct 30 |
| 43.d | Operation and Maintenance Manuals | Approval | | 30 days prior to construction completion of each replacement WWTP | |

| | | | | |
|---|---|---|---|---|
| 44 | O&M Plan and Procedures for Replacement WWTPs | Approval | 90 days before scheduled start-up of each replacement WWTP | |
| 45 | Operations Assessment and Training | Approval | 60 days before scheduled construction completion of each replacement WWTP | |
| 46 | Wastewater Collection and Treatment Operator Certification | | Specified due date, annually thereafter | December 31, 2023 |
| 46 | Submit Documentation for Subsequently Certified, Hired, or Temporarily Retained Operators | | 14 days after certifying, hiring, or retaining the new operator | |
| 47 | Regional Wastewater Treatment Operator Compensation Survey and Evaluation | | Annually. Submit in the Quarterly Report that follows the annual Compensation Evaluation | Jan 30, Apr 30, Jul 30, or Oct 30 |
| **Reporting Requirements** | | | | |
| 49 | Emergency Response Reporting | | In accordance with NPDES Permit and SSO Response Plan | |
| 50 | Quarterly Progress Reports | | Quarterly | Jan 30, Apr 30, Jul 30, Oct 30 |
| 51 | Notice of violation or potential violation of the CD | | Within 10 business days of the day NTUA first becomes aware of the violation | |
| 52 | Notice of a violation that may pose an immediate threat to public health or welfare or the environment. | | As soon as possible, but no later than 24 hours after NTUA becomes aware of the violation | |
| **Force Majeure** | | | | |
| 76 | Notice that NTUA may or will claim Force Majeure | | Up to three days after NTUA knew that an event would likely delay or prevent performance under the CD | |
| 77 | Further notice to assert the claim of Force Majeure | | Within seven days of making the claim in paragraph 76 | |

# APPENDIX B:

# CHINLE WASTEWATER TREATMENT PLANT COMPLIANCE PLAN

COMPLIANCE PLAN

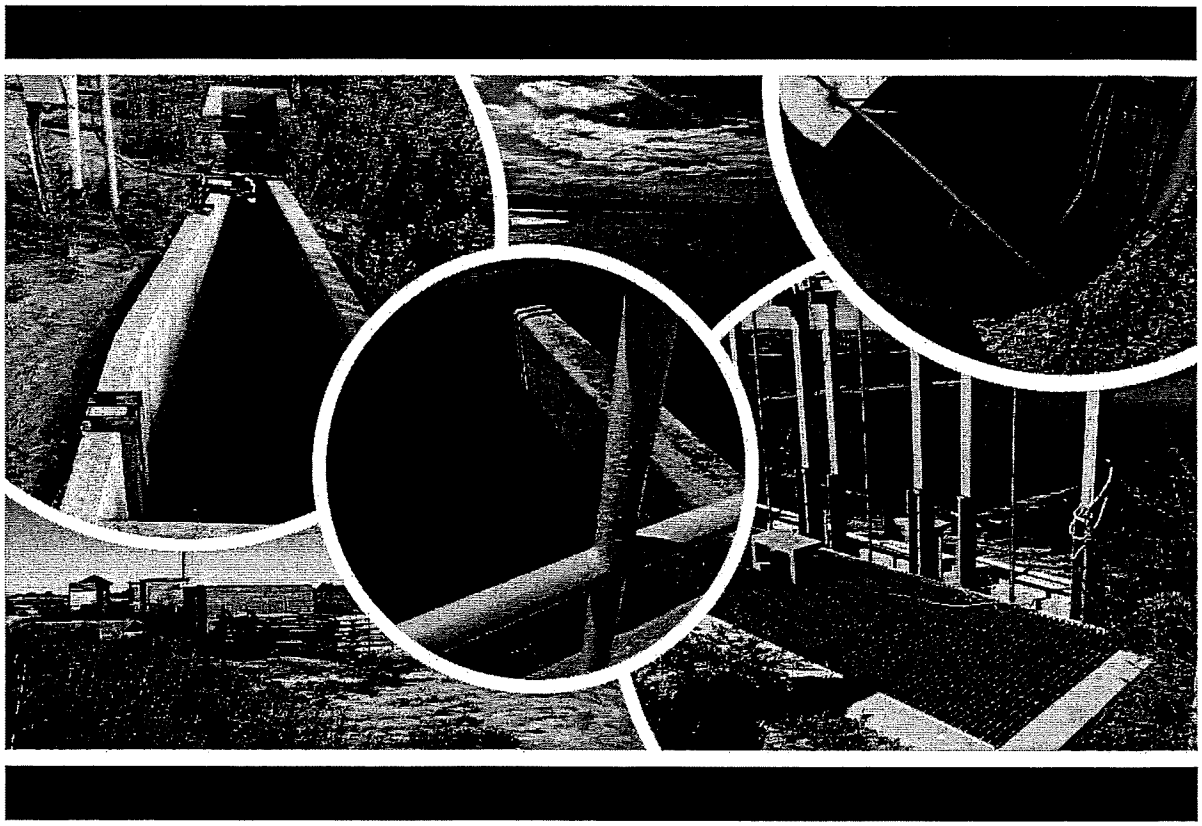
Navajo Tribal Utility Authority

# Chinle Wastewater Plant

## Response to Administrative Order on Consent

*US Docket No. CWA-309(a)-16-013, NN Docket No. NNCWA-AOC-2014-001*

*NPDES Permit No. NN0020265*



**October 2019** (revised July 2021, March 2022, and March 2023)

Prepared for:

**Navajo Tribal Utility Authority**

*Office of the Deputy General Manager*

PO Box 170, Ft. Defiance, AZ 86504

Prepared by:

**WSP**

*4221 Balloon Park Rd. NE, Albuquerque, NM 87113*

*505.821.1801*

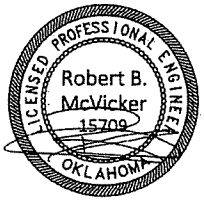
# Chinle Wastewater Treatment
# COMPLIANCE PLAN

Response to Administrative Order on Consent
US Docket No. CWA-309(a)-16-013, NN Docket No. NNCWA-AOC-2014-001
NPDES Permit No. NN0020265

October 2019
Revised July 2021
Revised March 2022
Revised March 2023

Navajo Tribal Utility Authority
Office of the Deputy General Manager
PO Box 170, Ft. Defiance, AZ 86504

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of Oklahoma, is affixed below.




Bruce McVicker, PE (OK 15709)

**TABLE OF CONTENTS**

1. COMPLIANCE HISTORY ..... 1
2. COMPLIANCE STATUS ..... 3
2.1 Discharge Limit Violations ..... 3
2.2 Operational Deficiencies ..... 4
2.3 Compliance Milestones ..... 5
3. PRESENT SITUATION ..... 8
3.1 Treatment ..... 8
3.2 Operation and Maintenance ..... 12
3.3 Summary ..... 14
4. COMPLIANCE OPTIONS ..... 15
4.1 Treatment ..... 15
4.2 Operation and Maintenance ..... 19
4.3 Conclusion ..... 19
5. PATHWAY TO COMPLIANCE ..... 24
5.1 Treatment ..... 24
5.2 Operations ..... 28
5.3 Schedule to Compliance ..... 29
5.4 Summary ..... 29

**TABLES**

Table 1: Chinle WWTP - Permit (by Year and Parameter) ..... 3
Table 2: Chinle WWTP - Whole Effluent Toxicity (WET) Testing ..... 4
Table 3: Chinle WWTP - Compliance Milestone ..... 6
Table 4: Chinle WWTP - Average Effluent Sampling Results* (by Month and Parameter) ..... 10
Table 5: Chinle WWTP - Effluent BOD ..... 10
Table 6: Chinle WWTP – Effluent TSS ..... 11
Table 7: Chinle WWTP – Effluent Total Ammonia ..... 11
Table 8: Chinle WWTP – Improvement Option Summary Table ..... 20

**FIGURES**

Figure 1: Chinle WWTP - Existing Treatment Scheme ..... 9
Figure 2: Chinle WWTP - Pathway to Compliance ..... 24
Figure 3: Chinle WWTP – Interim Measures (CFID) ..... 26

**APPENDIX**

Appendix A: Chinle WWTP - Design for Interim Measures ..... 30

## 1. COMPLIANCE HISTORY

The Chinle wastewater facility is not complying with its National Pollutant Discharge Elimination System (NPDES) permit. Troubles with the facility meeting permit requirements and the Navajo Tribal Utility Authority's (NTUA) struggle to bring the plant into full compliance date back to at least 2010 and continue today. Key events since 2006 are listed below.

- Region 9: NPDES Permit (December 23, 2006) - The Chinle wastewater facility NPDES permit (No. NN0020265) became effective. The discharge parameters to be monitored monthly for compliance included: five-day biochemical oxygen demand ($BOD_5$), total suspended solids (TSS), E. coli, total residual chlorine (TRC), and pH. BOD and TSS had monthly average and weekly average limits. E. coli and TRC had daily maximum and monthly average limits. An envelope, with a lower and upper limit, was provided for pH. Total dissolved solids (TDS)[1] and total ammonia were to be monitored quarterly[2] but had no limits. And a priority pollutant scan was to be conducted each year[3] but no limits were set.

- Region 9: NPDES Permit (May 1, 2012) - The reissued Chinle wastewater facility NPDES permit became effective with requirements largely the same as the 2006 permit, except BOD and TSS limits were raised and total ammonia limits were established.[4] Also, semi-annual whole effluent toxicity (WET) monitoring was introduced but no limits were set.

- NNEPA: Plant Inspection (April 15, 2014) – Navajo Nation Environmental Protection Agency (NNEPA) staff inspected the Chinle wastewater facility to evaluate compliance with the permit. The inspection found several operation and maintenance shortcomings and determined effluent from the wastewater plant exceeded permit limits.

- NNEPA: Administrative Order (October 28, 2014) – An Administrative Order on Consent (AOC) issued by the Navajo Nation's Environmental Protection Agency (NNEPA) became effective. The NN AOC found the NTUA was not in compliance with its NPDES requirements at six of its permitted facilities.[5] The NN AOC required the NTUA to secure a consultant, by December 17, 2014, to assist the Authority in preparing the plans. The NTUA and its consultant were then to prepare draft compliance plans for each site by June 10, 2015. The compliance plans were to address at least the following concerns for each facility.

    - TRC – Describe how chlorine used for disinfection was to be removed from the effluent prior to discharge or outline an alternative, replacement disinfection system.

---

[1] TDS was to be evaluated both flowing into and discharging out of the plant.

[2] The frequency at which total ammonia was to be monitored was tied to the amount of total ammonia in the effluent compared to the USEPA's National Water Quality Criteria (1999). If the results for the first four quarters of sampling revealed levels below the criteria, the monitoring frequency could be reduced to annually. For example, discharge water having a temperature of 20°C and a pH of 8.0 could not have a total ammonia concentration exceeding 5.6 mg/L.

[3] If the first-year scan complied with the USEPA's National Water Quality Criteria for priority pollutants, then no further pollutant scanning was required.

[4] The total ammonia was not to exceed the chronic values provided by the Navajo Nation Surface Water Quality (NN SWQ) Standards (2015), Table 207.21 for a given temperature and pH. For example, discharge water having a temperature of 20°C and a pH of 8.0 could not have a total ammonia concentration exceeding 1.71 mg/L.

[5] The Navajo Townsite facility has since been removed from the NPDES program. Currently there are nine NTUA facilities with NPDES permits.

- E. coli, BOD, and TSS – Describe how each facility will correct the permit deficiencies for these parameters.
- Ammonia – Describe how pH, temperature, and ammonia were to be sampled and tested for compliance with the permit at each facility.
- O&M – Prepare an operation and maintenance (O&M) plan for each facility. Describe how the O&M plans will prevent future violations.

- NTUA: Compliance Plan (September 2015) – In response to both the plant inspection and communications with Region 9, the NTUA prepared a Compliance Plan[6] designed to bring the Chinle wastewater facility into compliance with its permit by July 30, 2016, for organics, suspended solids, pathogenic bacteria, and residual chlorine, but not total ammonia.

- Region 9: Administrative Order (September 29, 2016) – An EPA Administrative Order on Consent (AOC) became effective. The AOC found at the Chinle wastewater facility that the NTUA:
  - discharged pollutants in excess of effluent limitations,
  - failed to submit and complete timely reports,
  - failed to properly sample and report sampling results, and
  - failed to adequately operate and maintain the treatment plant.

  The findings were based on actions and practices that occurred between October 2010 and September 2016. The AOC directed the NTUA by October 31, 2016, to implement the mitigation measures proposed in the Compliance Plan of 2015 and a modification letter[7]. The NTUA was also directed to develop an operator training plan to ensure operators understand the permit limits and how to comply with reporting requirements. Regardless of circumstances, the Chinle plant was to be in full compliance with the permit by January 30, 2017.

- NTUA: Performance Evaluation (May 10, 2017) – An assessment[8] of the Chinle wastewater facility was performed to identify operational conditions and practices that would bring the system into long-term, sustained compliance.

- Region 9: NPDES Permit (September 1, 2018) – The current Chinle wastewater facility NPDES permit became effective with requirements largely the same as the 2012 permit. The permit was reissued with an effective date of September 1, 2018. The ammonia impact ratio (AIR) was introduced.[9] The WET test was changed to monthly[10] and passing was made mandatory. The permit term ends on August 31, 2023.

---

[6] Smith Engineering, Chinle Wastewater Treatment Plant, NPDES Permit Compliance Plan, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (September 2015)

[7] Ben, Ronnie, Letter to Walter Haase (January 14, 2016)

[8] Harris, Steve, Performance Evaluation of the Chinle Sewer Treatment Plant, *H&S Environmental, LLC*, Mesa, AZ (May 10, 2017)

[9] But because the AIR is 1.0 the total ammonia limits remain directly correlated to the Navajo Nation Surface Water Quality (NN SWQ) Standards (2015), Table 207.21 for a given pH and temperature.

[10] If no toxicity is found during the first 12 months, testing can be relaxed to a quarterly event.

## 2. COMPLIANCE STATUS

The 2016 AOC directs the NTUA to take all measures necessary to comply with the NPDES permit and envisions that most of the needed actions are defined by the 2015 Compliance Plan. While the Chinle wastewater treatment plant (WWTP) regularly violates its discharge limits, the NTUA is in operating the plant within its permit requirements for pH, TRC, and E coli. The 2016 AOC and 2015 Compliance Plan also established milestones by which progress can be measured.

### 2.1 Discharge Limit Violations

The physical discharge parameters regulated by the Chinle WWTP permit are BOD, TSS, E. coli, residual chlorine (TRC), pH, and total ammonia.[11] In accordance with the permit, samples of the wastewater facility's effluent are taken monthly. BOD, TSS, and WET test are sampled by composite, everything else is by a discrete collection (grab samples). A short history of the facility's discharge, showing the frequency at which sampled parameters have exceeded the current permit limits, is provided in Table 1 and discussed below.

***Table 1: Chinle WWTP - Permit Violations (by Year and Parameter)***

| Year<br>Discharge Parameter | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021<br>Jan - Mar | Total | % of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $BOD_5$ | 4 | 12 | 7 | 7 | 8 | 9 | 9 | 9 | 9 | 9 | 3 | 86 | 39.4% |
| TSS | 0 | 0 | 0 | 3 | 2 | 5 | 3 | 1 | 1 | 2 | 2 | 19 | 8.7% |
| E. coli | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 9 | 4.1% |
| TRC | 7 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 5.5% |
| pH | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.5% |
| Sub-Total | 13 | 12 | 15 | 11 | 10 | 15 | 12 | 10 | 11 | 13 | 5 | 127 | |
| Months w/Discharge | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 3 | 122 | |
| Total Ammonia | 3 | 8 | 12 | 11 | 12 | 12 | 5 | 10 | 10 | 5 | 3 | 91 | 41.7% |
| Months w/Ammonia Data | 3 | 8 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 3 | 110 | |
| Total Violations | 16 | 20 | 27 | 22 | 22 | 27 | 17 | 20 | 21 | 18 | 8 | 218 | 100.0% |

Notes: Values reflect the number of months each year when sampling results exceeded/violated the monthly average (BOD, TSS, and total ammonia), daily maximum (E. coli and TRC), or (pH) values allowed by the NPDES permit for the given parameter. Daily loading (BOD and TSS), which is a function of both concentration and flow, is given a limit in the permit but is not considered here. Whole effluent toxicity (WET) testing is not included or considered here.

- BOD – In 2012, the concentration limit for BOD was raised from 30 milligrams per liter (mg/L) to 45 mg/L. Still, the amount of degradable organics in the water is **regularly non-compliant**. Since 2011, samples have exceeded 45 mg/L BOD an average of eight months each year.

- TSS – In 2012, the limit for TSS was raised from 30 mg/L to 90 mg/L. Still, the concentration of suspended solids is **intermittently non-compliant**. Since 2011, the plant exceeded 90 mg/L TSS an average of about two months each year.

- E. coli – The limit for E. coli has been 126 colonies per 100 milliliters since before 2011. This monitor of pathogenic content is **normally compliant.** Since 2013, the limit has exceeded four times.

- TRC – In 2011, there was an average monthly limit of 5 micrograms per liter (µg/L) and a maximum daily limit of 11 µg/L. In 2012, the average monthly limit was dropped. Today only the maximum daily limit of 11 µg/L remains. Since a sulfur dioxide unit upgrade in 2010, residual chlorine is **consistently compliant.**

[11] Beginning with the 2018 reissued permit, whole effluent toxicity (WET) testing is no longer allowed to fail. The NTUA has been performing variations of WET testing almost continuously since May 2012.

- pH – Since before 2011, the allowable envelope for pH has been between 6.5 and 9.0. Except for January 2014, when the pH was reported at 6.2, the pH has been **consistently compliant.**

- Total Ammonia – In 2012, a total ammonia limit based on the chronic toxicity value was introduced.[12] In 2018, an ammonia impact ratio (AIR) was added. However, because the permit limit for AIR is 1.0, the total allowed ammonia concentration remains equal to the numeric chronic toxicity value. The amount of total ammonia is **regularly non-compliant**. Since 2011, when sampled and tested, total ammonia has exceeded the numerical limit 10 times out of every twelve months.

Most effluent water quality problems at the Chinle facility result from variations in the water's biological processes. Of the six permit parameters, only two (E. coli and TRC) are treated by physical/chemical processes at the tailworks. The remaining four (BOD, TSS, pH, and ammonia) are affected by biological processes in the ponds, which in turn are influenced by temperature, wind, and sunshine. The seasonal nature of the BOD, TSS, and total ammonia concentrations in the plant's effluent can be seen in Table 4. Operators of pond-based facilities have significant control over physical/chemical processes, but little control over environmental factors and affected biological processes. Since 2011, if violations for parameters treated by physical processes are not considered, the WWTP exceeds one of the four remaining biologically affected parameters about 18 times each year. And monthly exceedances of total ammonia make up most of the violations (46.5%), followed by BOD at (41.2%). Together total ammonia and BOD account for 91.1% of the violations associated with biological parameters and 87.7% of all violations.

In 2012, the whole effluent toxicity (WET) testing was introduced into the plant's permit. A summary of the facility's discharge, showing the frequency at which the sampled effluent failed the WET test is shown in Table 2 and discussed below.

***Table 2: Chinle WWTP - Whole Effluent Toxicity (WET) Testing***

| | 2012 | 2013 | 2014 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 Jan-Jun |
|---|---|---|---|---|---|---|---|---|---|---|
| Months with a Failed Test | 5 | 12 | 12 | 7 | 12 | 5 | 9 | 9 | 11 | 1 |
| Months Testing was Conducted | 5 | 12 | 12 | 7 | 12 | 12 | 10 | 10 | 12 | 1 |

Effluent toxicity can result from many different contaminants and variations in water quality. Some contaminants, such as ammonia, can be reduced by a wastewater treatment plant. Other contaminants, such as pesticides and herbicides, are often not greatly affected by traditional wastewater treatment and can persist in wastewater through a treatment plant and into the discharge stream. The sources of toxicity in a community's waste stream must be identified and characterized for them to be managed and treated. For the Chinle plant, the likely cause for test failures is the presence of ammonia which cannot be effectively treated with an aerated pond system.

**2.2 Operational Deficiencies**

The NNEPA April 2014 plant inspection found the NTUA did not dedicate sufficient operations and maintenance staff to the Chinle plant, sample discharged effluent, and meet discharge requirements - notably for BOD. A review of the Chinle facility files, from October 2010 through September 2015, found the NTUA did not meet its reporting

[12] The limit on ammonia is set by the NN SWQ Standards and was established by considering toxicity to aquatic life. The standards call for total ammonia levels that will vary with each sampling event, depending on the effluent's simultaneous pH and temperature, with pH having the greatest influence. The higher the pH and the higher the temperature, the lower the total ammonia limit.

obligations. Noted reporting deficiencies included failing to submit monitoring data on time, as required by the permit, and occasionally failing to submit any monitoring data at all. The NTUA has taken steps to correct these operational deficiencies.

- Reporting – Discharge limit violation notices and monthly discharge monitoring reports (DMRs) are being consistently reported but not all required parameter data is being provided to Region 9 through the Central Data Exchange (CDX).

- Operation and Maintenance – The operational and maintenance improvements recommended in the 2015 Compliance Plan and the 2017 Performance Evaluation were implemented. Operation and maintenance (O&M) practices are **standardized and scheduled** for Chinle in the plant's O&M manual[13] and operations checklist.[14] Regular in-house operator training began in August 2017. The plant staff's adherence to the manual and checklist is monitored.

- Sludge Reporting – A sludge report, required by Part III.D.1 of the permit, was submitted to EPA for approval on January 22, 2021.

**2.3 Compliance Milestones**

Together the NNEPA's 2014 AOC and Region 9's 2016 AOC require the NTUA to accomplish eight action items at the Chinle facility. Region 9's AOC references the 2015 Compliance Plan and includes eight corrective modifications out of the compliance plan. The action items and corrective modifications result in 15 separate milestones which are listed and summarized in Table 3. Twelve (12) of the milestones were completed as of March 2021.

[13] Smith Engineering, Chinle Wastewater Treatment Plant Operation and Maintenance Manual, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (August 2016)
[14] NTUA, Chinle Wastewater Treatment Plant Sampling Schedule, and O&M and Flow Logs, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (May 24, 2018).

***Table 3: Chinle WWTP - Compliance Milestone***

| AOC Action Item | CP Corrective Mod.[15] | Milestone No. | Milestone | Compliance Date | Reference | Compliance Status | Comment |
|---|---|---|---|---|---|---|---|
| A | | I | Hire a Regulatory Compliance Consultant | 17-Dec-14 | NNEPA AOC | Complete | NTUA hired Smith Engineering to draft the first compliance plan submitted in September 2015. On 11-Nov-2018 the NTUA hired Wood E&IS to assist in preparing replacement compliance plans. |
| B | | II | Submit Compliance Plans | 10-Jun-2015 | NNEPA AOC | Complete | NTUA submitted a compliance plan to the Region 9 in September 2015. The compliance plan was incorporated into the Region 9 AOC. |
| C | | III | Compliance plan (implement) | 31-Oct-16 | AOC – Item 28 | Complete | All components of the 2015 compliance plan have been completed as described below. |
| | *1* | IV | Manage chlorination and dechlorination processes (testing) | As needed, beginning Jan-2016 | 2015 Compliance Plan, 2.7.1 | Complete | O&M tasks standardized, listed, and scheduled. |
| | *2* | V | Chlorine contact chamber structure (inspect) | 17-Jul-2015 | 2015 Compliance Plan, 2.7.2 | Complete | Chlorine contact chamber is structurally adequate and functioning as intended. |
| | *3* | VI | Chlorine contact chamber (maintain) | Quarterly beginning Jan-2016 | 2015 Compliance Plan, 2.7.3 | Complete | O&M tasks standardized, listed, and scheduled. |
| | *4* | VII | Clean lagoons and alter operation<br>• Complete report<br>• Take Cell 4 offline<br>• Clean Cell 2 and deposit dredgings in Cells 3 and 4<br>• Bring Cell 2 online | 28-Feb-2016 | 2015 Compliance Plan, 2.7.4 | Complete | Cell 2 was cleaned, deepened, lined, and brought online in October 2016. Construction did not acquire the design depth for cell 2 due to groundwater. Debris was deposited in Cell 3. |
| | *5* | VIII | Lagoon performance testing (implement) | 01-Jan-16 | 2015 Compliance Plan, 2.7.5 | Complete | A performance evaluation was issued by H&S Environmental, LLC on May 10, 2017. |
| | *6* | IX | Aeration system (upgrade)<br>• Evaluate<br>• Design<br>• Procure<br>• Install | <br>• Sep-2015<br>• 30-Dec-2015<br>• 30-Mar-2016<br>• 30-Jun-2016 | 2015 Compliance Plan, 2.7.6 | Complete | Aeration upgrade in Cell 2 (165 hp) performed in 2016. |
| | *7* | X | Chemical & flow meter (maintain) | Quarterly, beginning Jan-2016 | 2015 Compliance Plan, 2.7.7 | Complete | O&M tasks standardized, listed, and scheduled. |

[15] Smith Engineering, Chinle NPDES Permit Compliance Plan, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (September 2015), Section 2.7, Table 10

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *8* | XI | Illegal dumping (prevent)<br>• Cease & Desist (issue)<br>• Dump site (develop) | Jan-2016<br>Jun-2016 | 2015 Compliance Plan, 2.7.8 | Complete | No evidence of illegal wastewater dumping has been found. The situation continues to be monitored. NTUA is proceeding with plans to address septage disposal as part of their proposed WWTP project. |
| D | | XII | Operator training plan (implement) | 31-Oct-16 | AOC – Item 30 | Complete | A training program began in August 2017 and is ongoing. |
| E | | XIII | Compliance with permit (full) | 30-Jan-17 | AOC, Item 33 | Not complete | Effluent parameters continue to be exceeded. |
| F | | XIV | Chinle AOC Compliance Reports (submit) | Quarterly beginning 10-Oct-16 | AOC, Item 34 | Compliant and ongoing | Quarterly |
| G | | XV | Qualified O&M supervision (report supervisory team) | 29-Oct-16 | AOC, Item 37 | Not Complete | The engineering group at NTUA Headquarters supervises the technical operations at the Chinle facility. |
| H | | XVI | Plant Operations Supervisor (assign) | 28-Mar-17 | AOC, Item 38 | Not-Complete | Kee Gorman, a Grade 3 Certified Wastewater Treatment operator leads operations at Chinle. |

## 3. PRESENT SITUATION

The plant was originally constructed in 1970 with four ponds: aeration cell (outfitted with two mechanical aerators), stabilization lagoon, north recharge pit, and south recharge pit. The original ponds are today designated as Cells numbered 1, 2, 3, and 4. The ponds' structural condition has declined with time. This is most evident In Cells 1, 3, and 4 where the weather deteriorated liner has torn, ripped, and folded back on itself, exposing the underlying earthside slopes in many places. In some places, the exposed earth has eroded from wave action and the side slopes have sloughed into the cells.

The NTUA has undertaken maintenance projects over the years including sludge cleaning, headworks, tail works, and aeration upgrades. Cell 2 was recently cleaned, synthetically lined, and outfitted with six 25 horsepower (hp) and one 15 hp aspirating aerators (165 hp total). Beginning in October 2016, Cells 1, 3, and 4 were removed from service and Cell 2 became the sole treatment reactor. The current Chinle wastewater facility is shown in Figure 1. It is an aerated pond system with headworks, four constituent ponds (treatment cells), interconnection piping, gates and valves, and a tailworks. The headworks consists of a bar screen and flow meter. The treatment cells were constructed as earthen basins lined on the bottom with clay and the sides with synthetic fabric. Piping includes multilevel draw-off structures and flow junction boxes. The tailworks contains chlorination and dechlorination systems, flow meter, and outfall structure. The plant currently treats about 450,000 gallons per day[16] of municipal sewage.

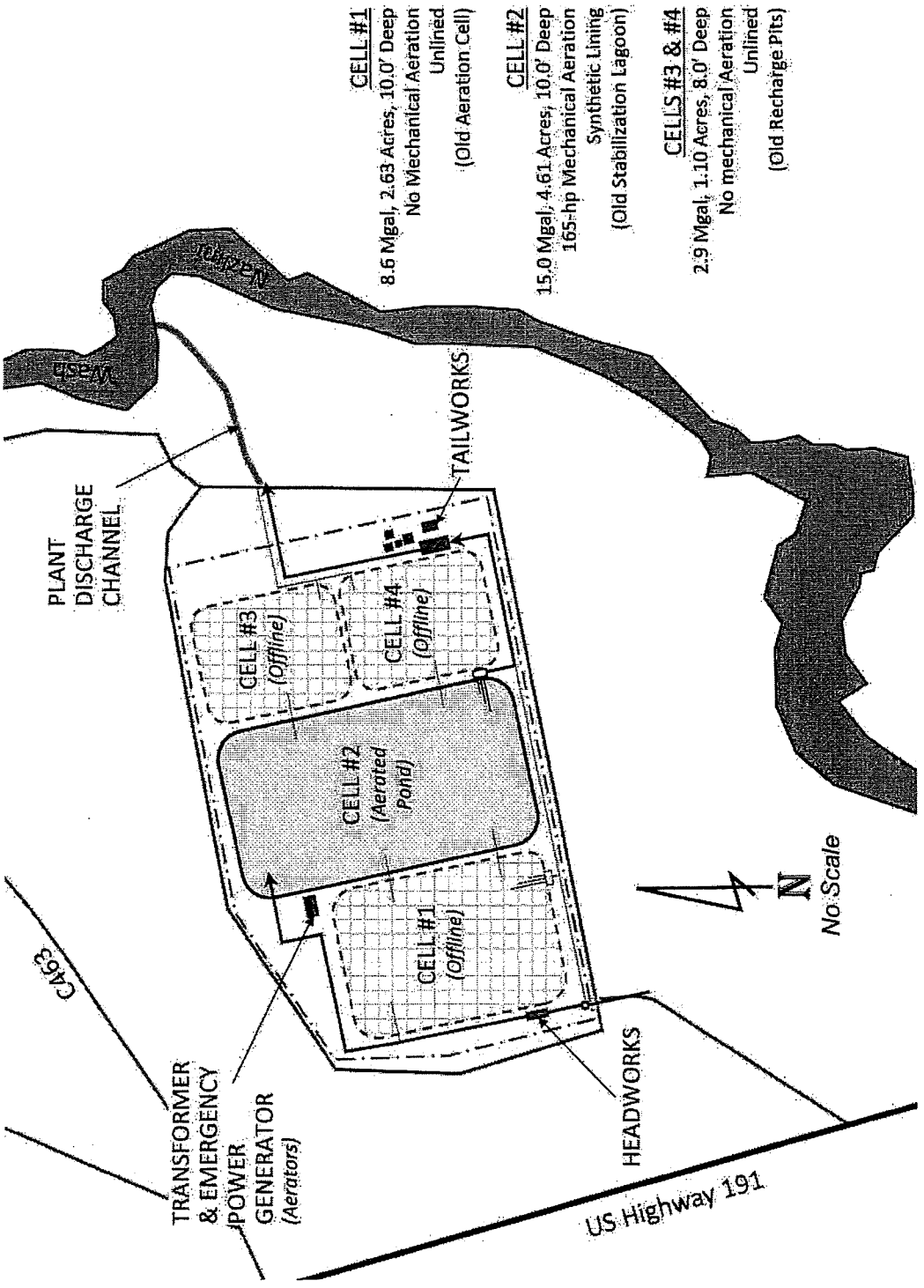
### 3.1 Treatment

Pond-based systems are limited and variable in their ability to treat wastewater. Still, the NTUA has made significant investments in upgrades and improved operations at the Chinle plant, including $1.6 Million in capital improvements. The investments were designed to reduce variability in the plant's effluent quality and improve overall treatment.

- Recent Upgrades - Since 2010, five improvement projects were completed at the Chinle plant.
    - *Pond Cleaning (2010)* – The bottom sludge in Cell 1 was removed.
    - *Dechlorination System (2010)* – A new sulfur dioxide system was installed and placed online.
    - *Pond Expansion (2016)* - Cell 2 was cleaned, enlarged, and synthetically lined.[17]
    - *Treatment Scheme Change (2016)* - The plant was converted into a single-cell aerated lagoon system[18]. Cells 1, 3, and 4 were taken offline.
    - *Aeration Upgrade (2016)* – Cell 2 was outfitted with 165 hp of new floating, aspirating aerators.[19]

[16] Based on the average monthly flows during 2017 and 2018.
[17] Sludge removal can be helpful in reducing treatment problems encountered with pond systems from spring turnover and algal nutrient feedback.
[18] A reduction in hydraulic retention time can improve effluent quality for BOD and TSS.
[19] Aeration improves biological treatment.

*Figure 1: Chinle WWTP - Existing Treatment Scheme*



- Current Performance – A review of Table 1 shows compliance rate improvement for the two chemical/physical processes effected parameters (TRC and E. coli) beginning in 2014. While all four of the biologically affected parameters (BOD, TSS, pH, and total ammonia) display no discernable improvement. Total ammonia does not present increased compliance but does show reduced concentrations in the effluent beginning in 2014.

  As can be seen in Table 4, BOD and TSS follow a seasonal pattern. Winter months tend to have higher quality water with lower BOD and TSS concentrations. Spring months exhibit poor water quality and elevated concentrations.

  - *BOD* – As shown in Table 5 below, effluent BOD exhibits **no discernable improvement** since 2010. It appears high BOD results from spring algae blooms and turnover in the ponds because groupings of high concentrations occurred in March or April of most years.[20]

***Table 4: Chinle WWTP - Average Effluent Sampling Results* (by Month and Parameter)***

| Month | BOD | TSS | $NH3^-$ |
|---|---|---|---|
| January | 54.0 | 43.8 | 19.3 |
| February | 64.5 | 60.6 | 24.1 |
| March | 87.9 | 72.3 | 23.4 |
| April | 104.4 | 80.9 | 19.0 |
| May | 66.6 | 60.1 | 19.6 |
| June | 68.2 | 67.0 | 16.6 |
| July | 51.8 | 53.4 | 17.7 |
| August | 67.8 | 64.8 | 17.1 |
| September | 56.7 | 60.9 | 18.1 |
| October | 55.4 | 61.0 | 14.8 |
| November | 57.1 | 45.9 | 12.8 |
| December | 46.0 | 38.9 | 20.2 |
| **Average** | **65.0** | **59.1** | **18.6** |
| NPDES Permit | 45 | 90 | Can be <2.0 |
| *Using monthly data from January 2011 through March 2021. | | | |

***Table 5: Chinle WWTP - Effluent BOD***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan - Mar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Effluent Maximum (mg/L) | 121.5 | 112.8 | 137.6 | 94.8 | 154.7 | 92.0 | 141.2 | 177.7 | 161.4 | 107.2 | 117.7 |
| Effluent Average (mg/L) | 51.6 | 67.1 | 63.3 | 50.6 | 70.0 | 67.8 | 60.6 | 78.7 | 75.1 | 61.9 | 82.3 |
| Note: Data are from composite samples taken monthly. | | | | | | | | | | | |

[20] Spring turnovers are a normal occurrence in wastewater ponds with bottom sludge.

- *TSS* – Suspended solids are a recurring problem at the Chinle facility. Table 4 shows high concentrations often occur around April of most years, indicating that spring algae blooms are a factor.[21] And Table 6 below indicates over that time the concentration of TSS in the effluent has **no discernable improvement.**

***Table 6: Chinle WWTP – Effluent TSS***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan - Mar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Effluent Maximum (mg/L) | 55.4 | 80.0 | 77.3 | 125.0 | 180.0 | 127.0 | 110.0 | 105.0 | 100.0 | 96.7 | 165.0 |
| Effluent Average (mg/L) | 36.7 | 56.4 | 43.3 | 62.6 | 66.1 | 73.5 | 73.2 | 53.9 | 51.2 | 60.9 | 111.0 |

- *E. coli* – The compliance rate for this pathogenic monitor **has improved** since 2013, and is now rarely out of compliance.

- *TRC* – The removal of residual chlorine **has improved.** Today the sulfur dioxide system is consistently effective at stripping free chlorine from solution. The facility had no exceedances since the dechlorination system was started up in 2010.

- *pH* - Since at least 2010, the effluent's pH shows **no discernable change**, falling outside the allowed parameters only once. The pH is frequently measured at or below 8.0, which is lower than most other NTUA pond-based plants. Chinle's relatively short hydraulic retention time may contribute to lower pH.

- *Total Ammonia* – The concentration of the ammonia species in the effluent still regularly exceeds the permitted limit. But as can be seen in Table 7, since Cell 2 was cleaned, enlarged, and lined in early 2016 the concentration of ammonia **has improved**. Still, even with improved ammonia removal, effluent concentrations are an order of magnitude above permit limits that often are below 2.0 mg/L.[22]

***Table 7: Chinle WWTP – Effluent Total Ammonia***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan - Mar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Effluent Maximum (mg/L) | 32.3 | 34.4 | 44.6 | 28.7 | 30.7 | 41.6 | 21.3 | 29.3 | 21.5 | 26.2 | 20.3 |
| Effluent Average (mg/L) | 29.1 | 27.6 | 26.3 | 22.6 | 24.8 | 27.8 | 6.1 | 16.0 | 9.5 | 7.3 | 19.4 |
| Average NN SWQ Limit | 2.4 | 1.8 | 1.9 | 2.2 | 2.2 | 2.9 | 3.5 | 3.2 | 1.7 | 1.5 | 2.8 |

Note: Data are from single discrete samples taken monthly. NN SWQ Limits are average of monthly chronic total ammonia limits from the NN SWQ Standards given pH and temperature measurements made simultaneous to each sampling event. Permitted Ammonia Impact Ratio (AIR) = 1.0.

- Facility Capability – Despite recent upgrades and modest improvements in effluent quality, the Chinle facility struggles to meet its discharge limits, particularly for BOD and total ammonia. If Chinle continues to use pond-based technology, it is possible the plant can be brought into compliance with BOD. But a pond facility cannot consistently meet the total ammonia limit[23]. Also, TSS will likely continue to exceed the permit limit from time to time.

[21] Suspended solids from pond-based systems are often algae.
[22] Depending on effluent pH and temperature.
[23] Boivin, W. Daniel, Ammonia Removal in Wastewater Lagoons, Wood Environmental & Infrastructure Solutions, Inc., Albuquerque, NM (December, 2017 & revised July 2020)

- *Physical Plant and Core Process* – Except for the offline cells, the plant is physically in good condition.[24] The aerated pond process in Cell 2, assisted by 165 hp of floating mechanical aeration, is handling the annual average 1,600 pounds per day organic load[25] without significant odors.

- *Treatment Performance* – The Chinle plant is performing in a normal range for an aerated pond system. If the current system is maintained, E. coli and TRC can be dependably controlled by the plant's physical/chemical processes. The pH can be low but consistently in compliance. And TSS is often in compliance but can experience seasonal variations. Careful use of the facility's multilevel overflow boxes might improve TSS. BOD will continue to regularly exceed permit limits. BOD might be improved with reducing retention time and removing sludge deposits. Short retention times are less conducive to algae. Having less sludge in the cells makes less organic matter available for re-entry into the water column, thereby reducing BOD. And because the highest BOD concentrations occur in spring (March and April), when ponds experience turnover, less sludge means less resuspension of solids.

  Total ammonia concentrations cannot be actively controlled. As with most aerated pond WWTPs, ammonia removal at the Chinle facility is primarily volatization, influenced by water surface area, pH, and temperature. Biological nitrification, while active at times, plays a secondary long-term role. The surface area[26] at the Chinle plant is not enough to volatize ammonia to the permitted level, which often is below 2.0 mg/L. And neither process modifications or reasonably scaled polishing will bring the plant consistently into compliance with ammonia limits.

- *Treatment Challenge* – While the plant today can meet the E. coli and TRC parameter limits, and BOD and TSS might be brought into compliance, the plant will face compliance challenges with a total ammonia limit using aerated pond technology.

**3.2 Operation and Maintenance**

The Chinle plant is staffed by trained operators who monitor and upkeep the facility per written standard operating procedures and schedules.

- Training - The NTUA **has begun** in-house operational training to fine-tune its operators' skills towards the Authority's rural wastewater pond facilities. The training program started in August 2017 with a four-day workshop that covered lagoon optimization, O&M manual familiarity, water quality sampling, and laboratory and laboratory equipment training. Another focused workshop was conducted in the Fall of 2018. Further, the NTUA requires its operators to regularly access and attend out-of-shop training through either Arizona or New Mexico professional operator associations.

- Monitoring and Reporting – Water quality testing and monitoring the plant's processes **have begun** and the facility's regulatory tracking reports are now being filed on time. Regular process testing/monitoring

[24] Smith Engineering, Chinle Wastewater Treatment Plant, NPDES Permit Compliance Plan - Amendment, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (June 2018), Tables 1, 2, and 3

[25] $L_{org}$ = $BOD_5$ X Q = 1,065 lbs/day = 350 mg/L X 550,000 gpd (using 2017 and 2018 average influent $BOD_5$ and flow rates)

[26] Chinle facility's available water surface area is 12.4 acres when all cells are full. The surface area of Cell 2, which is currently online, is 4.6 acres.

at Chinle started in December 2017. The following is a list of the plant's standard operating procedures. Each of the procedures has a log that must be completed, signed, and reported to NTUA Headquarters.

- *Water Quality Monitoring* – Three monitoring locations are established through the plant.
  - *Daily* - The water monitoring schedule covers reading meters to account inflow and outflow; measuring dissolved oxygen (DO), pH, and water temperature at each location, plus reading the TRC meter. For sampling locations in the ponds, DO, pH, and temperature are measured two feet below the water surface. The protocol calls for the calibration of meters plus DO and pH equipment.
  - *Weekly* – The chemical oxygen demand (COD), BOD, and TSS are measured, or sampled and tested, at each location. The protocol also calls for the calibration of testing equipment.
  - *Bi-Monthly* – Ammonia, nitrates, and nitrites are sampled throughout. E. coli is sampled and TRC measured at the outfall location only. Ammonia and nitrate concentrations are determined on-site, and their testing equipment is cleaned and checked for calibration. Nitrite and E. coli samples are sent to the NTUA laboratory for testing.

- *Plant O&M*
  - *Daily* - Each unit process and piece of equipment at the plant is inspected. The checklist includes: sluice gates, manholes, bar screen, lagoon surface aerators, aeration controls, and power, inflow, and outflow Parshall flumes, and the sludge drying lagoon. The screen is cleaned and screenings are disposed of every day.
  - *Weekly* – The buildings are checked weekly. Also, the flow structures are inspected and cleaned, plus all the valves and gates are exercised weekly. The chlorination equipment and dechlorination equipment are checked. The grit channel is cleaned and the grit is disposed of each week.
  - *Monthly* – Calibrate meters and instruments.
  - *Bi-monthly* – Clean the chlorine contact chamber.

- *Compliance Tracking & DMRs (monthly)* – Data from each wastewater facility's log is collated into an overall worksheet that tracks the NPDES compliance of each NTUA facility with an NPDES permit. The data from each facility's log is also used to complete its monthly discharge monitoring report (DMR). The completed DMRs are then sent to both Region 9 and the NNEPA.

- Sludge – Regular determination of sludge accumulation is being added to the plant's operation and maintenance checklist. A sludge depth measuring event was performed in May of 2020.

- Qualifications – NTUA is **in non-compliance** with the AOC. The NTUA has a certified Level III operator in both wastewater treatment and collection overseeing operation and maintenance activities at the Chinle plant:

Kee Gorman
Navajo Tribal Utility Authority
Chinle District Office
P.O. Box 549
Chinle, AZ 86503
(928) 729-5721

Chinle is required to have an operator that has a Level II certification in wastewater treatment and a Level I certification in wastewater collection. Currently, the WWTP operator position at Chinle is vacant and being advertised. Mr. Gorman is assisted by Mr. Dan Begay which has a Level I certifications in both wastewater treatment and collection.

**3.3 Summary**

The Chinle wastewater facility is operating within normal parameters for a single-pond system. Because the facility is not in compliance with its permit, the NTUA has dedicated resources to the facility. These resources have enhanced both the physical plant and the care and attention given the plant, improving effluent quality, notably E. coli and TRC since 2013. The plant will continue to receive attention and resources, but the parameters affected by biological processes (BOD, TSS, pH, and total ammonia) will be difficult to improve because operators have little control over those processes. NTUA will closely monitor and make good faith efforts to meet all NPDES permit requirements.

## 4. COMPLIANCE OPTIONS

The Chinle wastewater facility's NPDES record of violations varies with each constituent parameter. The plant has long complied with the allowed pH and TRC limits. Since 2013, E. coli has only twice exceeded allowable levels, while TSS periodically does not comply. BOD and total ammonia regularly do not comply. Noncompliance is almost always the result of weaknesses and variations in the biological processes that occur in ponds. To move towards compliance, the variability in the facility's treatment must be reduced or the current pond-based technology must be replaced.

On the Navajo Nation, total ammonia in wastewater facility discharges is a problem because of low effluent limits promulgated by the Navajo Nation Surface Water Quality Standards.[27] In summer, water in the Chinle treatment Cell 2 has elevated pH and warm temperatures. Elevated pH and temperatures result in an ammonia limit that is regularly below 2.0 mg/L. in June, July, and August[28]. Chinle is a simple, pond system. In general, exceptional pond systems and pond systems with added polishing processes may reduce total ammonia in the effluent down to concentrations near 2.0 mg/L most of the time, but will still vary in their treatment and have occasional spikes in their effluent quality.

The variability of the pond process is caused by atmospheric influences and biological activity that, because of the large water volumes, are strong, independent, and subject to little control. While many investigators have proposed process and technology improvements to help wastewater pond systems perform better, few of the improvements (if any) have shown consistent, long-term success.

A well-functioning aerated pond system with plug flow and adequate retention time might produce effluent that averages within the Chinle facility's limits for all parameters, including BOD, but not total ammonia. Average concentrations of total ammonia in the effluent at Chinle are today more than 500% above those allowed by the permit.[29] The problem is made worse by peak ammonia concentrations resulting from daily and seasonal variations in the physical and biological processes in the ponds. To complicate things, the permit limit for total ammonia is a moving target. Given this situation, the plant's treatment can be improved, but challenges remain with compliance if aerated pond technology continues to be used.

### 4.1 Treatment

At first glance, there appears to be several ways to improve the Chinle facility's treatment, such as improving the plant's process, altering the plant's process, constructing a new plant, or changing the disposal method. But upon closer examination, most options will not assure long-term consistent compliance. Each of the options are discussed below and presented for comparison in Table 8.

- Process Improvement – Historical treatment records of aerated pond systems show that pond-based treatment facilities are challenged when attempting to consistently not exceed 45 mg/L BOD and 90 mg/L TSS effluent concentrations.[30] And such records further indicate well-functioning aerated ponds are not

[27] NNEPA, Navajo Nation Surface Water Quality Standards 2007, Navajo Nation Environmental Protection Agency, Water Quality Program, Window Rock, AZ (2008).
[28] And occasionally down to near 0.5 mg/L in summer.
[29] Based on average monthly data from 2017 and 2018.
[30] Middlebrooks, E. Joe, et al., Wastewater Stabilization Lagoon Design, Performance and Upgrading, *Macmillan Publishing Co., Inc.*, New York, NY (1982), Figure 2-16.

able to consistently remove ammonia below 5.0 mg/L.[31] However, if the performance of Chinle's aerated ponds can be enhanced by improving operation and maintenance and adjusting the flow scheme, then continued use of Chinle's wastewater plant infrastructure could be **justifiable over the short-term.** Some ways that may be considered to improve effluent quality from aerated ponds include: aeration and mixing, flow path extension, effluent holding, multilevel draw-off, shortened retention time, process separation, solids settling and removal, sludge stabilization and storage, and effluent polishing. [32, 33]

- *Aeration and Mixing* – Aeration enhances microbial activity by supplementing oxygen. Mixing improves contact between bacteria and waste compounds. Mixing also discourages algae propagation by suspending solids (thereby decreasing light penetration into the water) and releasing carbon dioxide ($CO_2$), an algal substrate, to the atmosphere. But pond water bodies are large and the power to mix and aerate them is also large. And ponds' long retention times allow algae to propagate. Usually, with ponds, the energy applied by mechanical aerators is small compared to that supplied by the atmosphere on a breezy day. Unless the mechanical aeration is substantial and retention times are minimal, operators have little control over the bio-processes in a pond.

  About 120 hp is required to completely aerate Cell 2 and about 170 hp is required to mix the cell so solids don't settle out. Because Cell 2 is currently outfitted with 165 hp of aspirating aerators, proper placement of existing equipment will result in a basin that is completely aerated and well mixed. The cost will be less than $50,000 to move aerators and optimize aeration. But the retention time is over 30 days when only a nominal two days are required for algae to become established. Aeration and mixing will work to discourage algae against the retention time which will allow ample opportunity for growth. Because of retention time issues and because the solids are not separated out of the waste stream, aeration and mixing of Cell 2, by itself, **will not improve water quality**.

  A well-aerated and mixed Cell 2 is what exists today at Chinle. All the aeration and mixing is in the north half of the cell, while more quiescent waters (without mechanical aeration and mixing) exist in the south end. The designers probably had conversion of organics to biomass intended for the north half and settling of solids in the south half. Because solids are given an opportunity to settle-out prior to the water exiting the pond, the current treatment scheme is likely superior to the completely aerated and well-mixed cell described in the paragraph above. However, if the settled solids are not removed from the pond the resulting bottom sludge will exert a detrimental effect on effluent quality that will become more significant with time.

---

[31] Crites, Ronald W. – Chairman, Natural Systems for Waste Management and Treatment, 3/e, *McGraw-Hill, Inc.*, New York, NY (2001), Table 7.16

[32] Lengthening hydraulic retention time is sometimes proposed to improve performance. But lengthened retention time adversely impacts pond treatment because it increases algal growth. Increasing retention time can improve treatment only for small ponds. Short retention times (less than one day) in an aerated pond can result in a small part of the inflow organics not getting converted to biomass. And small non-aerated ponds can be subject to high areal loading of organics (above 45 lbs/acre per day) resulting in accumulation of bottom solids and odors.

[33] Recycling water from the end of a pond system to the beginning is sometimes proposed to improve performance. But because ponds have low concentrations of active biomass (mixed liquor suspended solids normally less than 300 mg/L) and no clarification to concentrate the solids, there is little biomass activation that can be achieved. And while recycle can work to reduce short circuiting, it can also introduce mature algae into the head of the plant increasing algae growth throughout the ponds. Because of these issues and the added operational requirements recycling water brings, pond-based facilities (almost without exception) do not recycle.

- *Extend Flow Path* – Increase time for treatment by changing the water's flow path. Baffles and series routing can prevent flow from short-circuiting to the outlet. Extending the flow path in this way also works to settle out solids early in the system, reducing sludge deposits in later cells, thereby reducing stabilization by-products from feeding back into the water. But in an aggressively mixed pond, such as Cell 2 at Chinle,[34] **short-circuiting is rarely a limiting factor in effective treatment.** There is plenty of time to convert waste organics and organic by-products to biomass, regardless of the flow path. And short-circuiting does not reduce the surface area for the volatization of ammonia. Some benefits may be realized if solids can be retained early in the system. It will cost less than $70,000 to install two baffles across Cell 2.

- *Hold Effluent* - Construct a new large pond or use the abandoned existing ponds at the Chinle plant to hold treated effluent when the effluent quality is not acceptable for release. Water quality can vary with season and temperature. Algae will naturally decrease at times. By monitoring a pond's water an operator can determine when the water is poor quality and cease discharge, instead of diverting flows to storage. When water is good quality a batch discharge can be made. However, temporarily holding effluent **might not work**. Because the biological processes within a pond are uncontrollable, there is no guarantee the water in the holding pond will ever achieve the permitted quality. Only minor servicing and refurbishing of flow boxes (estimated at $30,000) are required to divert flows to holding. Some cleaning and shaping of the abandoned ponds will be required at about $40,000.

- *Multilevel Draw-off* - The quality of the effluent exiting the plant might be improved by actively using the multilevel draw-off on Cell 2. An operator can use a multilevel draw-off to alternate the water stratum from which effluent is taken. Because the multilevel discharge has three outlet pipes at various depths, successful draw-off requires operators to regularly monitor water at varying depths through a pond's water column and then select the level with the clearest water. Clearwater is then tapped by using manual valves to open the pipe at the matching level. The draw-off structure is **ready to use** and multilevel discharge can begin immediately.

- *Shorten Retention Time* - Shorten the retention time to both reduce the energy required to aerate and mix and to reduce the opportunity for algae to propagate. Shortened retention can be achieved by using baffles on Cell 4 for about $80,000. Also, short retention allows individual treatment processes to be separated, without requiring more overall pond volume. Normally, shortened retention is **not used by itself** to improve treatment, but is combined with other improvements and upgrades.

- *Separate Processes* - Distinct unit processes (conversion of organics, settling of solids, sludge stabilization and storage, and nitrification, etc.) are assigned to specific small cells or little ponds where more controlled environments are created. Separated processes are used to create a *dual-powered, multicellular* (DPMC) and other systems. A DPMC system has an aerated and mixed pond followed by a settling pond.[35] DPMC systems are often referred to in the literature as high-performance aerated pond systems. High-performance ponds are feasible but require costly improvements and **cannot be relied upon to remove total ammonia** below 5.0 mg/L. It will cost $1.6 Million to install a high-performance pond system in Cell 4.

---

[34] The Chinle wastewater facility's hydraulic retention time is 30.6 days in the active Cell 2 and 61.6 days if all cells are used.

[35] Rich, Linvil G., High Performance Aerated Lagoon Systems, *American Academy of Environmental Engineers*, Annapolis, MD (1999)

- *Settle and Remove Solids* - When organic contaminants in wastewater are converted into biomass the biomass settles. In ponds, this creates bottom sludge. But the contaminants, now in a different form, never really leave the pond. When the sludge then stabilizes, decomposition by-products are released back into the water column. The by-products again contaminate the water and fertilize algae. Effluent quality can be improved only if the biomass is both settled and removed. A quiescent separate water body, without mechanical aeration or mixing, allows efficient settling but is **expensive to create**. Regular sludge removal is performed by pumping or dredging. Purchasing and installing a dredge will cost about $300,000.

- *Stabilization and Store Sludge* – Pond systems require little handling of sludge and biosolids. This reduced operational effort is a key advantage of ponds over other types of wastewater treatment. The depths of ponds are **ideal for storing and stabilizing solids**. And an aerated water column over the bottom sludge converts sludge stabilization off-gases to non-odorous compounds before they can escape to the atmosphere. But the sludge must be stabilized in a detached (e.g., separate from treatment train) reactor, separated from the main waste stream to prevent the reintroduction of degradable compounds back into the water. Detached sludge ponds can be created at Chinle by using baffles in Cell 2 or by bringing the smaller Cells 3 and 4 back online. Overflow piping from the sludge pond back to the head of the plant and light aeration will cost $20,000 and $50,000 respectively. Pumping sludge to a dedicated storage and stabilization pond **is expensive** and perpetuates long-term disposal issues.

- *Polish Effluent* – Add a process onto the end of the plant to further treat (polish) the effluent before discharge. Polishing processes can include filters and attached growth reactors. Fine sand, small synthetic media, constructed wetlands, and membranes can physically filter the water and reduce TSS and its associated BOD. Attached growth reactors (e.g. trickling filters/bio-towers, rock filters, floating media,[36] and coarse sand filters) are friendly to biofilms of nitrifying bacteria and can improve biological nitrification. A small moving bed bio-reactor process would be about $2 Million to construct. However, when filters or attached growth processes follow ponds, they are often overwhelmed by TSS (algae and other microorganisms that flourish in pond waters) and can clog. And biological nitrification processes are affected by cold weather[37] and **cannot be relied upon** for consistent oxidation of ammonia.

- Process Alteration – Continue to use the existing Chinle wastewater facility infrastructure, but change the treatment technology. Some ponds have been converted to extended aeration or sequencing batch reactor (SBR) systems by shortening the retention time, resequencing flow, changing or increasing the mechanical aeration and mixing, and adding recycle. For instance, a continuous-flow intermittent-discharge (CFID) system is an innovative technology that combines an extended aeration cell with an SBR cell in a single pond. Another example is using baffles and changes in flow path to rearranging ponds while filling some with media, to create an integrated fixed-film and activated sludge (IFAS) system. While changing a pond system's treatment technology is less expensive than a new plant, it is expensive. Both a CFID or an IFAS systems (like most innovative technologies) are based on sound theory, but they are **still experimental** with sequencing and biomass parameters not definitely established. Installing a CFID system in existing Cell 4 is estimated to cost $1.6 Million. The cost of an IFAS system is near $7.5 Million.

[36] Moving bed bio-reactors (MBBRs) and integrated fixed-film and activated sludge (IFAS) processes are examples.
[37] Biological nitrification is strongly impaired when water temperatures fall below 10°C/50°F. This is typically October through April for the Chinle facility.

- New Plant - Build a new plant with a better treatment process. Activated sludge plants **can dependably treat wastewater** to Chinle's permit limits, including total ammonia. An activated sludge plant will dependably and consistently meet permit limits for all parameters by controlling process variability through sludge recycle to maintain high concentrations of biomass and by providing aggressive aeration and mixing to support the biomass' activity. Because activated sludge reactors are small, they can provide a shielded environment that prevents both cold water temperatures and algae growth. And, although new plants are more sophisticated to operate than ponds, they are energy efficient and work straightforwardly. Plus, improved effluent quality will make effluent reuse possible. A new plant is estimated to cost $31 Million to plan, design, and construct.

- Change Disposal – Continue to use the existing Chinle wastewater facility by discontinuing the discharge of wastewater to waters of the United States (Nazlini Wash to Laguna Wash) and instead dispose of treated effluent through evaporation and land application. About 150 acres of ponded water surface area is required for complete evaporation of Chinle's wastewater. Nearly 170 acres are needed for land application, with an effluent distribution network and application system.[38] Land available for acquisition is uncertain. But open parcels in the area are currently dedicated to traditional uses (e.g. grazing) and near residences. If available, nearby **land parcels are expensive**. The cost of constructing lagoons capable of completely retaining the Chinle flows is $10 Million, not including land.

**4.2 Operation and Maintenance**

To support a new plant for a long-term dependable solution, the NTUA has experience with activated sludge technology at both the Shiprock and Window Rock wastewater facilities, and both those plants comply with their permits.[39] Experienced operators from each of these facilities can help to lead and train additional staff. In selecting a new plant, emphasis should be placed on a technology that is straightforward and economical to operate, and the similarity of processes with Shiprock or Window Rock can facilitate cross-training.

**4.3 Conclusion**

The multilevel draw-off can be used immediately to improve effluent quality. A CFID treatment system will be installed as an interim measure to improve effluent quality. Ultimately, a new activated sludge plant can be built to dependably meet the permit requirements for the long term.

If the fully implemented short term solutions fail to achieve compliance with NPDES permit limits, NTUA will notify Region 9 and NNEPA and investigate potential additional measures to implement. A polishing process may be added if other options fail.

---

[38] In most jurisdictions, the limiting concern in determining land application rates of wastewater is groundwater protection. And for municipal wastewater the parameter of concern is nitrogen loading to the soil. The NNEPA has not issued groundwater protection guidelines, but have reported that they are being considered. This value was determined from assuming 20 mg/L of total nitrogen in the treated effluent applied at a rate of 200 lbs/acre of total nitrogen (as nitrogen) per annum as permitted in New Mexico.

[39] The NTUA also operates two smaller activated sludge facilities at Northern Edge and Twin Arrows Casinos near Farmington, NM and Flagstaff, AZ respectively.

***Table 8: Chinle WWTP – Improvement Option Summary Table***

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| Process Improvement | | | | | | |
| Aeration and mixing<br>*Install mechanical aerators on Cell 2.* | Uses existing pond infrastructure.<br>Increases organic load capacity.<br>Discourages algae growth:<br>o Reduces $CO_2$ by releasing to the atmosphere.<br>o Decreases light penetration by suspending solids.<br>Required mechanical aeration is already in place. | A lot of power is required to aerate and mix, resulting in high operational costs.<br>Increased maintenance. | Difficult to predict and highly variable.<br>No increased performance is expected. | $50,000 to move aerators. | Aerators of sufficient power and oxygen transfer ability are already installed on Cell 2.<br>Aerators can be moved.<br>Can be combined with other process improvements to support a different treatment scheme. | Already exists.<br>Combine with other options and use as par of short-term solution. |
| Extend flow path<br>*Install two baffles in Cell 2* | Uses existing pond infrastructure.<br>Retains solids earlier in system.<br>Does not significantly increase operational effort.<br>Can reduce short-circuiting if needed. | Capital cost. | Difficult to predict and highly variable.<br>After 8 months, extending the flow path will:<br>o Cause less than 5% reduction in BOD during spring turnover event. There is a good chance no reduction will be seen.<br>o Cause no reduction in annual total ammonia out of the plant.<br>BOD reduction will become smaller with time and sludge accumulation. | $70,000 installation cost. | Install two baffles in Cell 2, creating three sub-cells.<br>Because of already long retention time, reducing short-circuiting may not improve treatment.<br>Baffles will increase overall retention time and possibly algae.<br>Baffles can separate treatment processes.<br>Can be combined with other process improvements to support a different treatment scheme. | Will not substantially improve treatment.<br>Do not use as either a short-term or long-term measure. |
| Hold Effluent<br>*Use Cell 3 or 4 to hold poor quality effluent.* | Uses existing pond infrastructure.<br>Low cost. | Requires active water quality monitoring and flow diversion by operators.<br>Difficult to get timely characterization of effluent quality because of lags in testing.<br>Limited volume for storage unless an additional pond is constructed. | Difficult to predict. Depends on pond variability and operational attention.<br>Water quality in holding ponds may not improve (may worsen with time).<br>o Probably cannot comply with 45 mg/L BOD.<br>o Might comply with TSS at 90 mg/L, but may make TSS worse.<br>Extremely bad discharge events can be avoided. | $30,000 construction cost.<br>Add $40,000 to clean and shape Cells 3 or 4. | Provides effluent storage to avoid discharge when water quality is poor.<br>Convert Cell 3 or 4 to hold non-compliant effluent. Can discharge from Cell 2 and hold in Cell 3 and 4.<br>Flow boxes must be serviced and refurbished. | Can prevent discharge for very bad events.<br>But increased retention time will likely make water quality worse.<br>Do not use for short-term or long-term measure. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Multilevel draw-off<br>*Use recently constructed structure on Cell 2.* | Uses existing pond infrastructure.<br>No capital cost. New draw-off structure already in place.<br>No power costs.<br>No motors or mechanical parts.<br>Low-tech operation. | Requires active monitoring of water quality and stratification by operators. | Difficult to predict. Depends on pond variability and operational attention.<br>Perhaps a 25% reduction in annual average TSS with attentive operation.<br>Perhaps a 10% reduction in annual average BOD with attentive operation.<br>If water quality improves it will be immediate. | No cost. | Use the existing draw-off structure on Cell 2.<br>Should be effective at improving water quality when used correctly.<br>Difficult to determine water quality at depths.<br>Often the water column in ponds does not stratify. At other times the stratification changes quickly. | Should improve effluent quality at no capital cost.<br>Use as immediate action. |
| Shorten retention time<br>*Use baffles to create 3 smaller cell in Cell 4.* | Uses existing pond infrastructure.<br>Shortened retention times can reduce algae.<br>May retain solids earlier in system.<br>Does not significantly increase operational effort. | Capital costs for new piping and baffles.<br>Sludge buildup will be accelerated in smaller cell. | Difficult to predict and highly variable.<br>After 1 month:<br>o Perhaps 20% reduction in BOD during spring turnover event.<br>o Perhaps 10% reduction in TSS.<br>o No reduction in annual total ammonia out of the plant.<br>BOD reduction will decrease with time and sludge accumulation. | $80,000 construction cost.<br>Essentially the same as extending the flow path (above). | Install two baffles across Cell 4 to create three cells: Cell 4A, Cell 4B, and Cell 4C.<br>Because of the already long retention time, reducing short-circuiting will not improve treatment.<br>Unless the flow-through scheme is changed, baffles will increase retention time and algae. | Can retain solids earlier in the system but expensive to install.<br>Combine with other options and use as part of short-term solutions. |
| Separate Processes<br>*Aerate/mix in Cell 4A. Settle in Cell 4B to create a high-performance pond system* | Uses existing pond infrastructure and existing floating aerators.<br>Does not significantly increase operational effort. | Capital costs for new piping and baffles.<br>There may be costs associated with repositioning aerators. | Treatment will be improved, perhaps substantially at first.<br>Treatment performance will decrease with time and sludge settling/accumulation.<br>Probably won't impact total ammonia. | 600,000 to aerate Cell 4a.<br>Plus costs listed above for piping, baffles, & to reshape & line Cell4.<br>Plus costs to purchase & install a horizontal dredge.<br>Total est. cost $1.6 M. | Combines "aeration and mixing," "extended flow paths," and "shortened retention" options above.<br>Cell 4A to be a reactor basin with appropriate aeration times and aeration/mixing regime. Cell 4B to be a settling basin.<br>This configuration is known as a "high performance pond system" in the literature.<br>Can be combined with other process improvements to support a different treatment scheme. | Will convert organics and settle solids efficiently.<br>Can be coupled with other options.<br>Use as part of short-term solution. |
| Remove Solids<br>*Dredge solids from Cell 4B and place into Cell 2.* | Uses existing pond infrastructure. | Capital costs for new dredge.<br>Increased operation required to monitor sludge depths, move dredge, and alter waste sludge discharge location. | If combined with "shortened retention" and "separate processes" options above, can produce effluent that consistently meets 45 mg/L BOD and 90 mg/L TSS, but meeting ammonia limits will remain a challenge.. | $300,000 cost for purchase and installation of floating dredge. | Use the baffle configuration described in shorten retention time option above.<br>Use floating dredge to remove solids from bottom of Cell 4B. Use Cell 2 for sludge storage and stabilization. | Will remove solids outside treatment stream.<br>Combine with other options and use as part of a short-term solution. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Stabilize & Store Sludge<br>*Use Cell 2 as a sludge pond.* | Uses existing pond infrastructure.<br>Will store and stabilize solids far into the future. | None.<br>May need light (low horsepower) mechanical aeration in future. | If combined with "remove solids" option above, can sequester solids from the water treatment stream for long-term stabilization. | $70,000 if light aeration is added. | Use Cell 4 described in shorten retention time option above.<br>Eventually, all of Cell 2 can be dedicated to long-term sludge storage and stabilization once the new plant is built. | Will manage solids.<br>Combine with other options and use as part of short-term solution. |
| Polishing process<br>*Install MBBR/IFAS in Cell 3 or 4 for nitrification.* | Uses existing pond infrastructure.<br>Will nitrify efficiently if effluent water quality is good and water is not cold. | Capital costs for blowers, media, and pond preparation.<br>Increases operation and maintenance requirements.<br>Increases power costs.<br>Will produce sludge to be managed.<br>Algae accumulation can congest the media. | If provided with good effluent quality from Cell 4B may meet permit requirements (even for ammonia) except in winter. | $2.0 Million.<br>Includes costs to refurbish offline cell. | Water quality from Cell 4B must be good.<br>Nitrification will slow, or even cease, in winter. | Expensive and difficult to operate.<br>May not remove ammonia in cold weather.<br>Do not use as either short-term or long-term solution. |
| Process alteration | | | | | | |
| Continuous-flow intermittent-discharge (CFID) pond system<br>*Install CFID in Cells 4A and 4B.* | Uses existing pond infrastructure.<br>Good to very good effluent quality.<br>Can be constructed within existing cells. | Sophisticated operation due to sequencing and sludge recycle.<br>Increased maintenance required (i.e. sequencing aerators, pumps, and controls).<br>The technology is innovative and lacks standard operating parameters (solids retention time, etc.).<br>Requires a lot of effort and time to operate and may not yield results as reliable as the simpler high-performance pond system. | Use Cells 4A, 4B, and 4C created in "shorten retention time" option above to create aeration, sequencing, and sludge cells.<br>Might consistently meet permit requirements, even for total ammonia. | $200,000 construction cost in addition to the costs required to initially convert the system to a high-performance pond. | Capital cost includes earthwork, bank lining, changes to onsite power, sequencing aerators and recycle pumps.<br>Lack of standard operating parameters means a lot of trial and error (finetuning).<br>Has potential to improve effluent quality beyond a high-performance pond. But should be implemented with caution and sensitively to the capabilities of local operations staff. | With caution, consider using as alternative short-term solution. |
| Integrated fixed-film & activated sludge (IFAS) system<br>*Install IFAS in Cell 3.* | Uses existing pond infrastructure.<br>Very good effluent quality.<br>Can be constructed within existing cells. | Capital cost.<br>Significant modifications to the plant are required.<br>Sophisticated operation. | Should consistently meet permit requirements, even for total ammonia. | $7.5 Million construction cost. | Capital cost is high with earthwork, bank lining, media, changes to onsite power, blowers, and pumps.<br>Lack of standard operating parameters means trial and error may be required. | Expensive and difficult to operate.<br>Should meet permit as operating |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Significant maintenance.<br>The technology is still establishing standard operating parameters. | | | | experience is gained.<br>Do not use as either short-term or long-term measure. |
| New Plant | | | | | | |
| Activated sludge<br>*Construct new plant.* | Very good effluent quality. | High capital cost.<br>Increased sophistication and expense in operation.<br>Significant maintenance effort.<br>Complete new construction is required. | Will consistently meet permit requirements, even for total ammonia.<br>NTUA has experience at operating two existing activated sludge plants. | $29 Million construction cost. | Because a small footprint is required, many siting options are available.<br>Clearly defined operating parameters will assist operators. | Will consistently meet permit requirements.<br>Use as long-term solution. |
| Change Disposal | | | | | | |
| Complete retention<br>*Construct new ponds.* | No effluent.<br>Low maintenance and simple operation requirements. | Significant construction cost.<br>Large land parcel(s) required. | N/A - Eliminates need for NPDES permit. | $10 Million construction cost (does not include land costs). | New ponds with significant surface area (145+ acres) require new, large right-of-way. | Too large.<br>Too expensive.<br>Do not use as either short-term or long-term measure. |

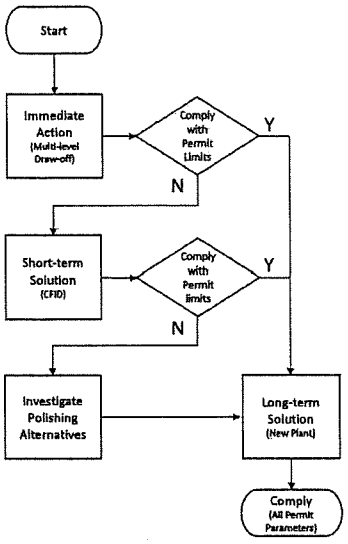
## 5. PATHWAY TO COMPLIANCE

After reviewing the Chinle plant's history of violations, the NTUA's recent efforts to improve treatment and operation, and the requirements of the plant's NPDES permit, the NTUA proposes the following strategy to achieve compliance. The process can be prioritized but there are no shortcuts. The work will take time and money. Both of which are necessary to achieve compliance with discharge requirements that are an order of magnitude more stringent than the plant's current treatment ability.

### 5.1 Treatment

The wastewater treatment technology employed at Chinle will be changed from aerated ponds to activated sludge through a multi-step process. During the conversion, the NTUA will take the following steps to improve the performance of the existing facility. Full compliance with the facility's NPDES permit, to be provided by a new plant, must be attained as quickly as possible.

***Figure 2: Chinle WWTP - Pathway to Compliance***




- Starting Place - Recent improvements to the Chinle plant and enhancements to operation and maintenance practices have laid the groundwork for improving the treatment and effluent quality of the existing facility. The important 2016 improvements include cleaning, reshaping, and relining of Cell 2, and upgrades to the mechanical aeration system on Cell 2. The improvement of this cell will allow straightforward modifications to the plant that will improve effluent quality in the near term.

- Asset Management – To plan for the long-term operation and maintenance of the Chinle wastewater system, an asset management program is required by Section III.E the permit. Asset management can begin on the collection system, but must wait on the treatment facilities until a new plant is up and running. NTUA has a work order program to manage its assets at the current lagoon facility as described in the Asset Management Plan submitted to EPA.

- Immediate Action (multilevel draw-off) - The NTUA attempted to improve the plant's effluent quality by actively using the multilevel draw-off on Cell 2. To do this, the water strata is sampled from Cell 2 using a clear tube (sludge judge) and visually inspected to determine the clearest layer. The draw-off pipe closest to the clear level is then be opened and the other pipes closed, using gate valves[40]. The water strata is resampled and the draw-off piping actuated/alternated each week while the long-term solution is pursued. Attaining compliance within 12 months is the goal. NTUA closely monitored and made a good faith efforts to meet all NPDES permit requirements. This solution has no capital cost and only requires operational skills consistent with the existing plant's. Unfortunately, NTUA was unable to achieve compliance in 12 months.

- Short-term Solution (Continuous-Flow Intermediate-Discharge) –A short-term solution will be implemented which consists of:
  - Aeration and mixing,
  - Extended flow path (baffling),

[40] All valves have been verified to be in good operational order.

- Shortened retention times,
- Separate processes,
- Settle and remove solids, and
- Sludge storage and stabilization in a sequestered reactor.

This multifaceted short-term solution, commonly referred to as a continuous flow intermittent discharge (CFID) system,[41] will be created entirely within a refurbished Cell 4 at an estimated cost of $1.6 Million to design and install. The goal will be compliance with the NPDES permit effluent limits within 12 months of startup.

As shown in Figure 3, the short-term solution will require Cell 4 to be divided into three sub-cells, Cells 4A, 4B, and 4C by floating synthetic baffles. Wastewater will be directed from the headworks to Cell 4A through a new headworks and existing piping. Cell 4A will be aggressively aerated to disperse oxygen throughout the cell and to keep solids suspended in solution, thereby converting incoming sewage organics to biomass. Biomass-ladened water from Cell 4A will then flow to Cell 4B through a window in the floating baffle.

A CFID system incorporates sequencing aeration, anoxic mixing, and quiescent settling into Cell 4B, plus recycle from Cell 4B back to Cell 4A. However, because CFID systems are innovative, operating parameters (e.g. solids retention time, etc.) are not defined, resulting in sophisticated operation requirements. To implement a CFID the Chinle operations staff must be capable. Outflow from the settling basin will be through a decanting weir, then into existing piping to the tailworks, where it will be discharged from the existing outfall to Nazlini Wash.

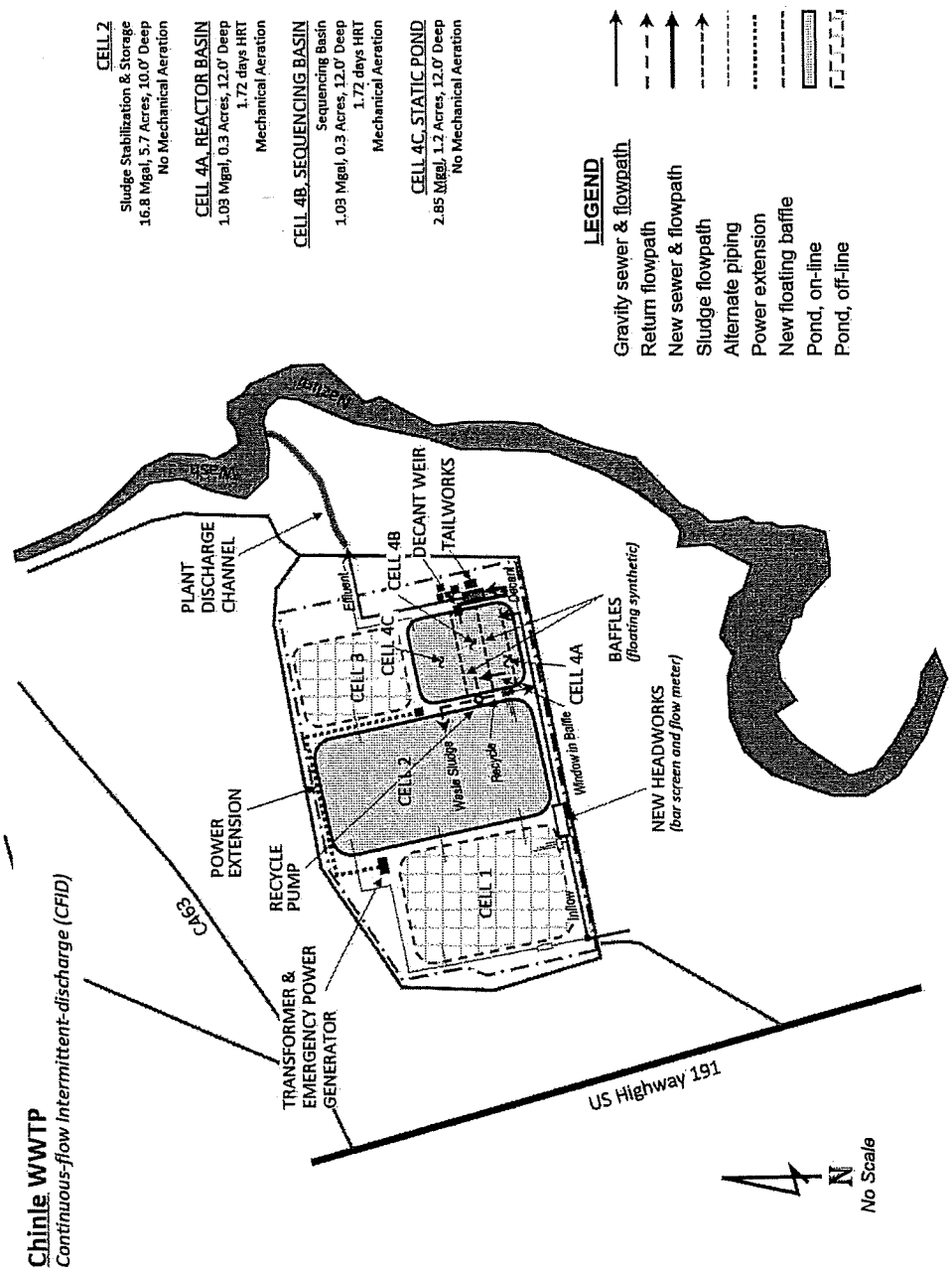
The NTUA is currently preparing a disposal plan that addresses the disposal of dried sludge at Chinle, Kayenta, and Window Rock for submission to Region 9 and NNEPA for approval.

Pertinent to solutions, NTUA compliance efforts will entail monitoring all NPDES permit requirements for trending improvements toward compliance and making operational and/or facility adjustments to meet this objective. If trends toward compliance become stalled, NTUA will investigate additional alternatives to reach compliance and discuss options and recommendations with EPA.

The NTUA is currently preparing a disposal plan for the disposal of dried sludge at Chinle, Kayenta, & Window Rock for submission to Region 9 and NNEPA for approval.

[41] Rich (1999)

***Figure 3: Chinle WWTP – Interim Measures (CFID)***



- Long-term Solution – The NTUA will construct a new activated sludge plant to dependably treat wastewater to the permit requirements. The new plant will continue to discharge through the existing permitted outfall. The new plant is estimated to cost $33 Million to plan, design, and construct. Securing funding and locating the new plant will be key challenges.

    - *Funding* – The NTUA will seek funding from various sources to reduce the impact this project has on wastewater customers. Grants are preferred, but loans may be necessary. A United States Department of Agriculture (USDA) grant application will be submitted. The USDA has Native American set-aside money for infrastructure projects that comes in both grants and loans. A Clean Water Act – Indian set-aside application will also be submitted through the US Indian Health Service's Sanitation Deficiency System. Grants and loans will also be sought from the State of Arizona and the Navajo Nation. An aggressive effort is planned to secure the necessary funding.

    - *Location* – Compared to other large NTUA wastewater plants, the Chinle site is small. But interim treatment can be implemented/coordinated to make area available within Cell 1 for a new activated sludge plant. Relocating the plant may be considered, if necessary. But most land near townsites on the Navajo Nation are designated for certain uses by righted interests within the community. So, while land immediately south of the existing site (between US Highway 191 and Nazlini Wash) is unoccupied it is obligated to use and there are residences nearby. Compensating community interests must be accounted for when planning for plant site relocation.

    - *Design and Construction* – The NTUA will solicit proposals from engineering firms and select a design team based on qualifications. Engineering qualifications will include categories such as experience and the ability to perform the design within the needed schedule. Once the design is complete, construction will be competitively bid to competent companies. Competent firms will have a record of constructing similar sized water/wastewater plants within budget and on schedule.

    - *Startup* – New activated sludge plants can take months or years after first accepting sewage to build the bioculture required to perform effective treatment. The NTUA will shorten this startup period by seeding the plant with bacteria from the Window Rock activated sludge plant, 65 miles distant.

    - *Decommission Existing Facility* – All cells have biosolids that will require disposal. Once sewage is diverted to the new facility and the new plant is up and running, the unused cells of the old pond-based plant can be closed. Unused cells will be dried via pumping decant to the new plant for treatment or through evaporation. Bottom sludge will remain in place until dried and disposed of according to the established federal regulation and the requirements of the facilities' NPDES permit. Buildings will be reused but other concrete structures that are not needed and are above ground will be abandoned in place. Unneeded concrete structures, greater than two feet below the surface, will be backfilled and left in place. Cell 4 will be made ready for emergency storage for the new wastewater treatment plant. Cell 2 may be used for on-site temporary storage of sludge. Cells 2 and 4 will remain in use or properly closed within two years of suspension of use.

    - *Sludge Management* - A new activated sludge plant treating Chinle's 430,000 gallons per day of domestic sewage will produce about 4,000 gallons per day of aerobically digested sludge with a solids content of 1.5%. The sludge can be dewatered using a belt filter press or centrifuge. About

2.0 cubic yards per day of dewatered biosolids, at 15% solids content, can be expected off a belt filter press. That is about 625 pounds of dried biosolids each day. Dewatered solids can be hauled by the NTUA, or a contracted hauling company, to either the: Painted Desert Landfill near Joseph City, Arizona; Red Rock Landfill near Thoreau, New Mexico; or Crouch Mesa Landfill near Farmington, New Mexico. All are located about 165 miles away. The large volume in Cell 2 at the Chinle wastewater plant can provide onsite sludge storage and stabilization for two years of temporary storage. For this, digested sludge could be pumped directly from the aerobic digesters bypassing the filter press. A minimum water cap will be required to avoid odors. Sludge from the pond will eventually require disposal. The preferred disposal method is land application. Additional equipment will be required. NTUA will need to work with the Nation and local Chapter officials to obtain required approvals and access to adequate land. A final decision on how to manage sludge from the new plant has not been made.

- *Emergency Operation* – While parts of the existing plant will be decommissioned, Cell 4 will be maintained. In the event of an upset or interruption of treatment at the new plant, water will be diverted to Cell 4 and retained for disposal through infiltration and evaporation, instead of discharging to Nazlini Wash. The piping and necessary flow structures will be left in place. The site's perimeter fencing will be maintained.

**5.2 Operations**

Except for asset management, operational practices at the Chinle plant have recently come into compliance with permit requirements. Operational compliance must be maintained throughout construction. And the good operational practices, recently implemented, can be built upon to provide quality operation and maintenance of a new plant.

- Current and Interim Operation – There will be a period of several years until a new plant can be brought online. The methodical operation and reporting practices recently developed at Chinle will continue, assuring that good treatment occurs at the facility. The immediate action (multilevel draw-off) does not require increased operating skills. NTUA will provide monthly updates on progress, conclusions, and any proposed changes in operations as they monitor water quality and progress through the flow chart shown in Figure 2 with Region 9 and NNEPA. NTUA will contract with a consulting firm to provide on-call technical guidance for staff during interim operations.

- Training – The NTUA operates wastewater pond facilities at many locations across the Navajo Nation. The NTUA's new wastewater pond operation and maintenance training program may have been spurred by AOCs from Region 9 and the NNEPA, but it was envisioned as filling the wider need to better operate the Authority's many pond-based wastewater facilities. This training will continue and improve as a basis from which future operators are trained for the NTUA's wastewater pond facilities.

- Operation & Maintenance Manual – The existing Chinle WWTP O&M manual will continue to be reviewed and used during the immediate action solution. A new O&M manual will be provided by the design engineer when the new plant goes online.

- Monitoring and Reporting – Good operational practices at the Chinle facility will continue during the immediate action solution. Key among the good practices for immediate action is weekly monitoring of the stratification in the pond immediately prior to the multilevel discharge. Monitoring stratification is required to access the clearest water layer. Regular monthly compliance sampling and testing will continue uninterrupted.

- Future Operation - Before startup, the NTUA will create a training program to develop and prepare operators to run the new Chinle facility. Formal education from the manufacturer, federal programs, tribal (Inter-Tribal Council of Arizona, Inc.) and state (Arizona and New Mexico) workshops, and in-house NTUA classes will be combined with mentoring from the experienced staff at the Shiprock and Window Rock plants. Operator certification will be required. Plant management and operations oversight can be contracted to private specialty firms if needed. The design engineer and the various manufacturers and suppliers/vendors of the equipment and controls will be required to participate in startup, troubleshooting, and hands-on operator training.

- Emergency Operations – During the immediate solution multilevel draw-off approach, the emergency operating procedures detailed in the existing Chinle WWTP O&M manual will continue to be reviewed and followed by the operations staff. Eventually, for the long-term solution's new plant, a new O&M manual, with emergency procedures, will be provided.

- Sludge (biosolids) Management – Biosolids in all cells and all future biosolids produced will be disposed ofin accordance with 40 CFR Part 503. NTUA is in the process of investigating possible disposal options forthe existing on-site biosolids in the cells and future biosolids produced from the activated sludge plant.These options may include hauling to a landfill, permanent on-site surface disposal, or land application.

- Qualifications – Both a Level 4 wastewater treatment certification and Level I collection certification are required to operate the current Chinle facility. The NTUA will continue efforts to attract and retain experienced, qualified operators. A Level 4 certification is required for the new plant.

**5.3 Schedule to Compliance**

It is estimated that construction and startup for the new plant will take 2 years to complete.

**5.4 Summary**

To achieve compliance with the Chinle NPDES permit a multi-step pathway is proposed. The existing aerated pond system that uses a multilevel draw-off structure is the best fit technology to improve effluent quality at the Chinle plant immediately. Discharge will continue to be made through the existing permitted outfall to the Nazlini Wash. Concurrently, a CFID treatment system will be designed and implemented in Cell 4 at a cost of $1.6 Million to achieve compliance. A new activated sludge plant will be constructed to dependably meet permit requirements in the long term. Biosolids planning for the new plant over the long term will be conducted. Operation and maintenance activities will be kept in step with the treatment technologies as they are brought into service. The total costs for the projects, both the CFID and activated sludge treatment systems, are estimated to be a combined $36 Million.

## *APPENDIX A - CHINLE CALCULATIONS*

**DESIGN FOR INTERIM MEASURES**

**Continuous Feed Intermittent Discharge (CFID)**

The continuous feed intermittent discharge (CFID) system proposed here modifies the Chinle WWTP aerated lagoon system according to concepts developed by Linvil Rich[1]. The CFID will be located entirely within Cell 4. Cell 2 will be utilized for the storage of sludge. The design parameters for a CFID system at Chinle WWTP and a conceptual design schematic follow.

The CFID is designed to use in-basin sequencing (aeration/mixing, settling, and decant) similar to sequencing batch reactor technology (SBR) to uncouple the bacteria/solids retention time (SRT) from the hydraulic retention time (HRT). As in an SBR, the discharge is intermittent and dependent upon treatment sequencing. Unlike an SBR, sewage inflow is continuous. The sequencing is operated by an automatic timer and water level switches through a programmable logic controller (PLC). Uncoupling the SRT and HRT allows bacteria to remain in the system much longer with beneficial treatment effects, especially nitrification. The design parameters for a CFID basin at Chinle and a conceptual design schematic follow.

1. Average daily flow rate between January 2010 and March 2021 is 0.5 Mgal/day. The design flow rate is 0.6 MGD. Organic loading over the same period averaged BOD=380 mg/L. For design, nitrogen loading is assumed to have a TKN=50 mg/L. The CFID is designed for BOD, TSS, and ammonia removal to meet the discharge limits outlined in the Chinle WWTP National Pollution Discharge Elimination System (NPDES) permit.
2. Cell A will be modified. The geometry at water surface of Cell 4 is:
    a. L = 310'
    b. W = 252'
    c. Water depth = 12'
    d. Total Volume = 5.3 Mgal
3. Use floating baffles to create two treatment sub-cells, Cell 4A and 4B.
    a. The CFID basins in Cell 4 are created by three hanging baffles. Cell 4A is created by two hanging baffles, one located at the toe of the side wall and the other to separate Cell 4A from Cell 4B. The third baffle separates Cell 4C from Cell 4B. The baffles are installed in an east-west configuration.
    b. Flow will be in series through Cell 4A to Cell 4B.
    c. Cell 4A is aggressively aerated/mixed to prevent short-circuiting, provide ample oxygen, and prevent solids from settling. The conversion of sewage organics into biomass is accomplished in this cell.
    d. Flow between 4A and 4B is provided via a window in the baffle wall.

[1] Rich, Linvil, High Performance Aerated Lagoon Systems, American Academy of Environmental Engineers, Annapolis, MD (1999)

e. Cell 4B sequences from aeration to quiescent settling and decanting during a 6-hour cycle[2]. During the aeration sequence, the cell is aggressively aerated/mixed. In the setting sequence, solids drop out of solution. During the decanting sequence, clarified liquid is removed at the water surface. Cell 4B is operated in sequence controlled by a PLC.

f. Cell 4C - A large part of Cell 4 is not required for the operation of a CFID. The volume remaining after the creation of Cells 4A and 4B is Cell 4C. The cell will not have discharge, other than evaporation. Water level in Cell 4C will fluctuate because of slow seepage around the floating baffle from Cell 4B. Odors will not result from Cell 4C because there is no organic loading.

g. The dimensions of each compartment in Cell 4 are:

A baffle is set at the bottom toe of the south wall of the pond. The second baffle is installed 46 ft from the first and forms the first reactor cell. Total volume of Cell 4A is 1.03 Mgal and detention time is 1.72 days.

A third baffle is installed 46 ft from the second to form Cell 4B. The geometry of Cells 4A and 4B is identical. The volume of Cell 4B is also 1.03 Mgal and detention time is 1.72 days.

4. Diffused air system will be utilized to aerate and mix Cell 4A. Aeration and mixing will be provided by aspirating aerators in Cell 4B.

a. Cell 4A - Complete suspension by injecting 3,021 cfm air to provide oxygen to degrade biological oxygen demand (both organic and nitrogen oxygen demands). This air supply will also meet the minimum complete mixing requirement. The floating diffused air system requires 4 cfm/1000 cf for mixing. Mixing intensity in Cell 4A is 23 cfm/1000 cf.

a. Cell 4B – Complete suspension mixing/aeration will be provided by two 25-hp aspirating aerators. Mixing/aeration (30 hp/Mgal minimum) is required for 4 out of every 6 hours.

5. Hydraulic Retention Time
   a. Cell 4A - All incoming organics are converted to biomass in Cell 4A in 1.72 days.
   b. Cell 4 B – Four 6-hour sequences (aeration, settling, and decant) cycles are provided each 24 hours. Discharge occurs after 4 hours aeration and 1 hour settling at a flow rate 6 times the inflow for an hour. Clarified liquid overflows a floating weir that also serves as a decanter before disinfection and discharge.
   c. Algae control requires the retention time not exceed 4 days total[3].
6. A recycle flow rate equal to the inflowing sewage rate (Q) is initially specified. The rate can be adjusted during operation to optimize treatment.

---

[2] Rich, Example 6-1, Step 15 for Average Dry Weather Flow (ADWF)

[3]Hydraulic retention should be limited to 4.5 days total: (1) Reactor Pond - Rich (pg. 50) notes that sewage organics are converted to biomass and formed into floc in 1.5 days but best if under 3 days (pg. 109). (2) Settling Pond/Sequencing Basin - Rich (pg. 79) also notes algae (showing up as effluent TSS) begins to become a problem after 2 to 2.5 days. (3) Two ponds in series: Reactor Pond and Settling Pond/Sequencing Basin = 1.5 days + 2.5 days or 2 days + 2 days. Therefore, 4 days total time is recommended (Rich, Figure 3.3).

7. Outflow of treated effluent from Cell 4B and water levels are controlled by using an SBR-type floating weir. Discharge is timed to fit the decant sequence.

8. Sludge Removal – Solids are removed from Cell 4B by wasting a small fraction of recycle mixed liquor suspended solids via the recycle pump daily. Waste MLSS will be deposited into Cell 2 causing a sludge blanket to develop on the cell's floor. Sludge will be retained for long-term stabilization.

**Sludge Handling**

1. The volume of MLSS pumped to Cell 2 is estimated to be about 14,000 gal/day and evaporation rate is estimated to be about 21,000 gal/day.

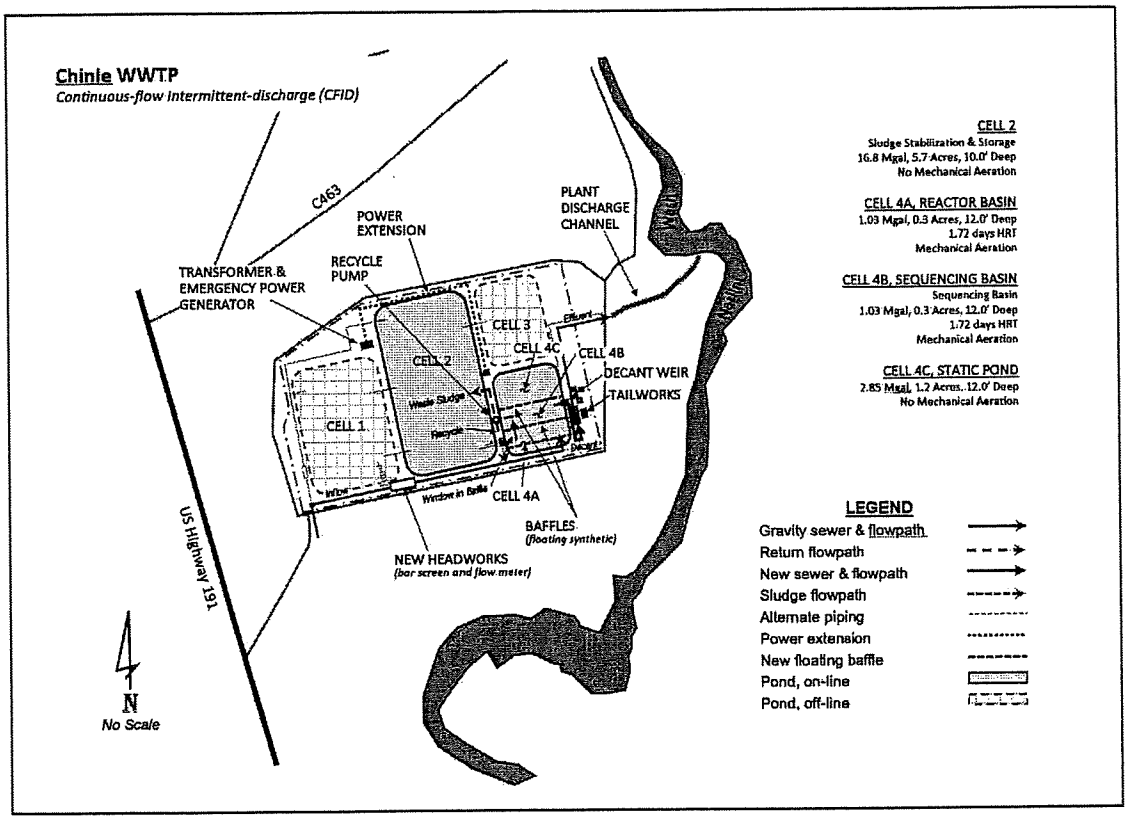



**Figure A-1: Continuous-Feed Intermittent Discharge (CFID) Schematic**

# APPENDIX C:

# KAYENTA WASTEWATER TREATMENT PLANT COMPLIANCE PLAN

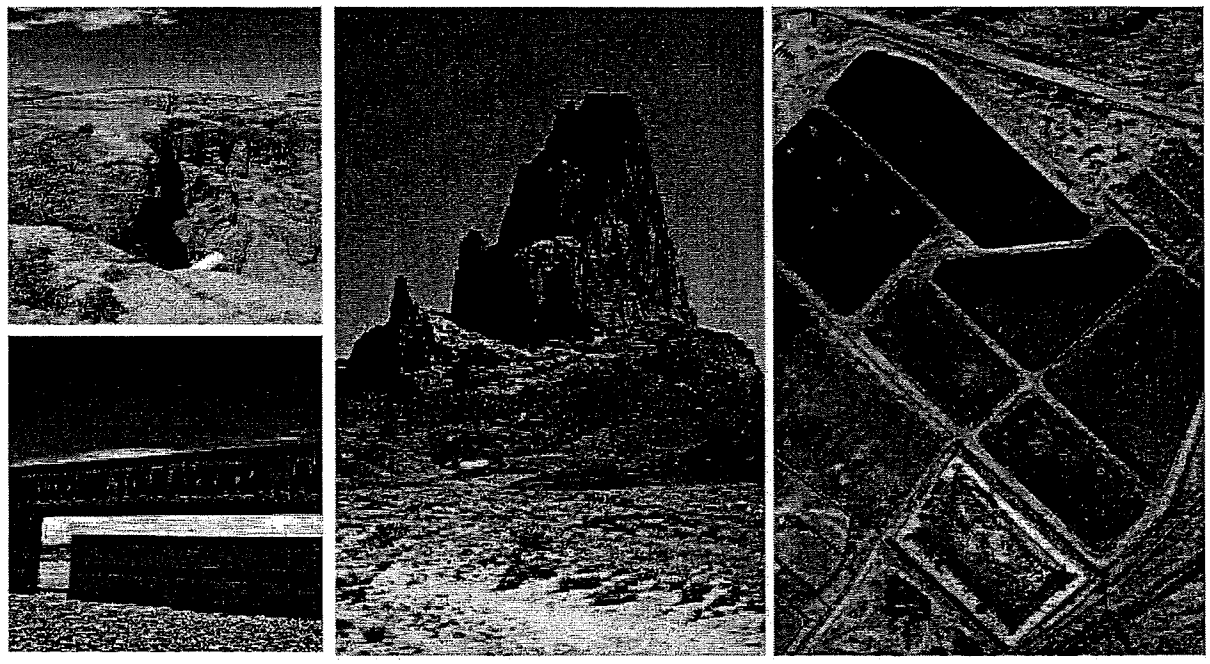
COMPLIANCE PLAN

Navajo Tribal Utility Authority

# Kayenta Wastewater Plant

## Response to Administrative Order on Consent

*Docket No. CWA-309(a)-16-011, NPDES Permit No. NN0020281*



**October 2019** (revised June 2021, March 2022, and March 2023)

Prepared for:

**Navajo Tribal Utility Authority**

*Office of the Deputy General Manager*

PO Box 170, Ft. Defiance, AZ 86504

Prepared by:

**WSP**

*4221 Balloon Park Rd. NE, Albuquerque, NM 87113*

*505.821.1801*

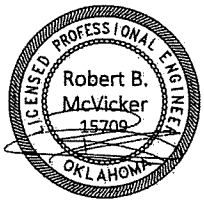
# Kayenta Wastewater Treatment Facility
# COMPLIANCE PLAN

Response to Administrative Order on Consent
Docket No. CWA-309(a)-16-011, NPDES Permit No. NN0020281

October 2019
Revised June 2021
Revised March 2022
Revised March 2023

Navajo Tribal Utility Authority
Office of the Deputy General Manager
PO Box 170, Ft. Defiance, AZ 86504

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of Oklahoma, is affixed below.




Bruce McVicker, PE (OK15709)

## TABLE OF CONTENTS


| | | |
|---|---|---|
| 1. | COMPLIANCE HISTORY | 1 |
| 2. | COMPLIANCE STATUS | 3 |
| 2.1. | Discharge Limit Violations | 3 |
| 2.2. | Operational Deficiencies | 4 |
| 2.3. | Compliance Milestones | 5 |
| 3. | PRESENT SITUATION | 9 |
| 3.1. | Treatment | 11 |
| 3.2. | Operation and Maintenance | 14 |
| 3.3. | Summary | 15 |
| 4. | COMPLIANCE OPTIONS | 16 |
| 4.1. | Treatment | 16 |
| 4.2. | Operations | 21 |
| 4.3. | Conclusion | 21 |
| 5. | PATHWAY TO COMPLIANCE | 26 |
| 5.1. | Treatment | 26 |
| 5.2. | Operations | 30 |
| 5.3. | Schedule to Compliance | 31 |
| 5.4. | Summary | 31 |


## TABLES


| | |
|---|---|
| Table 1: Kayenta WWTP - Permit Violations | 3 |
| Table 2: Kayenta WWTP – Whole Effluent Toxicity | 4 |
| Table 3: Kayenta WWTP – 2018 EPA Inspection Team Observations | 6 |
| Table 4: Kayenta WWTP - Compliance Milestones | 7 |
| Table 5: Kayenta WWTP – Average Effluent Sampling Results | 11 |
| Table 6: Kayenta WWTP – Effluent $BOD_5$ | 12 |
| Table 7: Kayenta WWTP – Effluent TSS | 12 |
| Table 8: Kayenta WWTP – Effluent Total Ammonia | 13 |
| Table 9: Kayenta WWTP – Improvement Option Summary | 22 |


## FIGURES


| | |
|---|---|
| Figure 1: Kayenta WWTP – Existing Treatment Scheme | 10 |
| Figure 2: Kayenta WWTP – Pathway to Compliance | 26 |
| Figure 3: Kayenta WWTP - Interim Measures (CFID) | 29 |


## APPENDIX


| | |
|---|---|
| Appendix A: Kayenta WWTP - Design for Interim Measures | 32 |

## 1. COMPLIANCE HISTORY

The Kayenta wastewater facility has not complied with its National Pollutant Discharge Elimination System (NPDES) permit. Troubles with the facility meeting permit requirements and the Navajo Tribal Utility Authority's (NTUA) struggle to bring the plant into full compliance date back to at least 2010 and continue today. Key events since 2010 are listed below.

- Region 9: NPDES Permit (December 1, 2012) - The Kayenta wastewater facility NPDES permit (No. NN0020281) was reissued with an effective date of December 1, 2012, and modifications to the biochemical oxygen demand, five-day (BOD), and total suspended solids (TSS) limits and the introduction of a total ammonia limit and chronic whole effluent toxicity testing (WET). No effluent limits were set to WET testing. The permit was scheduled to expire on November 30, 2017.

- Region 9: Plant Inspection (July 23, 2014) – Environmental Protection Agency (EPA) Region 9 staff inspected the Kayenta wastewater facility to evaluate compliance with the permit. The inspection found several operation and maintenance shortcomings and determined effluent from the wastewater facility exceeded permit limits.

- NNEPA: Administrative Order (October 28, 2014) – An Administrative Order on Consent (AOC) issued by the Navajo Nation's Environmental Protection Agency (NNEPA) became effective. The NN AOC found the NTUA was not in compliance with its NPDES requirements at six of its permitted facilities.[1] The NN AOC required the NTUA to secure a consultant, by December 17, 2014, to assist the Authority in preparing draft compliance plans for each site by June 10, 2015. The compliance plans were to address at least the following concerns for each facility.

    - TRC – Describe how chlorine used for disinfection was to be removed from the effluent prior to discharge or outline an alternative, replacement disinfection system.
    - E. coli, BOD, and TSS – Describe how each facility will correct the permit deficiencies for these parameters.
    - Ammonia – Describe how pH, temperature, and ammonia were to be sampled and tested for compliance with the permit at each facility.
    - O&M – Prepare an operation and maintenance (O&M) plan for each facility. Describe how the O&M plans will prevent future violations.

- NNEPA: Plant Inspection (June 26, 2015) - NNEPA staff inspected the Kayenta wastewater facility to evaluate compliance with the permit. The inspection found several operation and maintenance shortcomings in addition to those identified in the 2014 inspection and determined effluent from the wastewater facility was still exceeding permit limits.

- NTUA: Compliance Plan (September 2015) – In response to both plant inspections and communications with Region 9, the NTUA prepared a Compliance Plan[2] designed to move the Kayenta wastewater facility towards compliance with its permit. The Compliance Plan was intended to improve the treatment of organics, suspended solids, pathogenic bacteria, and residual chlorine, but not pH or total ammonia.

---

[1] The Navajo Townsite facility has since been removed from the NPDES program. Currently there are nine NTUA facilities with NPDES permits.

[2] Smith Engineering, Kayenta Wastewater Treatment Plant, NPDES Permit Compliance Plan, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (September 2015)

- Region 9: Administrative Order (September 29, 2016) - An Administrative Order on Consent (AOC) became effective. The AOC found at the Kayenta wastewater facility that the NTUA:
    - discharged pollutants in amounts greater than permit limits,
    - failed to properly sample,
    - failed to submit complete and timely reports, and
    - failed to perform adequate operation and maintenance.

  The findings were based on actions and practices that occurred between October 2010 and September 2016. The AOC directed the NTUA to implement the mitigation measures proposed in the Compliance Plan of 2015.

- NTUA: Performance Evaluation (May 16, 2017) – An assessment[3] of the Kayenta wastewater facility was performed to identify operational conditions and practices that would bring the system into long-term, sustained compliance.

- NTUA: Implementation Plan (October 19, 2017) – To report progress at improving both performance and operational practices at the Kayenta wastewater facility, a Performance Implementation, and Monitoring Plan[4] was prepared by the NTUA.

- Region 9: NPDES Permit (June 12, 2018) – The permit was reissued with an effective date of August 1, 2018. WET limits were added to the effluent limitations and monitoring requirements. The permit's term will end on July 31, 2023.

- Region 9 and NNEPA: Plant Inspection (December 6, 2018) – Region 9 and NNEPA inspected the Kayenta wastewater facility to evaluate compliance with the permit. The inspection found several operation and maintenance shortcomings and determined effluent from the wastewater facility was still exceeding permit limits.

---

[3] Harris, Steve, Performance Evaluation of the Kayenta Wastewater Lagoon System, H&S Environmental, LLC, Mesa, AZ (May 16, 2017)

[4] NTUA Technical Memorandum (Draft), Kayenta Lagoon, Performance Implementation, and Monitoring Plan, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (October 19, 2017)

## 2. COMPLIANCE STATUS

The 2016 AOC directs the NTUA to take all measures necessary to comply with the NPDES permit and summarizes that most of the needed actions are defined by the 2015 Compliance Plan. While the Kayenta wastewater treatment plant (WWTP) regularly violates its discharge limits, the NTUA is currently operating the plant within its permit's requirements for TSS, TRC, and E coli. The 2016 AOC and 2015 Compliance Plan established milestones by which progress can be measured.

### 2.1 Discharge Limit Violations

The physical discharge parameters regulated by the Kayenta WWTP permit are BOD, TSS, pathogens (E. coli), residual chlorine (TRC), pH, and total ammonia.[5] In accordance with the permit, samples of the wastewater facility's effluent are taken monthly. BOD and TSS are sampled by composite; everything else is by a discrete collection (grab samples). A short history of the facility's discharge, showing the frequency at which sampled parameters have exceeded the current permit limits, is provided in Table 1 and discussed below.

***Table 1: Kayenta WWTP – Exceedance of Current Permit Limits (by Year and Parameter)***

| Year<br>Discharge Parameter | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021<br>Jan-Feb | Total | % of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $BOD_5$ | 10 | 10 | 4 | 2 | 5 | 4 | 4 | 9 | 6 | 4 | 0 | 58 | 34.3% |
| TSS | 11 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 13.6% |
| E. coli | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 0 | 0 | 0 | 17 | 10.1% |
| TRC | 8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 5.9% |
| pH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 4 | 2.4% |
| Sub-Total | 32 | 26 | 7 | 3 | 7 | 6 | 7 | 11 | 6 | 7 | 0 | 112 | |
| Months w/ Discharge | 12 | 12 | 10 | 12 | 12 | 12 | 12 | 11 | 12 | 12 | 2 | 119 | |
| Total Ammonia | 4 | 3 | 8 | 7 | 3 | 3 | 6 | 5 | 7 | 9 | 2 | 57 | 33.7% |
| Months w/ Ammonia Data | 3 | 4 | 10 | 10 | 12 | 12 | 12 | 11 | 12 | 12 | 2 | 100 | |
| Total Violations | 36 | 29 | 15 | 10 | 10 | 9 | 13 | 16 | 13 | 16 | 2 | 169 | 100.0% |

Notes: Values reflect the number of months each year when sampling results exceeded/violated the monthly average (BOD, TSS, and total ammonia), daily maximum (E. coli and TRC), or (pH) values allowed by the NPDES permit for the given parameter. Daily loading (BOD and TSS), which is a function of both concentration and flow, is given a limit in the permit but is not considered. Whole effluent toxicity (WET) testing is not included or considered here.

- $BOD_5$ – The number of degradable organics **is regularly noncompliant.** In 2012 the concentration limit for BOD was raised from 30 mg/L to 45 mg/L. Since 2010, samples have exceeded the permitted limit for $BOD_5$ nearly half (49%) of the time.

- TSS – The concentration of suspended solids **is regularly compliant.** In 2012 the limit for TSS was raised from 30 mg/L to 90 mg/L. Since 2012 the plant exceeded the revised limit of 90 mg/L one time.

- E. coli – This monitor of pathogenic content **is periodically non-compliant.** Since 2013, a sample has violated the permitted limit up to as much as three times each year, however, there has not been a violation in the past 28 months.

- TRC – Since a sulfur dioxide unit upgrade in 2012, the residual chlorine concentration **has been consistently compliant.**

- pH – Plant effluent tends toward alkaline and **is periodically noncompliant** for pH. In recent years, values above the limit of 9.0 have occurred 4 times.

[5] Beginning with the 2018 reissued permit, whole effluent toxicity (WET) testing is no longer allowed to fail. The NTUA has been performing variations of WET testing since November 2012.

- Total Ammonia – The amount of total ammonia **is regularly non-compliant.** Because the permit's ammonia impact ratio (AIR) is 1.0, the total ammonia concentration limit is equal to the numeric chronic toxicity value.[6] Since 2012, total ammonia has been consistently measured and found to exceed the numerical limit over half the time (57%).

Most effluent water quality problems at the Kayenta facility result from variations in the water's biological processes. Of the six permitted parameters, two (E. coli and TRC) are treated by chemical processes at the tailworks. The remaining four (BOD, TSS, pH, and ammonia) are affected by biological processes in the ponds. And ammonia is affected by volatilization to the atmosphere. Operators of pond-based facilities have significant control over chemical processes, but little control over biological processes or environmental factors.

Since 2010, if violations for parameters treated by physical processes are not considered, the WWTP exceeds one of the four remaining biologically affected parameters more than once (1.2 times) each month. And monthly exceedances of BOD make up most of the violations (34%), followed by total ammonia (34%). Together, total ammonia and BOD account for 81% of the violations associated with biological treatment. Table 5 indicates that high effluent BOD concentrations are from April through November and the highest ammonia concentrations are in February and March.

In 2012, the whole effluent toxicity (WET) test monitoring was introduced into the plant's permit but was not added as a limit requirement until August of 2018. A summary of the facility's discharge, showing the frequency at which the sampled effluent failed the test is shown in Table 2 and discussed below.

***Table 2: Kayenta WWTP - Whole Effluent Toxicity (WET) Testing***

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan-Feb |
|---|---|---|---|---|---|---|---|---|---|---|
| Months with a Failed Test | - | - | - | - | - | - | 0 | 1 | 1 | 2 |
| Months Testing was Conducted | 1 | 10 | 11 | 9 | 10 | 11 | 12 | 12 | 12 | 2 |
| Note: Whole effluent toxicity (WET) test monitoring was introduced into the plant's permit in 2012 but was not added as a limit requirement until August 2018. | | | | | | | | | | |

Effluent toxicity can result from many different contaminants and variations in water quality. Some contaminants, such as ammonia, can be reduced by a wastewater treatment plant. Other contaminants, such as pesticides and herbicides, are often not greatly affected by traditional wastewater treatment and can persist in wastewater through a treatment plant and into the discharge stream. The source(s) of toxicity in a community's waste stream must be identified and characterized for them to be managed and treated.

### 2.2 Operational Deficiencies

Region 9 and NNEPA's reviews of the Kayenta facility records and July 2014, June 2015, and December 2018 plant inspections found the Kayenta plant did not have backup alarms or power, did not complete and promptly submit required notices and reports, and did not have standard operating procedures. It was also determined the NTUA failed to adequately operate and maintain the facility. The NTUA has taken steps to correct these operational deficiencies (see Table 3).

[6] The limit on ammonia is set by the Navajo Nation Surface Water Quality (NN SWQ) Standards. The standards call for total ammonia levels that will vary with each sampling event, depending on the effluent's simultaneous pH and temperature, with pH having the greatest influence. The higher the pH and the higher the temperature, the lower the total ammonia limit.

- Backup Power and Alarms – An emergency backup power generator **was installed** and brought online in June 2017.

- Notices and Reports – Discharge limit violation notices and monthly discharge monitoring reports (DMRs) **were consistently reported** to Region 9 through the Central Data Exchange since December 2017.

- Operation and Maintenance – The operational and maintenance improvements recommended in the 2015 Compliance Plan and the 2017 Performance Evaluation were implemented. Operation and maintenance (O&M) tasks **were standardized and scheduled** in writing. Both an operation manual (August 2016)[7] and a maintenance checklist (August 2017) were issued. Regular in-house operator training began in August 2017. The plant staff's adherence to the manual and checklist is monitored.

### 2.3 Compliance Milestones

Compliance milestones for the Kayenta facility are called out in the 2016 AOC and the 2015 Compliance Plan.[8] There are ten milestones, and seven component/sub-tier milestones. Each milestone and sub-tier milestone is listed and discussed in Table 4. While most milestones were not met on time, 13 of the 16 total milestones are now complete.

[7] Smith Engineering, Kayenta Wastewater Treatment Plant, Operation and Maintenance Manual, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (August 2016)

[8] The 2015 Compliance Plan is included by reference in the AOC per Paragraph 32.

*Table 3: Kayenta WWTP - December 2018 EPA Inspection Team Observations*

| Item No. | Comment | Response |
|---|---|---|
| a. | Uncontained screenings (rags and other material removed from the bar screen) were stored adjacent to the flow channel. | Staff has been directed to dispose of barscreen debris daily as required by the O&M checklist. |
| b. | The influent Parshall flume's level sensor appeared to be installed upstream of the appropriate $H_a$ point. | Adjustments were made to the location of the sensor. |
| c. | NTUA staff stated that the aerators have caused undesirable shifting of the baffle in Cell 1. At the time of the inspection the baffle was bowed. | The baffle in Cell 1 provides no functional purpose. The staff has been instructed to remove and properly dispose of baffle. |
| d. | Multiple gate valves at the facility were inoperable due to being bent or broken. Vegetation was present in one of the gate valve vaults. | Seven valves have been identified as requiring repairs and those repairs are in process. |
| e. | NTUA staff explained that the facility's old Onan generator is reliable despite its age; however, the staff reported that the automatic transfer switch sometimes does not engage. | PM has been performed on both the plant's generators. The effluent generator is in good working order, however, the newer influent generator has a few operational issues that are currently being addressed. |
| f. | NTUA staff explained that one of the three submersible pumps for moving flow from the headworks to Cell 1 was out of service. They stated that the pump likely would not be replaced since it would not be needed after the new headworks was brought online. | The new headworks and lift station has been placed in service. |
| g. | Tears were present in the Cell 1 synthetic liner. Also, there was a gap in the Cell 6 synthetic liner where vegetation was present. | These cells are not required for either of the proposed short-term options and, therefore, will not be repaired. |
| h. | The inlet and outlet structures for Cell 6 were located on the same side of the lagoon, potentially causing short-circuiting through the cell. It is recommended that NTUA evaluate options to alter the flow pattern in this cell to allow for maximized flow residence time. | This cell is proposed to be removed from service in all proposed treatment alternatives. |
| i. | The effluent Parshall flume's level sensor appeared to be installed slightly downstream of the appropriate $H_a$ reference point. The effluent meter indicated flow to the outfall was 0.107 MGD at the time of the inspection. | Adjustments were made to the location of the sensor. |
| j. | There was evidence of significant erosion on the bank of Laguna Wash at the facility's discharge point. Effluent from the facility's discharge pipe fell approximately 30 feet before entering Laguna Wash. Facility representatives stated that the pipe used to discharge closer to the water body before the bank eroded away. The end of the discharge pipe appeared to have broken off at some point before the inspection. | The referenced erosion poses no immediate threat to plant facilities or structures. The outfall structure will be upgraded as part of the overall plant conversion to an activated sludge plant. |

*Table 4: Kayenta - WWTP - Compliance Milestones*

| Item No. | Milestone | Compliance Date | Reference | Compliance Status | Comment |
|---|---|---|---|---|---|
| 1 | Hire a Regulatory Compliance Consultant | 17-Dec-14 | NNEPA AOC | Complete | NTUA hired Smith Engineering to draft the first compliance plan submitted in September 2015. On 11-Nov-2018 the NTUA hired Wood E&IS to assist in preparing replacement compliance plans. |
| 2 | Submit Compliance Plans | 10-Jun-2015 | NNEPA AOC | Complete | NTUA submitted a compliance plan to the Region 9 in September 2015. The compliance plan was incorporated into the Region 9 AOC. |
| 3 | Compliance plan (implement) | 31-Oct-16 | AOC – Item 29 | Complete | All components of the compliance plan have been completed as described below. |
| -a | Electrical service (assess) | Sep-2015 | 2015 Compliance Plan, 2.7.1 | Complete | Electrical systems, backup generator, and new aerators were tested and brought online 09-Jun-17. |
| -b | Process testing, chlorination, and dechlorination (implement) | As needed, beginning Sep-2016 | 2015 Compliance Plan, 2.7.2 | Complete | O&M tasks standardized, listed, and scheduled on 05-May-18. |
| -c | Influent lift station (rehabilitation) | Dec-2015 | 2015 Compliance Plan, 2.7.3 | Complete | A new influent lift station with the ability to screen the flow, remove grit, and measure flow went online in August 2019. |
| -d | Chlorine contact chamber (maintenance) | As needed, beginning 30-May-18 | 2015 Compliance Plan, 2.7.4 | Complete | O&M tasks listed and scheduled on 05-May-18. |
| -e | Lagoon performance testing (conduct) | 01-Jan-16 | 2015 Compliance Plan, 2.7.5 | Complete | Initial testing on 16-May-17 with follow-up testing after aeration improvements on 30-Sep-17. |
| -f | Aeration system upgrades (install) | 30-June-16 | 2015 Compliance Plan, 2.7.6 | Complete | Floating aeration system increased in Cell 1 (parts A and B) from 105 hp to 230 hp on 09-Jun-17. |
| -g | Chemical & flow meter (maintain) | Quarterly, beginning Sep-2015 | 2015 Compliance Plan, 2.7.7 | Complete | O&M tasks listed and scheduled on 05-May-18. |
| 4 | Operator training plan (implement) | 31-Oct-16 | AOC – Item 31 | Complete | Training program began 08-Aug-17 and is ongoing. |
| 5 | Compliance Reports (submit) | Quarterly, beginning 10-Oct-16 | AOC – Item 35 | Complete | Required reporting has occurred complete and on time since Dec-2017. |
| 6 | Qualified O&M supervisor (assign staff) | 26-Oct-16 | AOC – Item 38 | Complete | Darrell Holiday supervises operations at the Kayenta facility. Mr. Holiday is a Water Distribution Level 3, Water Treatment Level 3, Wastewater Collection Level 3, and a Wastewater Treatment Level 3 Certified Operator. |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Onsite Level 2 wastewater operator (assign staff) | 25-Mar-17 | AOC – Item 39 | Not Complete | Mr. Holiday is assisted at the plant by Nathaniel Ibarra and Malcolm Todecheene who perform the daily inspections and maintenance. Messrs. Ibarra and Todecheene are operators-in-training and are working towards obtaining their certifications. |
| 8 | Compliance with Permit (full) | 30-Jan-17 | AOC, Item 34 | Not complete | Effluent parameters continue to be exceeded. |
| 9 | Sludge Reporting | 10-Sep-20 | NPDES permit, Part III.D.1 | Complete | Sludge measurements were completed in June of 2020 and a sludge report was provided to EPA on January 22, 2021 for approval. |
| 10 | Asset Management | 11-Jun-2020 | NPDES permit, Part III.E | Not Complete | NTUA is undertaking the inventory of all assets for an Asset Management Plan (AMP). Once the inventory is complete, NTUA will assign the operator to collect the information needed for each asset and use the EPA's CUPPs program to manage the AMP. |

## 3. PRESENT SITUATION

The Kayenta wastewater facility, shown in Figure 1, is an aerated pond system with headworks, constituent ponds (treatment cells), interconnection piping, sand filters, and a tailworks. The headworks is new, brought online in August 2019, and consists of a lift station, bar screen, cavity for future grit removal system, and flow meter. The lift station is outfitted with submersible pumps in a triplex configuration (three pumps rotated electronically that can operate simultaneously as flow requires). The treatment cells are constructed as earthen basins lined on the bottom with clay and on the sides with synthetic fabric. Piping includes multi-level draw-off structures and flow junction boxes. The tailworks contains chlorination and dechlorination systems, a flow meter, and outfall structure.

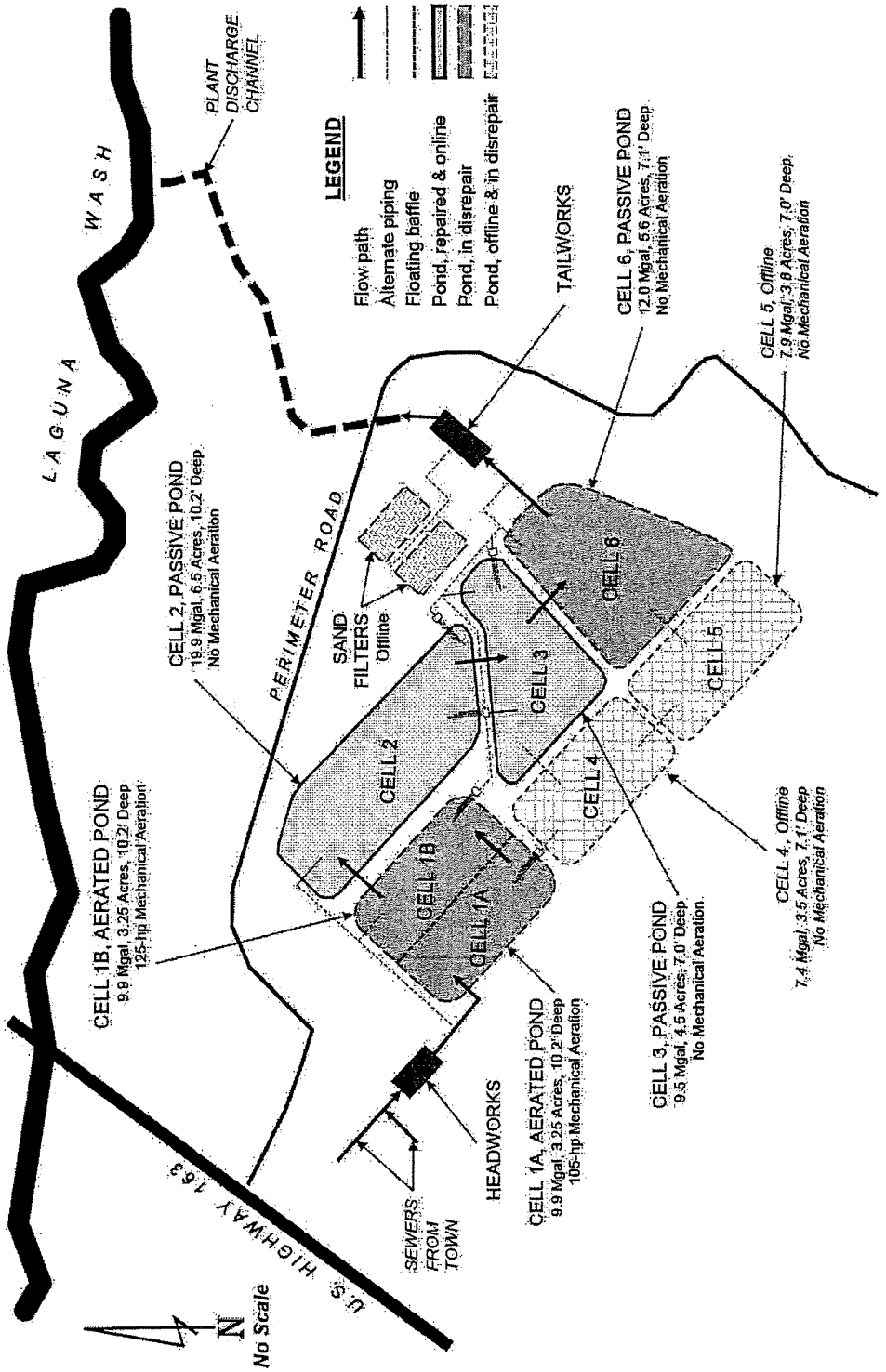
The plant was originally constructed in 1964 with only four cells. The original cells are today designated as numbers 3, 4, 5, and 6. In 1974, Cells 1 and 2 were added along with two effluent polishing sand filters. The ponds' structural condition has declined with time. This is most evident by the weather deteriorated liner that has torn/ripped, and folded back on itself exposing the underlying earth sideslopes in many places. In some places, the exposed earth has eroded from wave action and the sideslopes have sloughed into the cells. In 1998, rip-rap was installed on the cells' sideslopes to protect the earth in areas with sloughing. In 2009 and 2010, Cells 2 and 3 were cleaned of sludge, reshaped, and relined with HDPE fabric on the sideslopes.

Over the years, the facility has operated under different flow and treatment schemes. Since 2010, four of the six treatment cells have been used in series[9]. After the headworks flow enters Cell 1 it is subsequently discharged into Cells 2, 3, and 6 (see Figure 1). In 2006, a 30 horsepower (hp) surface aeration system was installed on Cell 1. Then in 2012, Cell 1's aeration power was increased to 105 hp. Today Cell 1 is divided into two parts by a baffle. The parts, Cells 1A and 1B, operate in series and are aerated and mixed by 105 hp and 125 hp of aspirating aerators, respectively. By including mechanical aeration, the plant is permitted for 880,000 gallons per day but treats about 380,000 gallons per day[10] of municipal sewage.

[9] Smith PER (2019), page 20, states cells 4 and 5 were taken offline to shorten the retention time and hopefully reduce algal growth. A date is not provided.

[10] Based on the average monthly flows during 2017 and 2018.

*Figure 1: Kayenta WWTP - Existing Treatment Scheme*



### 3.1 Treatment

Pond-based systems are limited and variable in their ability to treat wastewater. Still, the NTUA has made significant investments in upgrades and improved operations at the Kayenta plant. The investments were designed to reduce variability in the plant's effluent quality and improve overall treatment.

- Recent Upgrades - Since 2010, five improvement projects totaling $860,000 were completed at the Kayenta plant.
    - *Cell Rehabilitation (2010)* – Cells 2 and 3 were taken offline, cleaned, reshaped, and their sideslopes were protected with new HDPE liners. The cells were placed back online and operating in 2011.
    - *Plant Upgrades (Fall 2012)* – A 105 hp mechanical aeration system[11] was placed on Cell 1, and a sulfur dioxide dechlorination system was installed at the tailworks.
    - *Lift Station (December 2015)* – The influent lift station was rehabilitated. Upgrading the station was recommended by the 2015 Compliance Plan.
    - *Aeration Upgrades (June 2017)* – The existing aerators on Cell 1 were refurbished and augmented with new aerators. Cell 1 split into two parts (Cells 1A and 1B) and mechanical aeration power increased from 105 hp up to 230 hp. The facility's electrical service was upgraded and expanded. Upgrading the aeration was recommended by the 2015 Compliance Plan.
    - Headworks Replacement (August 2019) – A new headworks, including a bar screen, cavity for future grit removal system, flow meter, and lift station, was constructed and brought online. The new headworks was designed to support a future activated sludge plant.

***Table 5: Kayenta WWTP - Average Effluent Sampling Results (by Month and Parameter)****

| Month | BOD | TSS | $NH_3^-$ |
|---|---|---|---|
| January | 27.3 | 42.1 | 4.7 |
| February | 30.1 | 39.2 | 8.7 |
| March | 38.9 | 49.3 | 11.6 |
| April | 52.3 | 49.0 | 6.5 |
| May | 71.1 | 57.4 | 4.2 |
| June | 62.9 | 59.3 | 5.2 |
| July | 56.8 | 68.7 | 0.6 |
| August | 53.1 | 57.8 | 0.9 |
| September | 50.0 | 51.0 | 2.2 |
| October | 48.9 | 48.8 | 0.7 |
| November | 49.8 | 53.5 | 0.5 |
| December | 31.0 | 37.6 | 1.3 |
| Average | 47.7 | 51.1 | 3.9 |
| NPDES Permit | 45 | 90 | Can be <2.0 |
| *Using monthly data from January 2011 through February 2021. | | | |

- Current Performance – A review of Table 1 shows improvement for one of the two chemically treated permit parameters (TRC) beginning in 2013 and the other (E. coli) beginning in 2019. The four biological effected parameters (BOD, TSS, pH, and ammonia) display no discernable improvement. TSS has met its compliance requirements since 2012 because of a permit change. Total ammonia does not show increased compliance but does exhibit reduced concentrations in the effluent beginning in 2014.

  The effluent quality improves from 2012 through 2013 and into 2014. In 2010, ponds 2 and 3 were cleaned. In 2012 aerators were placed on cell 1. This combination of aeration and sludge removal may have moved organic conversion and settling up-front into cell 1, and limited the feedback from sludge later in cells 2 and

[11] Intermittent problems were experienced with the aerators' electrical power supply.

3 to provide better effluent quality. Aeration was improved in 2017 but things got worse from 2016 into 2018. Perhaps the new aeration re-suspended sludge and moved it downstream to cells 2 and 3; that together with the sludge accumulating in cells 2 and 3 since they were cleaned began to provide feedback of stabilization byproducts lead to a decline in effluent quality.

As can be seen in Table 5, BOD and TSS follow a seasonal pattern. Winter months tend to have higher quality water with lower BOD and TSS concentrations. Spring months exhibit poor water quality and elevated concentrations.

- *BOD* – As shown in Table 5, effluent BOD shows **no improvement** since 2012. It appears high BOD can result from spring turnover in the Kayenta ponds because effluent samples with very large oxygen demands are grouped in April through June of some years.[12] The BOD quality of Kayenta's effluent does show a consistent seasonal pattern of reduced readings during the winter months.

***Table 6: Kayenta WWTP – Effluent $BOD_5$***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum (mg/L) | 109.6 | 123.9 | 106.2 | 68.4 | 70.9 | 95.1 | 105.3 | 74.1 | 65.0 | 63.5 | 35.6 |
| Average (mg/L) | 52.6 | 73.8 | 47.4 | 34.6 | 36.7 | 47.3 | 45.9 | 52.5 | 43.5 | 43.0 | 27.8 |
| Note: Data are from a composite sample taken monthly. | | | | | | | | | | | |

- *TSS* – Suspended solids have not been a significant regulatory problem at the Kayenta facility. There was only one sample exceeding the 90 mg/L threshold since 2012 (see Table 1). But, as can be seen in Table 7, over that time the concentration of TSS in the effluent shows **no improvement.**[13]

***Table 7: Kayenta WWTP – Effluent TSS***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum (mg/L) | 168.0 | 85.3 | 82.7 | 76.0 | 126.0 | 76.0 | 58.3 | 87.3 | 88.0 | 86.7 | 36.7 |
| Average (mg/L) | 64.0 | 54.8 | 49.4 | 39.2 | 44.3 | 42.7 | 46.1 | 58.1 | 56.1 | 57.8 | 31.7 |

- *E. coli* – The facility's chlorination system can disinfect the water consistently. But dosing must be adjusted as the effluent quality changes. Since 2018, the treatment of this pathogenic monitor **has improved**.

- *TRC* – The removal of residual chlorine **has improved.** Today the sulfur dioxide system is consistently effective at stripping free chlorine from solution. The facility had no exceedances since the dechlorination system was installed in 2012.

- *pH* - Since 2011, the effluent's pH is frequently measured at the upper limit of 9.0 and has, in recent years, **occasionally exceeded** the limit.

- *Total Ammonia* – The concentration of the ammonia species in the effluent still regularly exceeds the permitted limit. But as can be seen in Table 8, its removal **has improved** since 2013. Still, even with improved removal, effluent concentrations are, on average, four times above the permit limits that are regularly below 2 mg/L.

[12] Spring turnovers are a normal occurrence in wastewater ponds with bottom sludge.
[13] Suspended solids from pond-based systems are often algae.

***Table 8: Kayenta WWTP – Effluent Total Ammonia***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 Jan-Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum (mg/L) | 34.4 | 27.4 | 30.1 | 20.5 | 5.9 | 13.9 | 10.2 | 1.5 | 1.5 | 1.7 | 1.86 |
| Average (mg/L) | 12.0 | 9.9 | 14.6 | 6.8 | 2.1 | 3.0 | 3.1 | 0.5 | 0.6 | 0.7 | 1.3 |
| Average Permit Limit | 0.6 | 0.9 | 1.7 | 3.4 | 2.7 | 1.8 | 1.0 | 0.4 | 0.3 | 0.4 | 0.4 |
| Note: Data are from single discrete samples taken monthly. Permit Limit is an average of monthly chronic total ammonia limits from the NN SWQ Standards given pH and temperature measurements made simultaneous to each sampling event. Permitted Ammonia Impact Ratio (AIR) = 1.0. | | | | | | | | | | | |

- Facility Capability – Despite recent upgrades and modest improvements in effluent quality, the Kayenta facility struggles to meet its discharge limits, particularly in BOD and total ammonia. If Kayenta continues to use pond-based technology, it might be possible to bring the plant into compliance with BOD, but a pond facility **cannot consistently meet the total ammonia limit**. Also, TSS will likely continue to exceed the permissible limit from time to time.

    - *Physical Plant and Core Processes* – The plant is physically in fair condition.[14] The aerated pond process, assisted by 230 hp of floating mechanical aeration, is handling the annual average 1,065 pounds per day organic load[15] without significant odors.

    - *Treatment Performance* – The Kayenta plant is performing reasonably well for an aerated pond system. Going forward E. coli and TRC can be dependably controlled by the plant's chemical processes at the tailworks. pH is high but generally in compliance. And TSS is normally in compliance but can experience daily and seasonal variations. Careful use of the facility's multi-level overflow boxes might improve TSS. BOD might be improved with reducing retention time and removing sludge deposits. Short retention times are less conducive to algal growth. Because many BOD violations occur in spring (April through June) when ponds can experience turnover, having less sludge in the cells makes less organic matter available for re-introduction into the water column.

      Total ammonia concentrations cannot be actively controlled. As with most aerated pond WWTPs, ammonia removal at the Kayenta facility is primarily by volatilization through water surface area and influenced by pH and temperature. Biological nitrification, while active at times, plays a secondary overall role. The surface area[16] at the Kayenta plant is not enough to volatilize ammonia to the permitted level, which in 2019 averaged 0.3 mg/L. Neither process modifications nor a reasonably sized polishing process will bring the plant consistently into ammonia compliance.

    - *Treatment Challenge* – While the plant today can meet the E. coli and TRC parameter limits, and BOD and TSS might be brought into compliance, the plant cannot consistently comply with a total ammonia limit using aerated pond technology.

---

[14] Smith Engineering, Kayenta Wastewater Treatment Plant, Preliminary Engineering Report (PER), *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (April 2014), Table 4

[15] $L_{org}$ = $BOD_5$ X Q = 1,065 lbs/day = 334 mg/L X 382,000 gpd (using 2017 and 2018 average influent $BOD_5$ and flow rates)

[16] Kayenta facility's available water surface area is 30.4 acres when all cells are full. The surface area of the cells 1, 2, 3, and 6 currently online is 23.1 acres.

### 3.2 Operation and Maintenance

The Kayenta plant is staffed by trained operators who monitor and upkeep the facility per written standard operating procedures and schedules.

- Training - The NTUA **has begun** in-house operational training to fine-tune its operators' skills towards the Authority's rural wastewater pond facilities. The training program started in August 2017 with a four-day workshop that covered lagoon optimization, O&M Manual familiarity, water quality sampling, and laboratory training focused on wastewater ponds. Another focused workshop was conducted in the Fall of 2018. The Authority also conducts refresher training for backup operators. Further, the NTUA requires its regular operators to access and attend out-of-shop training through either Tribal, Arizona, or New Mexico professional operator associations.

  A full-time operator training coordinator has been hired to manage an operator training and certification (OIT) program. His responsibility includes monitoring staffing and training requirements for water systems, sewer lagoons, and WWTPs. Online classes are now available to assist operators in obtaining certifications up to a level 2 in all 4 water and wastewater operator categories.

- Monitoring and Reporting –Monitoring the plant's processes **has begun** and the facility's regulatory tracking reports are now being filed on time. Regular process testing and monitoring at Kayenta started in December 2017. The Headquarters Operations Engineer with the assistance of a QA Officer monitor operations (i.e., checklists, daily maintenance records, and DMR reports) at each discharge facility to assure reporting continues to occur on time and provides regular status reports for management review. The following is a list of the plant's standard operating procedures. Each of the procedures has a log that must be completed, signed, and reported to NTUA Headquarters. The recurrence interval of the different procedures varies.

  - *Water Monitoring* – Six monitoring locations are established throughout the plant.
    - *Daily* - The water monitoring schedule covers reading meters to account inflow and outflow quantities; measuring dissolved oxygen (DO), pH, and water temperature at the six locations, plus reading the TRC meter. For sampling locations in the ponds, DO, pH, and temperature are measured two feet below the water surface. The schedule also calls for the calibration of meters plus DO and pH equipment.
    - *Weekly* – The chemical oxygen demand (COD), BOD, and TSS are measured, or sampled and tested, at the six locations. The schedule also calls for the calibration of testing equipment.
    - *Monthly* – Samples for ammonia, nitrates, and E. coli are scheduled at six locations throughout the plant. The samples are sent to the NTUA laboratory for testing. Ammonia and nitrate concentrations are determined on-site, and their testing equipment is cleaned and checked for calibration. E. coli samples are sent to the NTUA laboratory for testing.
  - *Plant O&M*
    - *Daily* - Each unit process and piece of equipment at the plant is inspected. The checklist includes sluice gates, manholes, lift station, bar screen, grit channel, inflow Parshall flume, lagoon surface water, aeration controls, and power, outflow Parshall flume, chlorination equipment, dechlorination equipment, and the sludge drying lagoon.

- *Weekly* – The buildings and storage facilities are checked weekly including the maintenance, lab, and office buildings, their HVAC equipment, and storage sheds. All the valves and gates are exercised. Pipes and flow surfaces are cleaned. Screenings and grit are disposed of.
- *Monthly* – The various meters and instruments are checked for calibration, calibrated, or (when needed) taken to a service shop for calibration.

- *Compliance Tracking (monthly)* – Data from the Kayenta plant's sampling/testing log is collated into an overall worksheet that tracks the NPDES compliance of each NTUA facility with an NPDES permit.

- Sludge - The accumulation of sludge in Cell 1A and Cell 1B was measured to be 2.4 feet and 1.3 feet respectively in 2018. A sludge depth measuring event completed in June of 2020 found similar sludge depths for these cells - 2.4 feet and 1.76 feet. Sludge depths for cells 2, 3, & 6 were reported as 0.58, 0.81, and 0.8 feet, respectively. Regular determination of sludge accumulation has been added to the routine operation and maintenance checklist.

- Qualifications – **In compliance** with the AOC, the NTUA has a certified Grade 2 Wastewater Operator overseeing operation and maintenance activities at the Kayenta plant:

  Darrell Holiday
  Navajo Tribal Utility Authority
  Kayenta District Office
  P.O. Box 37
  Kayenta, AZ 86033
  (800)528-5011

  Mr. Holiday also has certifications in Water Distribution (Grade 3), Wastewater Collection (Grade 3), and Water Treatment (Grade 3). He is assisted by Nathaniel Ibarra and Malcolm Todecheene, who are training but not yet certified in wastewater operations.

### 3.3 Summary

The NTUA has dedicated resources to the facility. A new headworks and lift station were constructed in 2018 and brought online in 2019. These resources have enhanced the care and attention given to the plant and improved effluent quality, notably E. coli and TRC. And they've set the stage for even better treatment by a new wastewater plant in the future. But for now, the plant will continue to receive attention and resources, with the understanding that the permit parameters affected by biological processes in pond-based plants (BOD, TSS, pH, and total ammonia) are difficult to improve because operators have little control.

## 4. COMPLIANCE OPTIONS

The Kayenta wastewater facility's NPDES violations vary with each constituent effluent parameter. Since 2012 the plant has not exceeded the TRC limit. E. coli, pH, and TSS have occasionally exceeded allowable levels, while BOD and total ammonia regularly do not comply. Noncompliance is almost always the result of weaknesses and variations in the biological processes that occur in ponds. To move towards compliance, the variability in the facility's treatment must be reduced or the current pond-based technology must be replaced.

On the Navajo Nation, total ammonia in wastewater facility discharges is a challenge because of low effluent limits promulgated by the Navajo Nation Surface Water Quality Standards.[17] Late summer (July – September) water in the Kayenta treatment ponds is characterized by high pH and warm temperatures. Elevated pH and temperatures result in an ammonia limit that is low, below 0.20 mg/L.[18] In general, exceptional pond systems may reach 5 mg/L, and those with added polishing processes may approach 2 mg/L total effluent ammonia but will still vary in their treatment and have spikes in concentration.

The variability of the pond process is caused by atmospheric influences and biological activity that, because of the large water volumes, are strong, independent, and subject to little control. While many investigators have proposed process and technology improvements to help wastewater pond systems perform better, few of the improvements (if any) have shown consistent, long-term success.

A well-functioning aerated pond system with plug flow and adequate retention time might produce effluent that averages within the Kayenta facility's limits for all parameters, including BOD, but not total ammonia. Concentrations of total ammonia in the effluent at Kayenta are, on average, over four times above those allowed by the permit.[19] The problem is made worse by peak ammonia concentrations resulting from daily and seasonal variations in the weather and biological processes in the ponds. To complicate things, the permitted limit for total ammonia is a moving target. Given this permitting situation, the plant's treatment can be improved, but challenges remain with compliance if aerated pond technology continues to be used.

### 4.1 Treatment

At first glance, there appears to be several ways to improve the Kayenta facility's treatment, such as improving the plant's processes, altering the plant's processes, constructing a new plant, or changing the disposal method. But upon closer examination, most options will not assure long-term consistent compliance. Each of the options are discussed below and presented for comparison in Table 8.

- Process Improvement – Historical treatment records of many aerated pond systems across the United States show the facilities are challenged when attempting to consistently meet 45 mg/L BOD and 90 mg/L TSS effluent concentrations.[20] And such records further indicate aerated ponds are not able to consistently remove ammonia below 5 mg/L.[21] However, if the performance of aerated ponds can be

---

[17] NN EPA, Navajo Nation Surface Water Quality Standards 2007, Navajo Nation Environmental Protection Agency, Water Quality Program, Window Rock, AZ (2008)

[18] NN EPA, Table 206.3

[19] 5.0 mg/L is the average of monthly samples since 2010. 1.2 mg/L was the total ammonia limit based on temperature and pH and Table 206.3, NN EPA (2008).

[20] Middlebrooks, E. Joe, et al., Wastewater Stabilization Lagoon Design, Performance and Upgrading, *Macmillan Publishing Co., Inc.*, New York, NY (1982), Figure 2-16.

[21] Crites, Ronald W. – Chairman, Natural Systems for Waste Management and Treatment, 3/e, *McGraw-Hill, Inc.*, New York, NY (2001), Table 7.16

enhanced by improving operation and maintenance and adding features or technology, then continued use of Kayenta's wastewater plant infrastructure could be **feasible over the short-term**. Some ways that may be considered to improve effluent quality from aerated ponds include aeration and mixing, flow path extension, effluent holding, multi-level draw-off, shortened retention time, process separation, solids settling and removal, sludge stabilization and storage, and effluent polishing. [22, 23]

- *Aeration and Mixing* – Aeration enhances microbial activity by supplementing oxygen. Mixing improves contact between bacteria and waste compounds. Mixing also discourages algae propagation by suspending solids (thereby decreasing light penetration into the water) and releasing carbon dioxide ($CO_2$), an algal substrate, to the atmosphere. But pond water bodies are large and the power to mix and aerate them is also large. And long retention times in ponds allow algae to propagate. Usually, the energy applied by mechanical aerators is small compared to that supplied by the atmosphere on a breezy day. Unless the mechanical aeration is substantial and retention times are minimal, operators have little control over the bio-processes in a pond.

  Currently, all the aeration and mixing is in Cell 1, while more quiescent waters (without mechanical aeration and mixing) exist in the other cells. The designers may have intended to convert organics to biomass in Cells 1A and 1B with settling of solids in the other cells. Or they may have simply been trying to control odors in Cells 1A and 1B. However, if the settled solids in the later cells are not removed from the treatment stream the resulting bottom sludge will have a detrimental effect on effluent quality that will become more significant with time. Because Cells 1 and 2 are in poor condition[24], an alternate scheme would be to move the aeration to a reshaped and lined Cells 4. About 40 hp is required to aerate Cell 4 and about 300 hp is required to mix the cell so solids don't settle out. Cell 1 is currently outfitted with 230 hp of aspirating aerators, proper placement of existing equipment on Cell 4 will result in basins that are completely aerated and partially mixed. The cost will be less than $500,000 for piping and to reshape, line, and move aerators to Cell 4. But the retention time in any of the Kayenta cells is long. Cell 4 is over 21 days when only a nominal two days are required for algae to become established. Aeration and mixing will work to discourage algae but the retention time will allow ample opportunity for growth. Because of algal growth allowed by long retention times, and because the solids are not separated out of the waste stream, aeration and mixing of Cell 4 **will not improve water quality**.

- *Extend Flow Path* – Increase time for treatment by changing the water's flow path. Baffles and series routing can prevent flow from short-circuiting to the outlet. Extending the flow path in this

[22] Lengthening hydraulic retention time is also sometimes proposed to improve performance. But lengthened retention time adversely impacts pond treatment because it increases algal growth. Increasing retention time can improve treatment only for small ponds. Short retention times (less than one day) in an aerated pond can result in a small part of the inflow organics not getting converted to biomass. And small non-aerated ponds can be subject to high areal loading of organics (above 45 lbs/acre per day) resulting in accumulation of bottom solids and odors.
[23] Recycling water from the end of a pond system to the beginning is also sometimes proposed to improve performance. But because ponds have low concentrations of active biomass (mixed liquor suspended solids normally less than 300 mg/L) and no clarification to concentrate the solids, there is little biomass activation that can be achieved. And while recycle can work to reduce short circuiting, it can also introduce mature algae into the head of the plant increasing algae growth throughout the ponds. Because of these issues and the added operational requirements recycling water brings, pond-based facilities (almost without exception) do not recycle.
[24] Cell 1 is unlined (it has an old synthetic liner that is so torn and is no longer effective) and has eroded banks. It also has a lot of aeration horsepower that has likely exacerbated cell degradation.

way also works to settle out solids early in the system, reducing sludge deposits in later cells, and thereby reducing stabilization by-products from feeding back into the water. But in ponds with mixing, such as Cells 1A and 1B at Kayenta,[25] **short-circuiting is rarely a limiting effective treatment.** There is plenty of time to convert waste organics and organic by-products to biomass, regardless of the flow path. And short-circuiting does not reduce the surface area for the volatilization of ammonia. However, some benefits may be realized if solids can be retained early in the system. It will cost $100,000 to install required piping and two full-width baffles in Cell 4.

- *Hold Effluent* - Construct a new large pond or use the abandoned existing ponds at the Kayenta plant to hold treated effluent when the effluent quality is not acceptable for release. Water quality can vary with season and temperature. Algae will naturally decrease at times. By monitoring a pond's water an operator can determine when the water is poor quality and cease discharge, instead of diverting flows to storage. When water is good quality a batch discharge can be made. However, temporarily holding effluent **might not work** because the biological processes within a pond can deteriorate the water's quality and the water may never achieve permitted quality. Still, only minor servicing and refurbishing of flow boxes (estimated at $10,000) is required to divert flows to holding.

- *Multi-level Draw-off* - The quality of the effluent exiting the plant might be improved by actively using the multi-level draw-offs. An operator can use a multi-level draw-off to alternate the water stratum from which effluent is taken. Because the multi-level discharge has three outlet pipes at various depths, successful draw-off requires operators to regularly monitor water at varying depths through a pond's water column and then select the level with the clearest water. Clear water is then tapped by using manual valves to open the pipe at the matching level. To implement the multi-level draw-off immediately, Cell 6 will need to be bypassed because Cells 2 and 3 have existing multi-level structures, but Cell 6 does not. Servicing and refurbishing the draw-offs will cost $20,000 and the multi-level draw-off **can be used** immediately.

- *Shorten Retention Time* - Shorten the retention time to both reduce the energy required to aerate and mix and to reduce the opportunity for algae to propagate. Shortened retention can be achieved by using two baffles on Cell 4 for about $150,000. Also, baffles can allow individual treatment processes to be separated, without requiring more overall pond volume. Often, shortened retention or the use of baffles is **not used by itself** to improve treatment but is combined with other improvements and upgrades.

- *Separate Processes* - Distinct unit processes (conversion of organics, settling of solids, sludge stabilization and storage, and nitrification, etc.) are assigned to specific small cells or little ponds where more controlled environments are created. Separated processes can be used to create a high-performance pond system or improved pond treatment schemes. A high-performance pond system has an aerated and mixed pond, with a short retention time, followed by a settling pond.[26] High-performance pond systems are often referred to in the literature as dual-powered multi-cellular (DPMC) systems. High-performance ponds are a feasible technology and can normally meet 45 mg/L BOD and 90 mg/L TSS effluent concentrations, especially when sludge is regularly removed from the settling cell. But high-performance ponds **cannot be relied upon the**

[25] The Kayenta wastewater facility's theoretical hydraulic retention time is more than 25 days in each Cell 1A and 1B, and over 50 days in Cell 2.

[26] Rich, Linvil G., High Performance Aerated Lagoon Systems, *American Academy of Environmental Engineers*, Annapolis, MD (1999)

**remove total ammonia** below 5.0 mg/L. It will cost $1.6 Million to install a high-performance pond system in Cell 4.

- *Settle and Remove Solids* - When organic contaminants in wastewater are converted into biomass, the biomass settles. In ponds, this creates bottom sludge. But the contaminants, now in a different form, never really leave the pond. When the sludge then stabilizes, decomposition by-products are released back into the water column. The by-products again contaminate the water and fertilize algae. **Effluent quality can be improved** only if the biomass is both settled and removed. A quiescent separate water body, without mechanical aeration or mixing, allows efficient settling. Regular sludge removal is performed by pumping or dredging. Purchasing and installing a dredge will cost about $300,000.

- *Stabilization and Store Sludge* – Pond systems require infrequent handling of sludge and biosolids. This reduced operational effort is a key advantage of ponds over other types of wastewater treatment. The depths of ponds are **ideal for storing and stabilizing solids**. And an aerated water column over the bottom sludge converts sludge stabilization off-gases to non-odorous compounds before they can escape to the atmosphere. But the sludge must be stabilized in a detached reactor, separated from the main waste stream to prevent the reintroduction of degradable compounds back into the water. The recently reshaped and relined Cell 3 in Kayenta can serve as a detached sludge pond. Overflow piping from the sludge pond back to the head of the plant and light aeration will cost $20,000 and $90,000 respectively. Pumping sludge to a dedicated storage and stabilization pond is effective at increasing effluent quality and inexpensive, but it only delays disposal issues.

- *Polish Effluent* – Add a process onto the end of the plant, such as the location of the old (abandoned) sand filters, to further treat (polish) the effluent before discharge. Polishing processes can include filters and attached growth reactors. Fine sand, small synthetic media, constructed wetlands, and membranes can physically filter the water and reduce TSS and its associated BOD. Attached growth reactors (e.g. trickling filters/bio-towers, rock filters, floating media,[27] and coarse sand filters) are friendly to biofilms of nitrifying bacteria and can improve biological nitrification. A small moving bed bio-reactor process would be about $2 Million to construct. However, when filters or attached growth processes follow ponds, they are often overwhelmed by TSS (algae and other microorganisms that flourish in pond waters) and can clog. And biological nitrification processes are affected by cold weather[28] and **cannot be relied upon** for consistent oxidation of ammonia. The Kayenta plant has old dosing sand filters that polished the plant's effluent before disinfection. The filters' condition can be assessed to determine viability for bringing them back online. They were abandoned because of difficult operation and maintenance.

- Process Alteration – Continue to use the existing Kayenta wastewater facility infrastructure, but change the treatment technology. Some ponds have been converted to extended aeration or sequencing batch reactor (SBR) systems by shortening the retention time, resequencing flow, changing or increasing the mechanical aeration and mixing, and adding recycle. For instance, a continuous-feed intermittent-discharge (CFID) system is an innovative technology that combines an extended aeration cell with an SBR cell in a single pond. Another example is using baffles and changes in flow path to rearranging ponds while

[27] Moving bed bio-reactors (MBBRs) and integrated fixed film and activated sludge (IFAS) processes are examples.
[28] Biological nitrification is strongly impaired when water temperatures fall below 10°C/50°F.This is typically November through March for the Kayenta facility.

filling some with media, to create an integrated fixed-film and activated sludge (IFAS) system. While changing a pond system's treatment technology is less expensive than a new plant, it is expensive. Both a CFID or an IFAS systems (like most innovative technologies) are based on sound theory, but they are **still experimental** with sequencing and biomass parameters not definitely established. Plus, for an IFAS system, it is difficult to fit media into a baffled pond cell and IFAS can clog with algae. Installing a CFID system in existing Cell 4 is estimated to cost $1.6 Million. The cost of an IFAS system is near $7.5 Million.

- New Plant - Build a new plant with a better treatment process. Activated sludge plants **can dependably treat wastewater** to Kayenta's permit limits, including total ammonia. An activated sludge plant will dependably and consistently meet permit limits for all parameters by controlling process variability through sludge recycle to maintain high concentrations of biomass and by providing aggressive aeration and mixing to support the biomass' activity. Because activated sludge reactors are small, they can provide a shielded environment that prevents both cold water temperatures and algae growth. And new plants are energy efficient and straightforward to operate. Plus, improved effluent quality will make effluent reuse possible. A new plant is estimated to cost $3.5 Million to plan and engineer and $22 Million to construct. [29]

- Change Disposal – Continue to use the existing Kayenta wastewater facility by discontinuing the discharge of wastewater to waters of the United States (Laguna Wash to Chinle Wash) and instead dispose of treated effluent through evaporation and land application. About 150 acres of ponded water surface area is required for complete evaporation of Kayenta's wastewater. Nearly 275 acres are needed for land application, with an effluent distribution network and application system.[30] Land available for acquisition is uncertain. The land in the area is dedicated to traditional uses (e.g. grazing). If available, nearby **land parcels are expensive to obtain**. The cost of constructing lagoons capable of completely retaining the Kayenta flows is $10 Million, not including land.

Because of Kayenta's frequent BOD violations, the ability of most options, by themselves, to attain consistent compliance with the NPDES permit is questionable. But options can be combined into more robust treatment schemes. Using the multi-level draw-off structure on Cell 2 or 3 is a simple adjustment and can be implemented immediately. It is possible, the multi-level draw-off might obtain compliance for all parameters except ammonia. If using the draw-off structure doesn't work, baffles can be used in combination with aeration/mixing and dredging to shorten retention times, separate processes, and remove sludge. The resulting treatment scheme, known as a high-performance pond system with sludge removal, may obtain compliance for all parameters except ammonia and can serve as a short-term solution. If a high-performance pond doesn't work, sequencing of the aeration and mixing, together with sludge recycle, can be added to produce a continuous-feed intermittent-discharge system. For the long-term, an activated sludge wastewater treatment plant is the dependable way to achieve compliance. This long-term option concurs with the recommendation of a recent planning project for the facility where four treatment options were evaluated, including continued use of the existing aerated pond technology.[31]

---

[29] Smith Engineering, Kayenta Wastewater Treatment Plant, Preliminary Engineering Report, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (June 2019), Table 50.

[30] In most jurisdictions, the limiting concern in determining land application rates of wastewater is groundwater protection. And for municipal wastewater the parameter of concern is nitrogen loading to the soil. The NN EPA has not issued groundwater protection guidelines, but have reported that they are being considered. This value was determined from assuming 20 mg/L of total nitrogen in the treated effluent applied at a rate of 200 lbs/acre of total nitrogen (as nitrogen) per annum as permitted in New Mexico.

[31] Smith Engineering, Kayenta PER (June 2019)

### 4.2 Operations

A key first step to an intermediate solution is using the multi-level draw-off structure on Cells 2 and 3. If the isolation valves associated with the draw-off structure do not work smoothly they should be replaced. If the valves work, they must be exercised. Exercising the isolation valves on the draw-off structures and throughout the plant is necessary to make sure the valves work when needed. A line item for valve exercising is on the operation and maintenance checklist.

To support the long-term solution of a new plant, the NTUA has experience with activated sludge technology at both the Shiprock and Window Rock wastewater facilities, and both those plants comply with their permits.[32] Experienced operators from each of these facilities can help to lead and train additional staff. In selecting a new plant, emphasis should be placed on a technology that is straightforward and economical to operate and is similar in processes to Shiprock or Window Rock to facilitate cross-training.

### 4.3 Conclusion

After exploring the many options that might be used in attempting to improve treatment and comply with Kayenta's NPDES permit, it seems that actively using the multi-level draw-off is the best approach to immediately improving effluent quality. NTUA will closely monitor and make good faith efforts to meet all NPDES permit requirements. If additional short-term improvements are needed for treatment, a divided unit process with shortened retention times and removal of sludge combined with additional interim steps of sequencing aeration/mixing and sludge recycle will be taken. Meanwhile, a new activated sludge plant is planned to dependably meet the permit requirements for the long term.

If the fully implemented short-term solutions fail to achieve compliance with NPDES permit limits, NTUA will notify Region 9 and NNEPA and investigate potential additional measures to implement. A polishing process may be added if other options fail.

[32] The NTUA also operates two smaller activated sludge facilities at Northern Edge and Twin Arrows Casinos near Farmington, NM and Flagstaff, AZ respectively.

***Table 9: Kayenta WWTP – Improvement Option Summary***

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| Process Improvement | | | | | | |
| Aeration and mixing<br>*Install mechanical aeration in Cell 4.* | Uses existing pond infrastructure.<br>Keeps organic load capacity high.<br>Discourages algae growth by:<br>o Reduces $CO_2$ by releasing to the atmosphere.<br>o Decreases light penetration by suspending solids. | Power to be extended to Cell 4.<br>A lot of power is required to aerate and mix resulting in high operational costs.<br>Aerators require maintenance. | Difficult to predict and highly variable.<br>No increased performance is expected over current conditions. | $500,000 to re shape, line, and move aerators to Cell4.<br>Additional piping is required. | Aerators of sufficient power and oxygen transfer ability are already installed in Cell 1.<br>Aerators can be moved and additionl aerators can be purchased.<br>Moves aeration out of a cell that is in poor condition and into a refurbished Cell 4..<br>Can be combined with other process improvements to support a different treatment scheme. | Will not substantially improve treatment by itself.<br>Combine with other options and use as part of short-term solution. |
| Extend flow path<br>*Install two baffles in Cell 4.* | Uses existing pond infrastructure.<br>Does not significantly increase operational effort.<br>Can reduce short circuiting.<br>Can retain solids earlier in system. | Capital costs for piping & baffles.. | Difficult to predict and highly variable.<br>After 8 months, extending the flow path will:<br>o Cause less than 5% reduction in BOD during spring turnover event. There is a good chance no reduction will be seen.<br>o Cause no reduction in annual total ammonia out of the plant.<br>BOD reduction will become smaller with time and sludge accumulation. | $100,000 installation cost. | Install two baffles in Cell 4, creating three sub-cells with no sludge removal.<br>Because of the already long retention time, reducing short circuiting will not improve treatment.<br>Unless flow-through scheme is changed, baffles will increase retention time and algae.<br>But baffles can be used to reduce retention time and separate treatment processes.<br>Can be combined with other process improvements to support a different treatment scheme. | Will not substantially improve treatment by itself.<br>Combine with other options and use as part of short-term solution. |
| Hold Effluent<br>*Use Cell 6 and 4 or 5 to hold poor quality effluent.* | Uses existing pond infrastructure. Kayenta has a lot of pond volume and surface area to work with.<br>Low cost. | Requires active discharge water quality monitoring and flow diversion by operators.<br>It is difficult to get timely characterization of effluent quality because of lags in testing. | Difficult to predict. Depends on pond variability and operational attention.<br>Water quality in holding pond may not improve (may worsen with time).<br>o Probably cannot comply with 45 mg/L BOD unless sludge is removed.<br>o Might comply with TSS at 90 mg/L, but also might make TSS worse for diverted flows. | $10,000 construction cost<br>Add $50,000 to clean and shape Cells 4 or 5. | Provides effluent storage to avoid discharge when water quality is poor.<br>Can discharge from Cell 2 or 3. Convert Cells 4, 5, and 6 to hold noncompliant effluent | Can prevent discharge for very bad events. But increased retention time will likely make water quality worse.<br>Might use for upsets or when problems with |

***Table 9: Kayenta WWTP – Improvement Option Summary***

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| | | | Extremely bad discharge events can be avoided. | | | treatment occur. |
| Multi-level draw-off<br>*Use existing structure on Cell 2 or Cell 3.* | Uses existing pond infrastructure.<br>Low capital cost. New draw-off structure already in place.<br>No power costs.<br>No motors or mechanical parts.<br>Low-tech operation. | Requires active monitoring of water stratification in ponds.<br>Stratification varies and can be difficult to detect. | Difficult to predict. Depends on pond variability and operational attention.<br>Perhaps 25% reduction in annual average TSS with attentive operation.<br>Perhaps 10% reduction in annual average BOD with attentive operation.<br>If water quality improves it will be immediate. | $20,000 to refurbish both draw-off structures. | Use the existing draw-off structure on Cell 2.<br>Should be effective at improving water quality when used correctly.<br>Difficult to determine water quality at depths.<br>Often the water column in ponds does not stratify. At other times the stratification changes quickly. | Should improve effluent quality at no capital cost.<br>Use as immediate action. |
| Shorten retention time<br>*Use two baffles to create three smaller cells in Cell 4.* | Uses existing pond infrastructure.<br>Shortened retention times can reduce algae.<br>May retain solids earlier in system.<br>Does not significantly increase operational effort. | Capital costs for new piping and baffles.<br>Sludge buildup will be accelerated in smaller cell. | Difficult to predict and highly variable.<br>After 1 month:<br>o Perhaps 20% reduction in BOD during spring turnover event.<br>o Perhaps 10% reduction in TSS.<br>o No reduction in annual total ammonia out of the plant.<br>BOD reduction will decrease with time and sludge accumulation. | $150,000 construction cost | Install two baffles across Cell 4 and create three smaller cells: Cell 4A, Cell 4B, and Cell 4C.<br>Can be combined with other process improvements to support a different treatment scheme. | Can reduce algae.<br>Combine with other options and use as part of short-term solution. |
| Separate Processes<br>*Aerate/mix in Cell 4a. Settle in Cell 4b.* | Uses existing pond infrastructure.<br>Does not significantly increase operational effort. | Capital costs for new piping, baffles, liner, & dredge.<br>Costs associated with purchase & installation of dredge, blowers & diffusers.<br>Delivery time for new dredge equipment can be up to 20 months. | Treatment will be improved, perhaps substantially at first.<br>Treatment performance will decrease with time and sludge deposition in the settling cell.<br>Probably won't affect total ammonia. | $600,000 to aerate Cell 4a.<br>Plus costs listed above for piping, baffles, & to reshape & line Cell4.<br>Plus costs to purchase & install a horizontal dredge.<br>Total est. cost $1.6 M. | Combines "aeration and mixing," "extended flow paths," and "shortened retention" options above.<br>Cell 4A to be reactor basin with appropriate aeration times and aeration/mixing regime. Cell 4B to be settling basin. This configuration is known as a "high-performance pond system" in the literature.<br>Can be combined with other process improvements to support a different treatment scheme. | Will convert organics and settle solids efficiently.<br>Combine with other options and use as part of short-term solution. |
| Remove Solids<br>*Dredge solids from Cell 4B and place into Cell 1.* | Uses existing pond infrastructure. | Delayed delivery & capital costs for new dredge.<br>Increased operation required to monitor sludge depths, move | If combined with "shortened retention" and "separate processes" options above, can produce effluent that consistently meets 45 mg/L BOD and 90 mg/L TSS. But meeting | $300,000 cost for purchase and installation of floating dredge. | Combined with "separate processes" above.<br>Use floating dredge to remove solids from bottom of Cell 4B. | Will remove solids and place them outside treatment stream. |

***Table 9: Kayenta WWTP – Improvement Option Summary***

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| | | dredge, and alter discharge location. | ammonia limits will remain a challenge. | | Use Cell 1 for sludge storage and stabilization. | Combine with other options and use as part of short-term solution |
| Stabilize & Store Sludge<br>*Use Cell 1 as sludge pond.* | Uses existing pond infrastructure.<br>Will store and stabilize solids far into the future. | May need light (low horsepower) mechanical aeration in future. | Can sequester solids from the water treatment stream for long-term stabilization. | $20,000 for overflow return piping.<br>+ $90,000 if light aeration is added. | Cell 1 can be dedicated to long-term sludge storage and stabilization. | Will manage solids.<br>Combine with other options.<br>Use as part of both short and long-term solutions. |
| Polishing process<br>*Install MBBR/IFAS in new shallow pond for nitrification.* | Uses existing pond infrastructure.<br>Will nitrify efficiently if effluent water quality is good and water is not cold. | Capital costs for blowers, media, and pond preparation.<br>Increases operation and maintenance requirements, often significantly.<br>Increases power costs.<br>Will produce sludge to be managed.<br>Algae accumulation can congest or clog media. | If provided with good effluent quality from Cell 4B may meet permit requirements (even for ammonia) except in winter. | $2 Million for MBBR polishing plant | Place in the abandoned/old sand filters.<br>Water quality from Cell 4B will need to be good.<br>Nitrification will slow (or even cease) in winter unless heated. | Expensive and difficult to operate.<br>May not remove ammonia in cold weather.<br>Do not use as either short-term or long-term solution. |
| Process alteration | | | | | | |
| Continuous-feed intermittent-discharge (CFID) pond system<br>*Install CFID in Cells 4A and 4B.* | Uses existing pond infrastructure.<br>Good to very good effluent quality.<br>Can be constructed within existing cells. | Sophisticated operation due to sequencing and sludge recycle.<br>Increased maintenance required (i.e. sequencing aerators, pumps, and controls).<br>The technology is innovative and lacks standard operating parameters (solids retention time, etc.).<br>Requires a lot of effort and time to operate and may not yield results as reliable as the simpler high-performance pond system. | Might consistently meet permit requirements, even for total ammonia. | $200,000 construction costs plus costs required to convert the system to a high-performance pond system. | Capital cost includes earthwork, bank lining, changes to onsite power, sequencing aerators, and recycle pumps.<br>Lack of standard operating parameters means a lot of trial and error (finetuning).<br>Has potential to improve effluent quality beyond a high-performance pond. But should be implemented with caution and sensitively to the capabilities of local operations staff. | With caution, consider using as alternate short-term solution. |

***Table 9: Kayenta WWTP – Improvement Option Summary***

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| Integrated fixed-film & activated sludge (IFAS) system<br>*Install IFAS in Cell 4A.* | Uses existing pond infrastructure.<br>Very good effluent quality.<br>Can be constructed within existing cells. | Capital cost.<br>Significant modifications to the plant are required.<br>Sophisticated operation.<br>Significant maintenance.<br>The technology is innovative and has no standard operating parameters (sludge age etc.). | Should consistently meet permit requirements, even for total ammonia. | $4.5 Million construction cost | Capital cost is high with earthwork, bank lining, media, changes to onsite power, blowers, and pumps.<br>Lack of standard operating parameters means a lot of trial and error. | Expensive and difficult to operate.<br>Should meet permit as operating experience is gained.<br>Do not use as either short-term or long-term measure. |
| New Plant | | | | | | |
| Activated sludge<br>*Construct new plant.* | Very good effluent quality. | High capital cost.<br>Sophisticated and expensive operation.<br>Significant maintenance effort.<br>Complete new construction is required. | Will consistently meet permit requirements, even for total ammonia.<br>NTUA has experience at operating two large and two small activated sludge plants. | $22 Million construction cost | Because a small footprint is required, many siting options are available.<br>Clearly defined operating parameters will assist operators. | Will consistently meet permit requirements.<br>Use as long-term solution. |
| Change Disposal | | | | | | |
| Complete retention<br>*Construct new ponds.* | No effluent.<br>Low maintenance and simple operation requirements. | Significant construction cost.<br>Large land parcel(s) required. Right-of-way will be objectionable to the community and expensive, difficult, and time-consuming to obtain.<br>May restrict future growth. | N/A - Eliminates need for NPDES permit. | $12 Million construction cost (does not include land costs) | Significant surface area (150+ acres) is required for complete retention.<br>Kayenta already has 30+ acres of pond surface area.<br>Therefore, 120 acres of new pond surface must be constructed and the corresponding amount of right-of-way must be obtained. | Too large.<br>Too expensive.<br>Do not use as either short-term or long-term measure. |

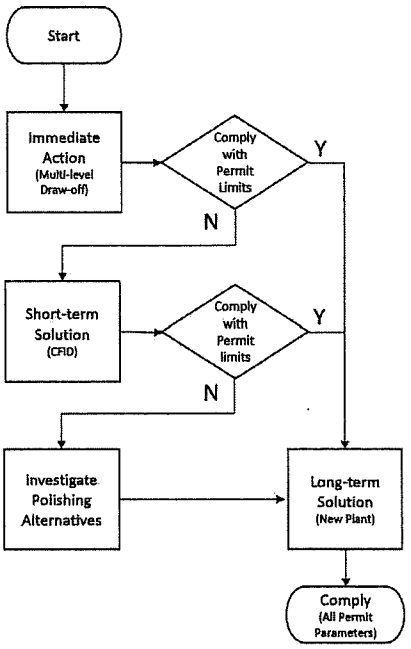
## 5. PATHWAY TO COMPLIANCE

Full compliance with the Kayenta facility's NPDES permit will be attained by constructing a new activated sludge treatment plant. The path to a new plant has interim steps. During the plant's conversion, sewage must continue to be managed by the existing facility. And the performance of the existing facility must be improved, to address discharged effluent for compliance. The treatment technology employed by the existing plant will be changed, through steps, until compliance is attained for all discharge parameters, except total ammonia. The steps to improve performance of the existing plant as listed and discussed below.

### 5.1 Treatment

The wastewater treatment technology employed at Kayenta will be changed from aerated ponds to a new activated sludge plant through a multi-step process.

*Figure 2: Kayenta WWTP - Pathway to Compliance*




- Starting Place - Recent improvements to the Kayenta plant and enhancements to operation and maintenance practices have laid the groundwork for improving the existing facility's treatment and effluent quality. Key improvements include cleaning, reshaping, and relining of Cells 2 and 3, and upgrades to the mechanical aeration system now operating on Cell 1. The improvement of these cells, together with aeration upgrades will allow straightforward modifications to the plant that will improve effluent quality in the near term.

- Asset Management – To plan for the long-term operation and maintenance of the Kayenta wastewater system, an asset management program is required by Section III.E of the permit. Asset management can begin on the collection system but must wait on the treatment facilities until a new plant is up and running. NTUA has a work order program to manage its assets at the current lagoon facility as described in the Asset Management Plan submitted to EPA.

- Immediate Action (multi-level draw-off) – Discharge from Cell 2 or 3 and bypass Cell 6. Improve the effluent water quality by regularly monitoring the water strata within Cell 2 or 3 and using the multi-level alternating discharge structure to tap into a clear layer. Cell 6 would be left hydraulically full but without flow-through. Determining which cell (2 or 3) to discharge from will depend on which cell can produce the better effluent quality. Monitoring and testing are required. This will be most important during the months of April through November.

- Short-term Solution (Continuous Flow Intermittent-Discharge) – A short-term solution will be implemented which consists of:
  - Aeration and mixing,
  - Extended flow path (baffling),
  - Shortened retention times,
  - Separate processes,
  - Settle and remove solids, and
  - Sludge storage and stabilization in a sequestered reactor.

This multifaceted short-term solution, commonly referred to as a continuous flow intermittent discharge (CFID) system,[33] will be created entirely within a refurbished Cell 4 at an estimated cost of $1.6 Million to design and install. The goal will be compliance with the NPDES permit effluent limits within 12 months of startup.

As shown in Figure 3, the short-term solution will require Cell 4 to be divided into three sub-cells, Cells 4A, 4B, and 4C by floating synthetic baffles. Wastewater will be directed from the existing headworks and lift station to Cell 4A through a new force main. Cell 4A will be aggressively aerated to disperse oxygen throughout the cell and to keep solids suspended in solution, thereby converting incoming sewage organics to biomass. Biomass-ladened water from Cell 4A will then flow to Cell 4B through a window in the floating baffle.

A CFID system incorporates sequencing aeration, anoxic mixing, and quiescent settling into Cell 4B, plus recycle from Cell 4B back to Cell 4A. However, because CFID systems are innovative, operating parameters (e.g. solids retention time, etc.) are not defined, resulting in sophisticated operation requirements. To implement a CFID the Kayenta operations staff must be capable. Outflow from the settling basin will be through a decanting weir, then into existing piping to the tailworks, where it will be discharged from the existing outfall to Laguna Wash.

The NTUA is currently preparing a disposal plan that addresses the disposal of dried sludge at Chinle, Kayenta, and Window Rock for submission to Region 9 and NNEPA for approval.

- Long-term Solution (new plant) – The NTUA will build a new activated sludge plant. The new plant is estimated to cost $22 Million to construct.[34] Securing funding will be a key challenge.
  - *Funding* – The NTUA will seek funding from various sources to reduce the project's impact on sewer customers. Grants are preferred but loans may be necessary. A United States Department of Agriculture (USDA) grant application has been submitted. NTUA is awaiting notification or application results. The USDA has Native American set-aside money for infrastructure projects provided in both grants and loans. A Clean Water Act – Indian Set-aside application will also be submitted through the US Indian Health Service's Sanitation Deficiency System. Grants and loans will also be sought from the State of Arizona and the Navajo Nation. An aggressive effort is planned to secure the necessary funding.
  - *Location* –The plant will be located immediately north of Cell 1.[35] No new rights-of-way will be required.

[33] Rich (1999)
[34] Smith PER (2019), Table 50
[35] Smith PER (2019), Figure 15

- *Design and Construction* – The NTUA has solicited proposals from engineering firms and has selected a design team based on qualifications. Qualifications included categories such as experience and the ability to perform the design within the needed timeframe. Once the design is complete, construction will be competitively bid to competent construction companies. Competent contractors will have a record constructing similar-sized water or wastewater plants within budget and on schedule.

- *Startup* – New activated sludge plants can take several months after first accepting sewage to build the bioculture required to perform effective treatment. The NTUA will shorten this startup period by seeding the plant with bacteria from the Twin Arrows, Shiprock, or Window Rock activated sludge plants.

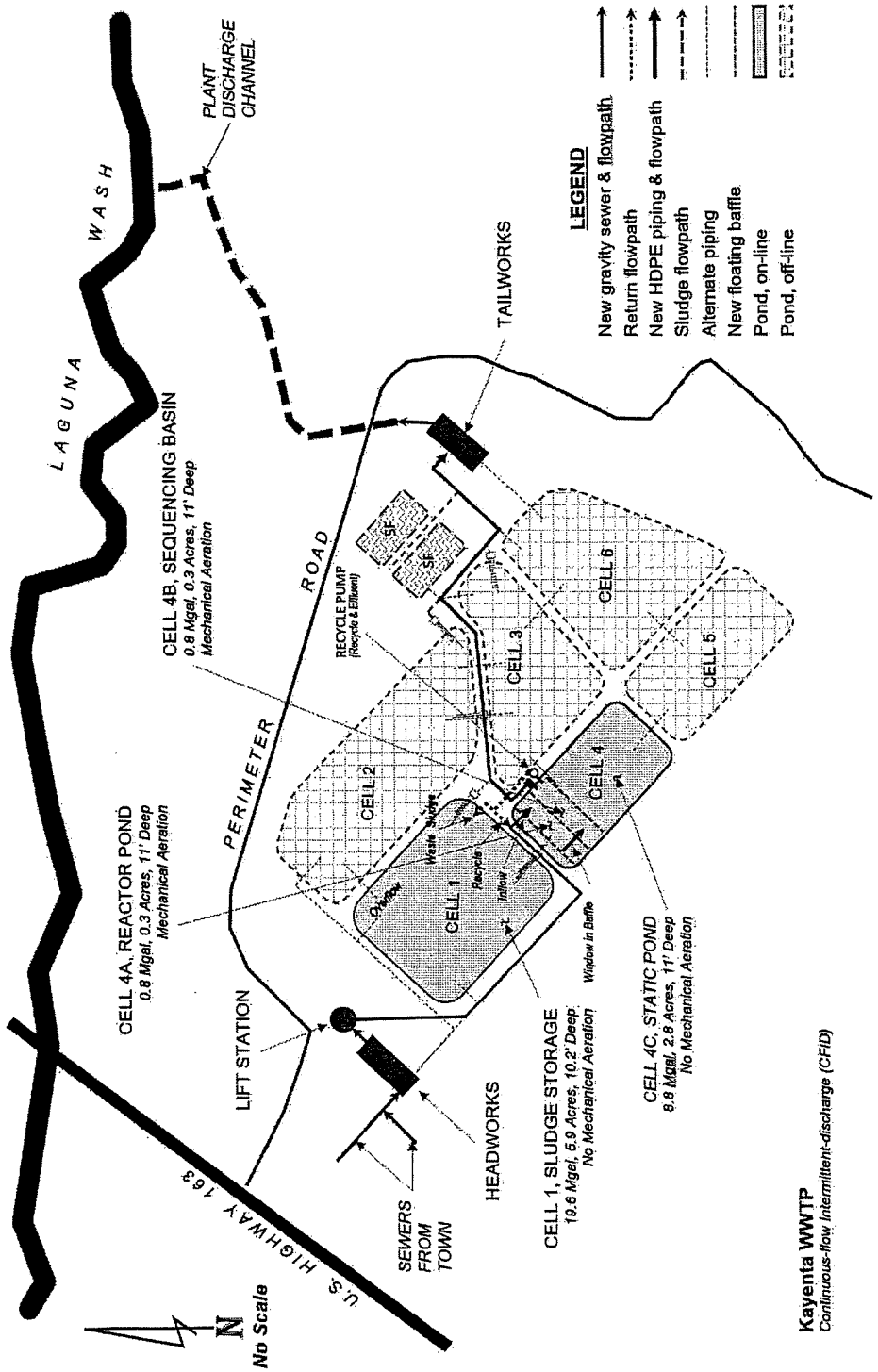
- *Decommissioning of Existing Facility* - All cells have biosolids that will require disposal. Once sewage is diverted to the new facility and the plant is up and running the old pond-based plant can be closed out. The ponds will be allowed to empty by evaporation/percolation or pumping liquid to the new plant. Pond 4 will be lined and maintained for future emergency operations. Synthetic liners in Cells, 1, 2, 3, and 6 will be torn-up and removed or buried in place. All buildings will be reused. Other concrete structures that are not needed and are above ground will be broken up or abandoned in place. Unneeded concrete structures, greater than two feet below the surface, will be backfilled and left in place.

- *Emergency Operation* – Cell 4 will remain. In the event of an upset or interruption of treatment at the new plant, water will be diverted to Cell 4 and retained, instead of discharging to Laguna Wash. Disposal from the cell will be through evaporation or pumping liquid to the new plant. The piping and flow structures necessary to convey water to the cell will be left in place. The site's perimeter fencing will be maintained.

- *Sludge Management* - A new activated sludge plant will produce about 6,000 gal/day of sludge with a solids content of 1.5%. This volume can be stored and stabilized for many years in Kayenta plant's existing ponds. Or sludge from the plant can be dewatered using a belt-filter press or centrifuge. About 2.8 $yd^3$/day of dewatered biosolids (at 1.5% solids content) can be expected. The disposal of sludge will be performed in accordance with 40 CFR Part 503.

- *Site Recovery* – Areas of the existing plant that will not be used will be abandoned in place. Pond liners will be removed and disposed of. Pits and vaults will be filled.

*Figure 3: Kayenta WWTP- Interim Measures (CFID)*



**5.2 Operations**

Except for asset management, operational practices at the Kayenta plant have recently come into compliance with the permit requirements. Operational compliance must be maintained throughout construction. And the good operational practices, recently implemented, can be built upon to provide quality operation and maintenance of a new plant.

- Current and Interim Operation – There will be a period of several years until a new plant can be brought online. The methodical operation and reporting practices recently developed at Kayenta will continue, assuring that good treatment occurs at the facility. The immediate action (multi-level draw-off) does not require increased operating skills. NTUA will provide monthly updates on progress, conclusions, and any proposed changes in operations as they monitor water quality and progress through the flow chart shown in Figure 2 with Region 9 and NNEPA. NTUA will contract with a consulting firm to provide on-call technical guidance for staff during interim operations.

- Training for Interim (Short-term) Operations – The NTUA operates wastewater pond facilities at many locations across the Navajo Nation. The NTUA's new wastewater pond operation and maintenance training program may have been spurred by AOCs from Region 9 and the NNEPA, but it was envisioned as filling the wider need to better operate the Authority's many pond-based wastewater facilities. This training will be continued and improved as a basis from which future operators are trained for the NTUA's wastewater pond facilities.

- Operation and Maintenance Manual – The existing Kayenta WWTP O&M manual will continue to be reviewed and used during the immediate action solution. However, the manual will be modified and revised to reflect the high-performance pond system and the CFID system if needed. And a new O&M manual will be provided by the design engineer when the new plant goes online.

- Monitoring and Reporting – Good operational practices at the Kayenta facility will be continued during the implementation of immediate action and short-term solutions. Key among the good practices for immediate action is weekly monitoring of the stratification in the pond immediately prior to adjusting the multi-level discharge. Monitoring stratification is required to access the clearest water layer. Regular monthly compliance sampling, testing, and reporting will continue uninterrupted.

- Future Operation - Before startup, the NTUA will create a training program to develop and prepare operators to run the new Kayenta facility. Formal education from federal, tribal (ITCA),[36] and state (AZ and NM), and in-house NTUA classes and workshops will be combined with mentoring from the experienced staff at the Shiprock and Window Rock plants. Operator certification will be required. Plant management and operations oversight can be contracted to specialty firms if needed. The design engineer and the manufacturers and suppliers/vendors of the equipment and controls will be required by specification to participate in start-up, troubleshooting, and hands-on operator training.

- Emergency Operations – During the immediate solution's multi-level draw-off approach, the emergency operating procedures detailed in the existing Kayenta WWTP O&M manual will continue to be reviewed by the operations staff and followed. The emergency procedures will be updated to reflect the short-term

[36] ITCA - Inter-Tribal Council of Arizona, Inc

solutions of a high-performance pond system and a CFID system, as needed. Eventually, for the long-term solution of a new plant, a new O&M manual, with emergency procedures, will be provided.

- Sludge (biosolids) Management – Biosolids in all cells and all future biosolids produced will be disposed of in accordance with 40 CFR Part 503. NTUA is in the process of investigating possible disposal options for the current on site biosolids in the cells and the future biosolids that will be produced from the activated sludge plant. These options may include hauling to a landfill, permanent on site surface disposal, or land application. The NTUA is currently preparing a disposal plan that addresses the disposal of dried sludge at Chinle, Kayenta, and Window Rock for submission to Region 9 and NNEPA for approval.

- Qualifications – A Level 2 wastewater certification is required to operate the current Kayenta facility. The NTUA will continue efforts to attract and retain experienced, qualified operators. A Level 4 certification is required for the new plant.

### 5.3 Schedule to Compliance

It is estimated that construction and start-up for the new plant will take 2 years[37] to complete.

### 5.4 Summary

To achieve compliance with the Kayenta NPDES permit a multi-step pathway is proposed. The existing aerated pond system that uses a multi-level draw-off structure is the best fit technology to improve effluent quality at the Kayenta plant immediately. Discharge will continue to be made through the existing permitted outfall in Laguna Wash. Imperative in this strategy is the continued dialogue between NTUA and EPA. NTUA will make good faith efforts to meet all NPDES permit requirements. NTUA compliance efforts will entail monitoring all NPDES permit requirements for trending improvements toward compliance and making operational and/or facility adjustments to meet this objective. If trends toward compliance become stalled, NTUA will investigate additional alternatives to reach compliance and discuss options and recommendations with EPA. In the short term, if the draw-off does not provide effluent that meets the BOD and TSS permit limits, then the plant will be converted to a continuous-feed intermittent-discharge system. A new activated sludge plant will be constructed and brought online to dependably meet permit requirements in the long term. Operation and maintenance activities will be kept in step with the treatment technologies as they are brought into service. The total costs for the projects, both the CFID and activated sludge treatment systems, are estimated to be a combined $24 Million. Biosolids planning for the new plant over the long term will be conducted.

[37] Smith Engineering PER, Section 6.B estimates 36 months for just engineering and construction.

# *APPENDIX A - KAYENTA CALCULATIONS*

## DESIGN FOR INTERIM MEASURES

**Continuous Feed Intermittent Discharge (CFID)**

The continuous feed intermittent discharge (CFID) system proposed here modifies the Kayenta WWTP aerated lagoon system according to concepts developed by Linvil Rich[1]. The CFID will be located entirely within Cell 4. Cell 1 will be utilized for the storage of sludge. The design parameters for a CFID system at Kayenta WWTP and a conceptual design schematic follow.

The CFID is designed to use in-basin sequencing (aeration/mixing, settling, and decant) similar to sequencing batch reactor technology (SBR) to uncouple the bacteria/solids retention time (SRT) from the hydraulic retention time (HRT). As in an SBR, the discharge is intermittent and dependent upon treatment sequencing. Unlike an SBR sewage inflow is continuous. The sequencing is operated by an automatic timer and water level switches through a programmable logic controller (PLC). Uncoupling the SRT and HRT allows bacteria to remain in the system much longer with beneficial treatment effects, especially nitrification. The design parameters for a CFID basin at Kayenta and a conceptual design schematic follow.

1. Average daily flow rate between January 2010 and March 2021 is 0.42 Mgal/day. The design flow rate is 0.5 MGD. Organic loading over the same period averaged BOD=350 mg/L. For design, nitrogen loading is assumed to have a TKN=50 mg/L. The CFID is designed for BOD, TSS, and ammonia removal to meet the discharge limits outlined in the Kayenta WWTP National Pollution Discharge Elimination System (NPDES) permit.
2. Cell A will be modified. The geometry at water surface of Cell 4 is:
    a. L = 553'
    b. W = 282'
    c. Water depth = 11'
    d. Total Volume = 10.7 Mgal
3. Use floating baffles to create two treatment sub-cells, Cell 4A and 4B.
    a. The CFID basins in Cell 4 are created by three hanging baffles. Cell 4A is created by two hanging baffles, one located at the toe of the side wall and the other to separate Cell 4A from Cell 4B. The third baffle separates Cell 4C from Cell 4B. The baffles are installed in an east-west configuration.
    b. Flow will be in series through Cell 4A to Cell 4B.
    c. Cell 4A is aggressively aerated/mixed to prevent short-circuiting, provide ample oxygen, and prevent solids from settling. The conversion of sewage organics into biomass is accomplished in this cell.
    d. Flow between 4A and 4B is provided via a window in the baffle wall.

[1] Rich, Linvil, High Performance Aerated Lagoon Systems, American Academy of Environmental Engineers, Annapolis, MD (1999)

e. Cell 4B sequences from aeration to quiescent settling and decanting during a 6-hour cycle[2]. During the aeration sequence, the cell is aggressively aerated/mixed. In the setting sequence, solids drop out of solution. During the decanting sequence, clarified liquid is removed from the water surface. Cell 4B is operated in sequence controlled by a PLC.

f. Cell 4C - A large part of Cell 4 is not required for the operation of a CFID. The volume remaining after the creation of Cells 4A and 4B is Cell 4C. The cell will not have discharge, other than evaporation. Water level in Cell 4C will fluctuate because of slow seepage around the floating baffle from Cell 4B. Odors will not result from Cell 4C because there is no organic loading.

g. The dimensions of each compartment in Cell 4 are:

A baffle is set at the bottom toe of the south wall of the pond. The second baffle is installed 46 ft from the first and forms the first reactor cell. Total volume of Cell 4A is 0.8 Mgal and detention time is 1.6 days.

A third baffle is installed 46 ft from the second to form Cell 4B. The geometry of Cells 4A and 4B is identical. The volume of Cell 4B is also 0.8 Mgal and detention time is 1.6 days.

4. Diffused air system will be utilized to aerate and mix Cell 4A. Aeration and mixing will be provided by aspirating aerators in Cell 4B.

a. Cell 4A - Complete suspension by injecting 2,672 cfm air to provide oxygen to degrade biological oxygen demand (both organic and nitrogen oxygen demands). This air supply will also meet the minimum complete mixing requirement. The floating diffused air system requires 4 cfm/1000 cf for mixing. Mixing intensity in Cell 4A is 21 cfm/1000 cf.

a. Cell 4B – Complete suspension mixing/aeration will be provided by two 25-hp aspirating aerators. Mixing/aeration (30 hp/Mgal minimum) is required for 4 out of every 6 hours.

5. Hydraulic Retention Time
   a. Cell 4A - All incoming organics are converted to biomass in Cell 4A in 1.6 days.
   b. Cell 4 B – Four 6-hour sequences (aeration, settling, and decant) cycles are provided each 24 hours. Discharge occurs after 4 hours aeration and 1-hour settling at a flow rate 6 times the inflow for an hour. Clarified liquid overflows a floating weir that also serves as a decanter before disinfection and discharge.
   c. Algae control requires the retention time not exceed 4 days total[3].
6. A recycle flow rate equal to the inflowing sewage rate (Q) is initially specified. The rate can be adjusted during operation to optimize treatment.

---

[2] Rich, Example 6-1, Step 15 for Average Dry Weather Flow (ADWF)

[3]Hydraulic retention should be limited to 4.5 days total: (1) Reactor Pond - Rich (pg. 50) notes that sewage organics are converted to biomass and formed into floc in 1.5 days but best if under 3 days (pg. 109). (2) Settling Pond - Rich (pg. 79) also notes algae (showing up as effluent TSS) begins to become a problem after 2 to 2.5 days. (3) Two ponds in series: Reactor Pond and Settling Pond = 1.5 days + 2.5 days or 2 days + 2 days. Therefore, 4 days total time is recommended (Rich, Figure 3.3).

7. Outflow of treated effluent from Cell 4B and water levels are controlled by using an SBR-type floating weir. Discharge is timed to fit the decant sequence.
8. Sludge Removal – Solids are removed from Cell 4B by wasting a small fraction of recycle mixed liquor suspended solids via the recycle pump daily. Waste MLSS will be deposited into Cell 1 causing a sludge blanket to develop on the cell's floor. Sludge will be retained for long-term stabilization.

**Sludge Handling**

1. The volume of sludge pumped to Cell 1 is estimated to be about 10,000 gal/day and evaporation rate is estimated to be about 22,000 gal/day. Cell 2 can be utilized for additional surface area if required.

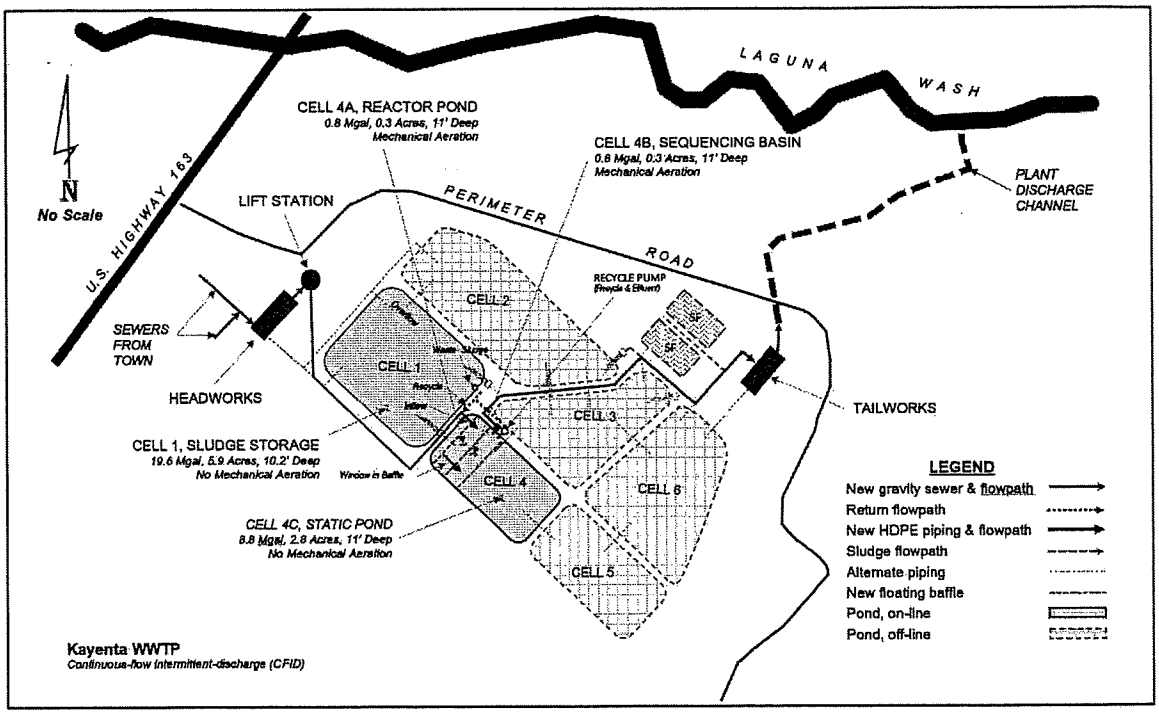



**Figure A-1: Continuous-Feed Intermittent Discharge (CFID) Schematic**

# APPENDIX D:

# TUBA CITY WASTEWATER TREATMENT PLANT COMPLIANCE PLAN

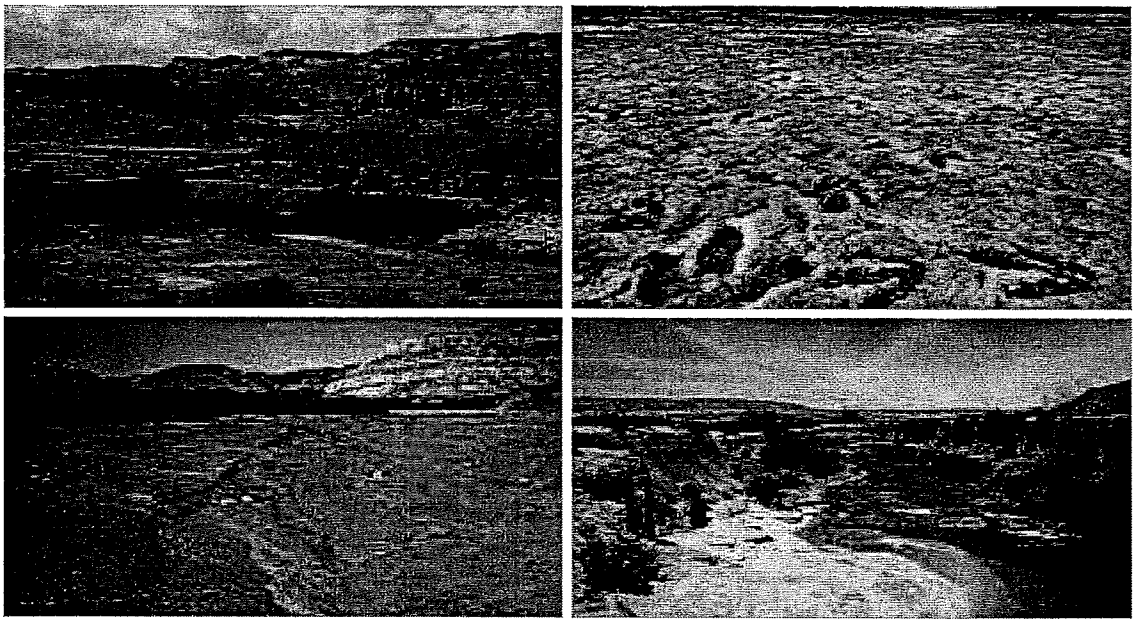
COMPLIANCE PLAN

Navajo Tribal Utility Authority

# Tuba City Wastewater Plant

Response to Administrative Order on Consent

*Docket No. CWA-309(a)-16-001, NPDES Permit No. NN 0020290*



**November 2018** (revised August 2019, December 2019, June 2021, March 2022, and March 2023)

Prepared for:

**Navajo Tribal Utility Authority**

*Office of the Deputy General Manager* PO Box 170, Ft. Defiance, AZ 86504

Prepared by:

**WSP**

*4221 Balloon Park Rd. NE, Albuquerque, NM 87113,*

*505.821.1801*

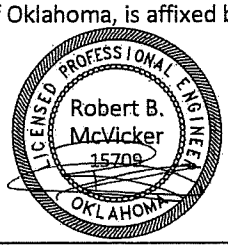
# Tuba City Wastewater Treatment Plant
# COMPLIANCE PLAN

Response to Administrative Order on Consent
Docket No. CWA-309(a)-16-001, NPDES Permit No. NN 0020290

November 2018
Revised August 2019
Revised December 2019
Revised June 2021
Revised March 2022
Revised March 2023

Navajo Tribal Utility Authority
Office of the Deputy General Manager
PO Box 170, Ft. Defiance, AZ 86504

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of Oklahoma, is affixed below.




Robert B. McVicker, PE (OK 15709)

## TABLE OF CONTENTS


| | | |
|---|---|---|
| 1. | COMPLIANCE HISTORY | 1 |
| 2. | COMPLIANCE STATUS | 2 |
| 2.1. | Discharge Limit Violations | 2 |
| 2.2. | Operational Deficiencies | 4 |
| 2.3. | Compliance Milestones | 5 |
| 3. | PRESENT FACILITY | 7 |
| 3.1. | Treatment | 7 |
| 3.2. | Operation and Maintenance | 11 |
| 3.3. | Summary | 12 |
| 4. | COMPLIANCE OPTIONS | 13 |
| 4.1. | Treatment | 13 |
| 4.2. | Operations | 18 |
| 4.3. | Conclusion | 18 |
| 5. | PATHWAY TO COMPLIANCE | 23 |
| 5.1. | Treatment | 23 |
| 5.2. | Operations | 28 |
| 5.3. | Schedule to Compliance | 29 |
| 5.4. | Summary | 29 |


## TABLES


| | |
|---|---|
| Table 1: Tuba City WWTP - Permit Violations (by Year and Parameter) | 3 |
| Table 2: Tuba City WWTP – Average Effluent Sampling Results (by Month & Parameter) | 4 |
| Table 3: Tuba City WWTP - Compliance Milestones | 6 |
| Table 4: Tuba City WWTP – Effluent BOD | 8 |
| Table 5: Tuba City WWTP – Monthly Effluent BOD and TSS | 9 |
| Table 6: Tuba City WWTP – Effluent Total Ammonia | 9 |
| Table 7: Tuba City WWTP – Improvement Option Summary Table | 19 |


## FIGURES


| | |
|---|---|
| Figure 1: Tuba City WWTP – Existing Treatment Scheme | 7 |
| Figure 2: Tuba City WWTP - Pathway to Compliance | 23 |
| Figure 3: Tuba City WWTP – Short-Term Solution (HPP) | 25 |
| Figure 4: Tuba City WWTP – Alternate Short-term Solution (CFID) | 26 |


## APPENDIX


| | |
|---|---|
| Appendix A: Tuba City WWTP - Design of Interim Measures | 30 |

## 1. COMPLIANCE HISTORY

The Tuba City wastewater facility is not complying with its National Pollution Discharge Elimination System (NPDES) permit. Troubles with the facility's compliance and the Navajo Tribal Utility Authority's (NTUA) struggle to bring the plant into full compliance date back to at least 2010 and continue today. Key events since 2010 are listed below.

- Region IX: NPDES Permit (December 1, 2010) - The Tuba City wastewater facility NPDES permit (No. NN0020290) was reissued with modifications to the biochemical oxygen demand, 5-day (BOD) and total suspended solids (TSS) limits, and the introduction of a total ammonia limit.

- Region IX: Plant Inspection (July 25, 2014) – Environmental Protection Agency (EPA) Region 9 staff inspection of the Tuba City wastewater facility to evaluate compliance with the permit. The inspection found several operation and maintenance shortcomings and determined effluent from the wastewater facility exceeded permit limits.

- NNEPA: Administrative Order (October 28, 2014) – An Administrative Order on Consent (AOC) issued by the Navajo Nation's Environmental Protection Agency (NNEPA) became effective. The NN AOC found the NTUA was not in compliance with its NPDES requirements at six of its permitted facilities.[1] The NN AOC required the NTUA to secure a consultant, by December 17, 2014, to assist the Authority in preparing the plans. The NTUA and consultant were then to prepare draft compliance plans for each site by June 10, 2015. The compliance plans were to address at least the following concerns for each facility.

    - TRC – Describe how chlorine used for disinfection was to be removed from the effluent prior to discharge or outline an alternative, replacement disinfection system.
    - E. coli, BOD, and TSS – Describe how each facility will correct the permit deficiencies for these parameters.
    - Ammonia – Describe how pH, temperature, and ammonia were to be sampled and tested for compliance with the permit at each facility.
    - O & M – Prepare an operation and maintenance (O & M) plan for each facility and describe how the O & M plans will prevent future violations.

- NTUA: Compliance Plan (September 2015) – In response to both the plant inspection and communications with Region IX, the NTUA issued a Compliance Plan[2] designed to bring the Tuba City wastewater facility into compliance with its permit. The Compliance Plan was intended to improve the treatment of organics and suspended solids.

- Region IX: NPDES Permit (June 1, 2016) – The current permit was reissued with no changes in the discharge limits from its 2010 predecessor. Its term ends on May 31, 2021.

---

[1] The Navajo Townsite facility has since been removed from the NPDES program. Currently there are nine NTUA facilities with NPDES permits.

[2] Smith Engineering, Tuba City Wastewater Treatment Plant, NPDES Permit Compliance Plan, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (September 2015)

- NTUA: O&M Manual (August 2016) – An operation and maintenance manual[3] was issued for the Tuba City wastewater facility.

- Region IX: Administrative Order (September 26, 2016) - An Administrative Order on Consent (AOC) became effective. The Region AOC found that NTUA at the Tuba City wastewater facility had:
    - discharged pollutants in amounts greater than permit limits,
    - failed to properly sample,
    - failed to submit complete and timely reports, and
    - failed to perform adequate operation and maintenance.

  The findings are based on actions and practices that occurred between December 2010 and June 2016. The AOC directed the NTUA to implement the mitigation measures proposed in the Compliance Plan of 2015.

- NTUA: Performance Evaluation (May 18, 2017) – An assessment[4] of the Tuba City wastewater facility was performed to identify operational conditions and practices that would bring the system into long-term, sustained compliance.

- NTUA: Implementation Plan (November 15, 2017) – To report progress at improving performance and operational practices at the Tuba City wastewater facility, a Performance Implementation, and Monitoring Plan[5] was prepared by the NTUA.

## 2. COMPLIANCE STATUS

The 2016 AOC directs the NTUA to take all measures necessary to comply with both the operational and discharge requirements of the NPDES permit and envisions that most of the needed measures to do so are defined by the 2015 Compliance Plan. While the Tuba City wastewater treatment plant (WWTP) regularly violates its discharge limits, the NTUA has recently moved the facility into compliance with the permit's operational requirements. The AOC and 2015 Compliance Plan established milestones by which progress can be measured.

### 2.1 Discharge Limit Violations

The discharge parameters regulated by the Tuba City NPDES permit are BOD, TSS, pathogens (E. coli), total residual chlorine (TRC), pH, and total ammonia. Samples of the wastewater facility's effluent are taken monthly. BOD and TSS are sampled by composite; everything else is by a discrete collection. A short history of the facility's discharge violations is provided in Table 1 and discussed below.

---

[3] Smith Engineering, Tuba City Wastewater Treatment Plant, Operation and Maintenance Manual (draft), *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (August 2016)

[4] Harris, Steve, Performance Evaluation of the Tuba City Wastewater Lagoon System, H&S Environmental, LLC, Mesa, AZ (May 18, 2017)

[5] NTUA Technical Memorandum (Draft), Tuba City Lagoon, Performance Implementation and Monitoring Plan, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (November 15, 2017)

***Table 1: Tuba City WWF - Permit Violations (by Year and Parameter)***

| Year<br>Discharge Parameter | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021<br>Jan - Feb | Total | % of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $BOD_5$ | 5 | 1 | 2 | 3 | 2 | 3 | 1 | 2 | 4 | 2 | 0 | 25 | 15.2% |
| TSS | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 1.8% |
| E. coli | 4 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 6.1% |
| TRC | 11 | 8 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 16.5% |
| pH | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 2 | 7 | 2 | 17 | 10.4% |
| Sub-Total | 20 | 13 | 10 | 4 | 2 | 8 | 5 | 3 | 6 | 9 | 2 | 82 | |
| Months w/ Discharge | 12 | 9 | 12 | 12 | 12 | 12 | 12 | 11 | 11 | 12 | 2 | 117 | |
| Total Ammonia | 9 | 6 | 7 | 7 | 9 | 10 | 7 | 10 | 8 | 7 | 2 | 82 | 50.0% |
| Months w/ Ammonia Data | 11 | 9 | 12 | 10 | 12 | 12 | 12 | 11 | 11 | 10 | 2 | 112 | |
| Total Violations | 29 | 19 | 17 | 11 | 11 | 18 | 12 | 13 | 14 | 16 | 4 | 164 | 100.0% |

Notes: Values reflect the number of months each year when sampling results exceeded/violated the monthly average (BOD, TSS, and total ammonia), daily maximum (E. coli and TRC), or (pH) values allowed by the NPDES permit for the given parameter. Daily loading (BOD and TSS), which is a function of both concentration and flow, is given a limit in the permit but is not considered. Whole effluent toxicity (WET) testing is not included or considered here.

- BOD – The concentration of degradable organics is **regularly not compliant**. In 2010 the limit for BOD was raised from 30 mg/L to 45 mg/L. Since then, on average, two to three samples each year were in violation. BOD violations always occur between April and August, with most events coming in May, June, and July.

- TSS – The concentration of suspended solids is **usually compliant**. In 2010 the limit for TSS was raised from 30 mg/L to 90 mg/L. Since then, the plant was only out of compliance three times. The worst month for TSS, by far, is June.

- E. coli – This monitor of pathogenic content is **usually compliant**. After a disinfection system upgrade was brought on-line in 2012, there have been only two permit violations. The violations were the result of operator error in October and December of 2016.

- TRC – Since a sulfur dioxide dechlorination unit process was upgraded in 2014, the residual chlorine concentration has been **consistently compliant**.

- pH – The effluent pH is alkaline, above 8.5 and below 9.0, but is **regularly not compliant**. Elevated pH can be caused by algae. The facility exceeded its maximum pH limit seventeen times since 2011.

- Total Ammonia – The concentration of total ammonia is **regularly not compliant**. The limit on total ammonia was new in the 2016 permit[6] and is sometimes below 1.0 mg/L.[7] Since 2011, the concentration of total ammonia in the effluent has exceeded the recent limits about half the time. Total ammonia violations generally occur in the winter and spring.

[6] The limit on ammonia is set by the Navajo Nation Surface Water Quality (NN SWQ) Standards and was established by considering toxicity to aquatic life. The standards call for total ammonia levels that will vary with each sampling event, depending on simultaneous pH and temperature, with pH having the greatest influence. The higher the pH and temperature, the lower the total ammonia limit.

[7] The ammonia impact ration (AIR) in the permit is 1.0.

Of the six permit parameters discussed above, two (E. coli and TRC) are treated by physical/chemical processes and the remaining four (BOD, TSS, pH, and ammonia) are affected by biological processes. And ammonia is significantly affected by volatilization to the atmosphere. Operators of pond-based facilities have significant control over a physical-chemical process but little control over biological processes. Because of system upgrades and improved operation and maintenance practices, the parameters treated by physical processes have only been in violation three times since 2012.

If violations of parameters treated by physical processes are not considered from 2011 to present, the facility exceeds one of the four remaining biological affected parameters nearly 12 times each year. As implied from Table 2, the high effluent BOD concentrations are from April through July and highest ammonia concentrations are from December through May. Monthly exceedances of total ammonia make up most of such violations (50.0%), followed by BOD (15.2%). Together total ammonia and BOD account for 64.6% of the violations associated with biological treatment.

***Table 2: Tuba City WWTP - Average Effluent Sampling Results* (by Month and Parameter)***

| | BOD (mg/L) | TSS (mg/L) | Total Ammonia (mg/L) |
|---|---|---|---|
| January | 30.4 | 38.1 | 8.0 |
| February | 28.4 | 38.8 | 16.1 |
| March | 35.5 | 44.5 | 15.7 |
| April | 49.6 | 46.7 | 15.4 |
| May | 67.0 | 42.7 | 12.5 |
| June | 64.9 | 72.4 | 2.7 |
| July | 49.4 | 47.7 | 1.5 |
| August | 31.8 | 49.5 | 1.6 |
| September | 33.9 | 44.9 | 0.7 |
| October | 32.8 | 59.2 | 0.3 |
| November | 29.6 | 46.0 | 1.8 |
| December | 30.4 | 46.6 | 4.8 |
| Average | 40.3 | 48.1 | 6.8 |
| NPDES Permit Limit | 45 | 90 | Can be < 1.0 |

*Using monthly data for the years January 2011 through February 2021.

### 2.2 Operational Deficiencies

The Region IX plant inspection in 2014 found the NTUA failed to take samples and submit testing results, did not complete and promptly submit required reports, and failed to adequately operate and maintain the facility. The NTUA has taken steps to correct these operational deficiencies.

- Sampling and Reporting – The monthly sampling and testing required by the permit has been **consistently performed** since 2010. Required reports were completed and submitted on time since 2015.

- Operation and Maintenance – Regular in-house operator training began in August 2017. Operation and maintenance have been **standardized and scheduled** with a checklist for the Tuba City facility since December 2017.

Other operational deficiencies include a lack of valve maintenance, improperly setup flow meters, and a lack of sludge management planning.

- Aeration - Keeping the aerators at the facility operational has been problematic and they are, at times, out of service for repairs.

- Flow Metering – The inflow and outflow meters are set up incorrectly. Notably, the ultrasonic probe is misaligned with the water surface profile.

- Sludge Management – A 12-month chemical sludge reduction program was completed in July 2018.[8] A sludge judging exercise to determine the effectiveness of the reduction program and sludge accumulation **was completed** in June of 2020. A sludge report, required by Section D.1 of the permit, **was submitted** to Region IX on January 22, 2021.

- Isolation Valves - Some isolation valves (such as at the multi-level draw-off structures) are nonfunctional, closed shut, and cannot be opened.

### 2.3 Compliance Milestones

Compliance milestones for the Tuba City facility are identified in either the AOC or the 2015 Compliance Plan.[9] The milestones are listed and discussed in Table 3. Fifteen (15) out of 17 milestones were completed, but not on schedule.

[8] Harris (2017) did not report Cell 3 having sludge accumulation issues but did recommend sludge removal for Cell 1. This sludge reduction program is for Cell 1.
[9] The Smith, NPDES Permit Compliance Plan (2015) is included by reference in the AOC per Paragraph 32.

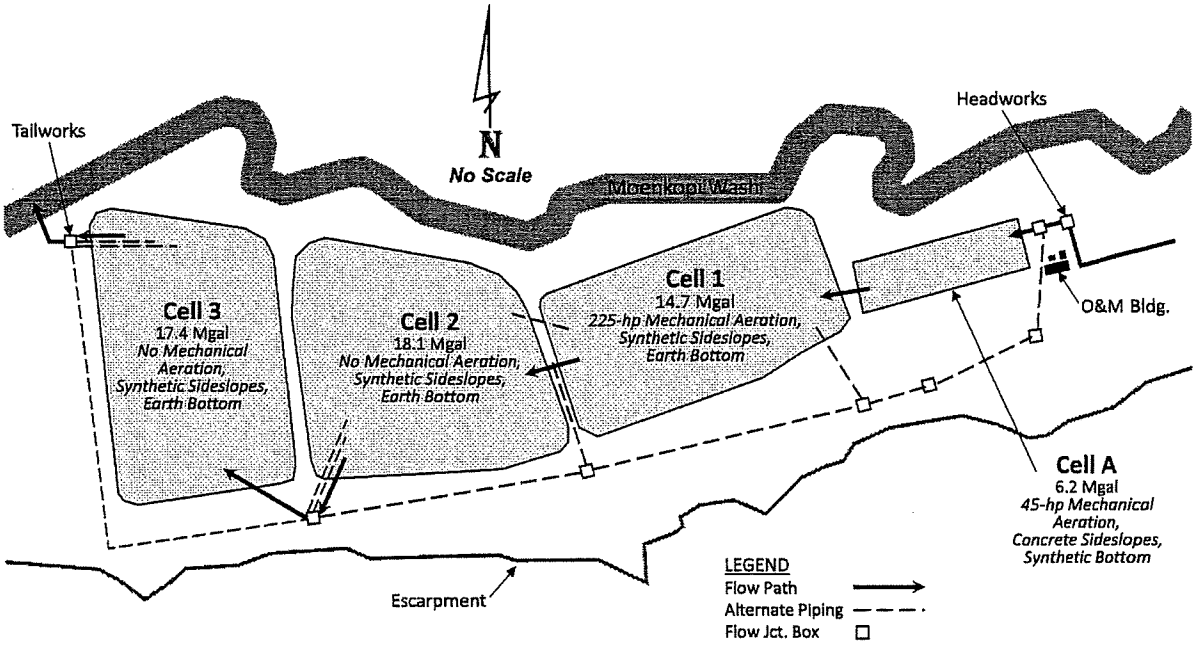
***Table 3: Tuba City WWTP - Compliance Milestones***

| | Milestone | Required Compliance Date | Reference | Compliance Status | Comment |
|---|---|---|---|---|---|
| 1 | Hire a Regulatory Compliance Consultant | 17-Dec-14 | NNEPA AOC | Complete | NTUA hired Smith Engineering to draft the first compliance plan submitted in September 2015. On 11-Nov-2018 the NTUA hired Wood E&IS to assist in preparing replacement compliance plans. |
| 2 | Submit Compliance Plans | 10-Jun-2015 | NNEPA AOC | Complete | NTUA submitted a compliance plan to the Region IX in September 2015. The compliance plan was incorporated into the Region IX AOC. |
| 3 | Design Aeration Upgrades | 12/30/15 | 2015 Compliance Plan, Table 8 | Complete | Design issued 10/21/2016. |
| 4 | Chlor/Dechlor Process Testing | 1/1/16 | 2015 Compliance Plan, Table 8 | Complete | Initiated on 08/28/2017. |
| 5 | Procure Aeration Equipment | 3/30/16 | 2015 Compliance Plan, Table 8 | Complete | Purchased on 05/18/2017. |
| 6 | Install Aeration Equipment | 6/30/16 | 2015 Compliance Plan, Table 8 | Complete | Construction completed 10/19/16. Punch listed completed on 7/31/17. |
| 7 | Chlorine Contact Chamber Improvements | 6/30/16 | 2015 Compliance Plan, Table 8 | Complete | Installation finished on 01/30/17. |
| 8 | Clean Cell A | Apr. 2016 | 2015 Compliance Plan, Table 8 | Complete | Opted for sludge reduction additive instead. Application for CBX PR oxidizer began in August 2017 and ended July 2018. |
| 9 | Complete Plant O&M Manual | 1/1/16 | 2015 Compliance Plan, Section 2.8 | Complete | Manual written and issued on 12/09/2016. |
| 10 | Lagoon Process Testing | Begin Jan. 2016 | AOC, Paragraph 32 | Complete | Began on 08/28/2017 and is ongoing. |
| 11 | Quarterly Compliance Reports | Begin 10/10/16 | AOC, Paragraph 38 | Complete | 2018 Q1, Q2, Q3, and Q4 submitted. 2019 Q1 and Q2 submitted. |
| 12 | Compliance I Report | 10/29/16 | AOC, Paragraph 41 | Complete | The NTUA engineering staff has changed with David Shoultz, Principal Engineer replacing Thomas Bayles, Division Manager. This was communicated during the Fall 2017 quarterly call between NTUA, NNEPA, and Region 9. |
| 13 | Operator Training Plan | 10/31/16 | AOC, Paragraph 34 | Complete | Initial training completed on 8/25/17. Continuing one-on-one training. NPDES permit training provided to field managers. |
| 14 | Fully Implement Compliance Plan | 10/31/16 | AOC, Paragraph 32 | Pending revisions | Focusing on existing pond performance improvements. |
| 15 | Full Compliance with Permit | 1/30/17 | AOC, Paragraph 37 | Incomplete | Effluent quality is in partial compliance. Operational practices are complying. |
| 16 | Responsible Operator | 3/28/17 | AOC, Paragraph 42 | Complete | The plant's operations are overseen by Jimmy Dugi, Tuba City District Water & Wastewater Foremen, a Level III WW Operator. |
| 17 | Sludge Reporting | 01-Mar-17 | NPDES Permit, Section D.1 | Complete | Sludge report was submitted to EPA on January 22, 2021. |

## 3. PRESENT FACILITY

The Tuba City wastewater facility is an aerated pond system with a headworks, earthen basins, piping, and tailworks. The plant has not changed its basin volume or layout and piping for decades. Over the years, however, the facility has been operated under different flow schemes and with different ponds being offline for maintenance. [10] Today, the plant receives and treats 655,000 gal/day[11] of municipal sewage with typical municipal strength[12] and all ponds are active and operating with series flow, as shown in Figure 1.

***Figure 1: Tuba City WWTP – Existing Treatment Scheme***




### 3.1 Treatment

Pond-based systems are limited and variable in their ability to treat wastewater. Still, the NTUA has made significant investments in facility upgrades and improved operations at the Tuba City plant. The investments were designed to reduce variability in the plant's effluent quality and improve overall treatment.

- Recent Upgrades - Since 2010 four improvement projects together costing over $2 million have been completed at the Tuba City facility.
    - *Basin Rehabilitation (2010, 2012, and 2014)* – Cells 1, 2, and 3 were cleaned, reshaped, and their side-slopes were protected with synthetic liners. All the ponds were back online and operating in 2015. Combined these pond improvement events cost $1,011,255.

[10] Cells 1, 2, and 3 were alternately cleaned, shaped, and lined from 2010 through 2014. Each cell was taken offline in sequence, for close to a year each, to perform the work.
[11] Based on the average monthly flows recorded at the plant in 2017.
[12] Influent BOD in mg/L is 250 averages, 239 median, and 342 90th-percentile. Influent TSS in mg/L is 229 averages, 232 median, 334 90th-percentile. These figures were determined from monthly sampling results from 2017.

- *Chlorine Contact Chamber Improvements (2011)* – The chlorine gas injection piping was repositioned to the front of the serpentine tank to increase contact time. The chlorine disinfection enhancements cost $314,455.

- *Dechlorination System Reconfiguration (2013)* – The sulfur dioxide injection piping was reconfigured, and a small mixer was added to provide better contact between sulfur dioxide and free chlorine in the water. The sulfur dioxide system cost $91,000.

- *Aeration Upgrades (February – July 2017)* – The existing floating surface aerators were repaired, and new ones installed. With the old aerators, totaling 45-hp on Cell A and the new aerators totaling 225-hp on Cell 1, the mechanical power increased from 45-hp up to 270-hp. Consequently, the facility's electrical service was upgraded and expanded. Upgrading the aeration was recommended by the 2015 Compliance Plan and cost $616,189.

- Improved Performance – A review of Table 1 shows compliance has been obtained for the two chemical/physical processes (TRC and E. coli) affected by the chlorination and dechlorination improvement projects. The four parameters (BOD, TSS, pH, and total ammonia) affected by biological processes within the ponds show no compliance improvement. However, BOD and total ammonia show reduced concentrations in the effluent. The timing of these reductions is coincident with the recent plant upgrades.

  - *BOD* – Effluent BOD continues to periodically violate the permit. There has been a spike in the number of violations in 2019, coinciding with lowering the water level in Cells 2 and 3 to perform sluice gate repair. Otherwise, the treatment and removal of organics from the effluent **improved in 2017 and 2018** (see Table 4). In 2017, 2018, 2020, and so far in 2021 the annual maximum effluent BOD is lower.[13] The annual average appears to be lower as well. It is too early to claim a durable trend, and the adverse impact of the 2019 water level lowering does not help. But the numbers look promising and are a logical result of the 2017 aeration upgrades. Aeration promotes the conversion of organics into settable biomass. Another year or two of data is required to give confidence that improved treatment is occurring.

***Table 4: Tuba City WWTP – Effluent BOD (mg/L)***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum (mg/L) | 80.3 | 93.0 | 123.1 | 99.4 | 122.3 | 76.5 | 48.8 | 71.9 | 117.4 | 71.3 | 27.7 |
| Average (mg/L) | 39.4 | 36.8 | 40.9 | 37.4 | 43.8 | 39.2 | 29.6 | 41.8 | 52.5 | 40.7 | 26.5 |

  - *TSS* – While effluent TSS continues to occasionally violate the permit, the treatment and removal of solids from the effluent **has not improved**, see Table 5. Suspended solids from pond-based systems are largely algae, with bacteria and other microorganisms contributing, plus some detritus, dust, and colloids, especially during and after wind events. Since 2011, the annual maximum effluent TSS shows no discernable trend.[14] To date, the multi-level draw-off structures on Cells 3 and 4 have not been used. If the structures are brought into service additional reductions in suspended solids might be realized for the short-term.

[13] The worst (maximum) exceedances result from turnover events and from the re-introduction of organics into the water column from warming bottom sludge deposits in April through July. See Table 2.
[14] Most years the exceedance occurs in June during algae blooms. See Table 2.

***Table 5: Tuba City WWTP – Effluent TSS (mg/L)***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum (mg/L) | 87.8 | 101.0 | 63.5 | 73.6 | 69.0 | 92.0 | 103.0 | 70.8 | 75.0 | 97.0 | 46.0 |
| Average (mg/L) | 43.6 | 49.1 | 38.8 | 46.7 | 41.3 | 57.4 | 48.0 | 42.8 | 56.0 | 55.1 | 44.0 |

- *E. coli* – Since the 2011 contact chamber upgrades, the treatment of this intestinal bacteria (a pathogenic content monitor) **has improved** and is within limits, except for two events in 2016. One of those events was simply non-compliant, but a second resulted from an error in sampling.

- *TRC* – The removal of residual chlorine **has improved.** Today the sulfur dioxide system is consistently effective at stripping free chlorine from solution. The facility had no exceedances since the mid-2013 dechlorination system reconfiguration.

- *pH* - The effluent's high pH shows **disconcerting deterioration** since 2011. Algal photosynthesis contributes to alkaline water in pond-based treatment plants.

- *Total Ammonia* – The ammonia concentration in the effluent still regularly exceeds the permitted limit but, as can be seen in Table 6, effluent concentration **has improved.** There appears to be three progressive steps in this improvement. Step one from 2011 and 2012 has a 31.6 mg/L maximum value[15] and 13.3 mg/L average value and can be considered a background or benchmark concentration. Step two from 2013 and 2014 has reduced amounts, with 22.0 mg/L maximum[16] and 7.5 mg/L average. Step three from 2015 through 2020 is still lower with a 15.5 mg/L maximum[17] and a 5.2 mg/L average. These steps correspond to the basin rehabilitation projects that removed old sludge.[18] Sludge is a source of ammonia in wastewater ponds. And after the ponds were brought back online, the facility's full retention time[19] and water surface area were reestablished. Volatilization through water surfaces is the primary way ammonia is removed.

***Table 6: Tuba City WWTP – Effluent Total Ammonia (mg/L)***

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum (mg/L) | 31.3 | 31.9 | 22.7 | 21.3 | 15.4 | 16.7 | 18.4 | 10.2 | 16.8 | 15.6 | 7.0 |
| Average (mg/L) | 13.2 | 13.3 | 7.1 | 7.9 | 5.6 | 5.8 | 5.7 | 4.5 | 4.6 | 4.8 | 4.8 |
| Permit Limit | 1.1 | 1.0 | 1.1 | 1.3 | 0.6 | 0.5 | 1.1 | 1.2 | 0.7 | 0.6 | 0.5 |

Note: Data are from single discrete samples taken monthly. Permit Limit is an average of monthly chronic total ammonia limits from the NNSWQ Standards given pH and temperature measurements made simultaneous to each sampling event. Permitted Ammonia Impact Ratio (AIR) = 1.0.

- Facility Capability – The Tuba City plant has received upgrades and is physically in good shape, producing effluent with a quality typical of a well-performing aerated pond system. But the facility struggles to meet its permitted limits. While it is possible the plant may be brought into compliance for TSS and even BOD the total ammonia limits present challenges with aerated pond technology. And pH will likely continue to

[15] This is an average of maximums for 2011 and 2012.
[16] This is an average of maximums for 2013 and 2014.
[17] This is an average of maximums for 2015 through 2020.
[18] The oxidizable byproducts of settled sludge, stabilizing in cell bottoms, can be a significant source of BOD and total ammonia in pond system effluent. Removing sludge periodically helps to reduce this impact.
[19] Total retention time is 86.1 days = 56.4 Mgal combined pond volume / 0.655 MGD). Long retention times can reintroduce BOD, TSS, and nitrogen into the water from algal metabolism and growth, including photosynthesis and nitrogen fixation.

exceed the limit from time to time. NTUA will closely monitor and make good faith efforts to meet all NPDES permit requirements.

- *Physical Plant and Processes* – The plant is in good structural condition.[20] The aerated pond process, assisted by 270-hp of floating mechanical aeration, is handling the near 1,150 lbs. per day organic load[21] without significant odors.

- *Treatment Performance* – The Tuba City facility's aerated pond system performs well. A discussion of the existing plant's treatment ability for each permitted parameter follows.

  - BOD – Since the aerator upgrades went online in early 2017, the plant's removal of BOD and TSS has been good. If water lowering for maintenance work in 2019 is ignored, then only during May, coinciding with the spring turnover in both 2017 and 2018, in August 2018, and again in April and June of 2020 has BOD risen above the permitted limit.

  - TSS - Similarly, TSS rises in June when frequent algae blooms are experienced. TSS exceeded the limit three times since 2011. At times, sludge and algae can exist in isolated strata within a pond's water column. Monitoring the water strata and using the existing multi-level draw-off structures might reduce the suspended solids in the effluent, particularly during May turnovers and the later June algae blooms.

  - Total Ammonia - Ammonia is removed from ponds primarily through volatilization. Biological nitrification, while active at times, plays a secondary overall role. Sampling results indicate the retention time and surface area[22] at the Tuba City plant are insufficient to volatile ammonia to the permitted level. Ammonia removal cannot be improved further without the acquisition of large land parcels or modifications whose scale approaches the cost of building a new plant.

  - pH – The acid/base balance in a wastewater pond is influenced by algal metabolism (increases pH), biological nitrification (lowers pH), and local wastewater characteristics. In Tuba City, the wastewater has high alkalinity and can buffer significant biological nitrification. Therefore, modifications that control algae (see BOD and TSS above), may work to reduce pH as well.

  - E. coli and TRC are already dependably controlled by physical-chemical processes.

- *Treatment Challenge* – While the plant can meet the E. coli and TRC parameter limits, and BOD and TSS might be brought into compliance, pH will continue to fluctuate and result in occasional violations. Still, compliance with a total ammonia limit periodically at 0.5 mg/L, or below, using aerated pond technology remains a challenge. NTUA will closely monitor and make good faith efforts to meet all NPDES permit requirements.

---

[20] Smith Engineering, Tuba City Wastewater Treatment Plant, Preliminary Engineering Report, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (April 2014), Table 4

[21] Organic Loading = $BOD_5$ X Q = 1,365 lbs./day = 250 mg/L X 655,000 gpd using 2017 average influent $BOD_5$ and flow rate. The combined surface area of the four Tuba City basins is 32.7 acres. The total Areal Loading = 41.7 lbs./acre-day = 1,365 lbs./day / 32.7 acres = organic load / total pond area.

[22] The combined surface area of the four Tuba City basins is 32.7 acres.

### 3.2 Operation and Maintenance

Operational decisions at each of the NTUA discharging wastewater facilities are made by Headquarters engineers. And the NTUA has prepared written operation and maintenance protocols for those facilities, of which Tuba City is one. The Authority has recently centralized its aerator maintenance program by assigning those responsibilities to the Headquarters pump and motor maintenance crew and initiated an operation training program geared towards staff certification. The Tuba City plant is now staffed by trained and experienced operators who monitor and upkeep the facility per documented and scheduled standard operating procedures.

- Training - The NTUA **has begun** in-house operational training to fine-tune its operators' skills towards the Authority's rural wastewater pond facilities. The training program started in August 2017 with a four-day workshop that covered lagoon optimization, O&M Manual familiarity, water quality sampling, and laboratory training focused on wastewater ponds. Another focused workshop will be conducted in the Fall of 2018. Further, the NTUA requires its operators to access and attend out-of-shop training through either Arizona or New Mexico water and wastewater associations.

- Monitoring and Reporting – Systematic monitoring of the plant's infrastructure and processes **has begun,** and the facility's regulatory tracking reports are now being filed on time. Regular internal plant process testing and plant monitoring checklists were implemented at Tuba City in December 2017. And in 2019 a full-time Headquarters QA Officer has been hired by the NTUA to monitor operations at each discharge facility and to assure reporting continues to occur on time. Below is a list of the plant's standard operating procedures. Each of the procedures has a recording schedule that must be completed, signed, and reported to NTUA headquarters regularly. The recurrence interval for the different procedures varies.

    - *Process Sampling (daily)* – The recording schedule requires meters be read and the inflow and outflow quantities determined, the water temperature measured at various locations, and the TRC meter, recorded and calibrated.

    - *Dissolved Oxygen (DO) and pH (daily)* – DO and pH are scheduled to be measured at three levels (high/top, middle, and low/bottom) in the water column at various locations.

    - *Plant/Process O&M (daily)* - Each unit process and piece of equipment at the plant is inspected. The checklist includes sluice gates, manholes, bar screen, grit channel, inflow Parshall flume, lagoon surface water, aeration controls, and power, outflow Parshall flume, chlorination equipment, dechlorination equipment, and the sludge drying lagoon.

    - *Buildings and Flow Controls/Surfaces (weekly)* – The buildings and storage facilities are checked weekly, including the maintenance, lab, and office buildings, their HVAC Equipment, and storage sheds. All the gates are exercised. Pipes and flow surfaces are cleaned, and screenings and grit are disposed of.

    - *Process Sampling (weekly)* – Samples for chemical oxygen demand (COD), BOD, and TSS are scheduled at six locations throughout the plant. COD is determined on-site. The BOD and TSS samples are sent to the NTUA laboratory for testing.

    - *Process Sampling (monthly)* – Samples for E. coli, total ammonia, total ammonia chronic limit, Ammonia Impact Ratio (AIR), and nitrates are scheduled at six locations throughout the plant. The samples are sent to the NTUA laboratory for testing. Ammonia and nitrate concentrations

are determined on-site, and their testing equipment is cleaned and checked for calibration. E. coli samples are sent to the NTUA laboratory for testing.

- *Data Log (computer)* – Monthly sampling and testing data collected by the operators and the laboratory are entered into a computer spreadsheet data log. The log is used for analysis and reporting.

- *Compliance Tracking (monthly)* – Data from each wastewater facility's log is collated into a utility-wide worksheet that tracks the compliance of each wastewater facility against its own NPDES permit.

- *Valve Exercising (semi-annually)* – Valve exercising was erroneously omitted from the original operation and maintenance checklist. Valve exercising will occur semi-annually.

- Sludge – The accumulation of sludge in Cell A was measured to be 4.5 feet in 2015. A chemical sludge reduction program was conducted in 2017 and 2018. Regular determination of sludge accumulation is being added to the routine operation and maintenance checklist. A sludge depth measuring event was completed in June 2020.

- Qualifications – **In compliance** with the AOC, the NTUA has a certified Level 3 Wastewater Treatment Operator overseeing operation and maintenance activities at the Tuba City plant:

  Jimmy Dugi, Wastewater Treatment Level 3
  Navajo Tribal Utility Authority, Tuba City District Office
  P.O. Box 398, Tuba City, AZ 86045
  (800)528-5011

  Mr. Dugi also is a certified Level 2 Wastewater Collection operator. He is assisted by Jason Watson who is onsite every day performing routine operation and maintenance tasks. Mr. Watson is also a Level 2 Wastewater Treatment Operator and has a Level 1 Wastewater Collection certification. Mr. Watson has several laborers from the Tuba City District Office available to him when needed. Mr. Dugi does not work at the plant each day but can be onsite with the hour when needed.

**3.3 Summary**

While the Tuba City wastewater facility is not in full compliance, the NTUA has expended effort and money on the plant to meet most of its compliance milestones. These resources have enhanced the plant and the care and attention provided to it, resulting in improved effluent quality. More attention can be dedicated to the plant to potentially improve effluent BOD and TSS further. However, permit compliance for total ammonia, and to a lesser extent pH, will remain elusive. Nonetheless, NTUA is committed to comply with all NPDES permit requirements.

## 4. COMPLIANCE OPTIONS

Recent plant upgrades at the Tuba City plant have brought physically/chemically treated E. coli and TRC parameters consistently into compliance. However, the high levels of the remaining biologically affected parameters BOD, TSS, pH, and total ammonia result from weaknesses and variations in the biological processes of treatment ponds. Modifications can be made to the existing plant that will improve effluent quality for biological parameters. To move the facility into dependable compliance, the variability in treatment must be significantly reduced. And the hardest effluent parameter to meet is ammonia.

The variability of the pond process is caused by atmospheric influences and biological activity that, because of the large water volumes, are hard to control. While many investigators have proposed process and technology improvements to help wastewater pond systems perform better, few improvements (if any) have shown consistent, long-term success. In general, a well-functioning aerated pond system with plug flow and adequate retention time might produce effluent that averages within the Tuba City facility's limits for most parameters, perhaps even BOD, but not total ammonia.

On the Navajo Nation, ammonia is a special problem because of the low effluent limits promulgated by the Navajo Nation Surface Water Quality Standards.[23] These limits were adopted by Region IX in the Tuba City facility's NPDES permit. However, the limits for total ammonia were established to protect the designated uses of Moenkopi Wash, not the ability to treat wastewater. Thus, the NTUA's pond-based treatment plants are not able to meet the ammonia permit requirements. In late summer (July to September) water in the Tuba City treatment ponds is characterized by high pH and temperature. Elevated pH and temperature result in an ammonia limit that is low, sometimes for Tuba City near 0.30 mg/L.[24] Some exceptional pond systems, and those with added polishing processes, may approach 2 mg/L total effluent ammonia, but will regularly have high concentration spikes.

As shown in Table 2, concentrations of total ammonia in the Tuba City plant effluent each month are often an order of magnitude above those allowed by the permit. And the average of monthly values, from January 2015 through December 2018, is 7.6 mg/L.[25] The Table 2 numbers, in-all-probability, don't reflect the peak ammonia concentrations that result from daily and seasonal fluctuations in pond water quality. To complicate things, the permitted limit for total ammonia also varies with water quality (pH and temperature). Given this situation, the plant cannot consistently attain compliance using aerated pond technology.

### 4.1 Treatment

At first glance, there appears to be several ways to improve the Tuba City facility's treatment, such as improving the plant's process, altering the plant's process, constructing a new plant, or changing the disposal method. But upon closer examination, most options will not assure long-term consistent compliance. Each of the options are discussed below and presented for comparison in Table 7.

- Process Improvement – Historical treatment records of aerated pond systems show that pond-based treatment facilities are challenged when attempting to consistently not exceed 45 mg/L BOD and 90 mg/L

[23] NNEPA, Navajo Nation Surface Water Quality Standards 2007, Navajo Nation Environmental Protection Agency, Water Quality Program, Window Rock, AZ (2008)
[24] NNEPA, Table 206.3
[25] This reflects the period after all the ponds were brought back online after the cleaning and reshaping/lining projects.

TSS effluent concentrations.[26] And such records further indicate well-functioning aerated ponds are not able to consistently remove ammonia below 5.0 mg/L.[27] However, if the performance of Tuba City's aerated ponds can be enhanced by improving operation and maintenance and adjusting the flow scheme, then continued use of Tuba City's wastewater plant infrastructure could be **justifiable over the short-term.** Some ways that may improve effluent quality from aerated ponds include aeration and mixing, flow path extension, effluent holding, multilevel draw-off, shortened retention time, process separation, solids settling and removal, sludge stabilization and storage, and effluent polishing. [28, 29]

- *Aeration and Mixing* – Aeration enhances microbial activity by supplementing oxygen. Mixing improves contact between bacteria and waste compounds. Mixing also discourages algae propagation by suspending solids (thereby decreasing light penetration into the water) and releasing carbon dioxide ($CO_2$), an algal substrate, to the atmosphere. But pond water bodies are large and the power to mix and aerate them is also large. And ponds' long retention times allow algae to propagate. Usually, with ponds, the energy applied by mechanical aerators is small compared to that supplied by the atmosphere on a breezy day. Unless the mechanical aeration is substantial and retention times are minimal, operators have little control over the bio-processes in a pond.

  About 120-hp is required to completely aerate Cell 2 and about 170-hp is required to mix the cell so solids don't settle out. Because Cell 1 is currently outfitted with 225-hp of aspirating aerators, proper placement of existing equipment will result in a basin that is completely aerated and well mixed. The cost will be less than $50,000 to move aerators from Cell 1 to Cell 2 and optimize aeration. But the retention time is over 30 days when only a nominal two days are required for algae to become established. Aeration and mixing will work to discourage algae against the retention time which will allow ample opportunity for growth. Because of retention time issues and because the solids are not separated out of the waste stream, aeration and mixing of Cell 2, by itself, **will not improve water quality**.

  A well-mixed Cell A and a well-aerated and mixed Cell 1 is what exists today at Tuba City. More quiescent waters (without mechanical aeration and mixing) exist in Cells 2 and 3. The designers probably had conversion of organics to biomass intended for Cell A and Cell 1 and settling of solids in Cell 2. Because solids are given an opportunity to settle-out prior to the water exiting the pond, the current treatment scheme is likely superior to the completely aerated and well-mixed cell described in the paragraph above. However, if the settled solids are not removed from

---

[26] Middlebrooks, E. Joe, et al., Wastewater Stabilization Lagoon Design, Performance and Upgrading, *Macmillan Publishing Co., Inc.*, New York, NY (1982), Figure 2-16.

[27] Crites, Ronald W. – Chairman, Natural Systems for Waste Management and Treatment, 3/e, *McGraw-Hill, Inc.*, New York, NY (2001), Table 7.16

[28] Lengthening hydraulic retention time is sometimes proposed to improve performance. But lengthened retention time adversely impacts pond treatment because it increases algal growth. Increasing retention time can improve treatment only for small ponds. Short retention times (less than one day) in an aerated pond can result in a small part of the inflow organics not getting converted to biomass. And small non-aerated ponds can be subject to high areal loading of organics (above 45 lbs./acre per day) resulting in accumulation of bottom solids and odors.

[29] Recycling water from the end of a pond system to the beginning is sometimes proposed to improve performance. But because ponds have low concentrations of active biomass (mixed liquor suspended solids normally less than 300 mg/L) and no clarification to concentrate the solids, there is little biomass activation that can be achieved. And while recycle can work to reduce short circuiting, it can also introduce mature algae into the head of the plant increasing algae growth throughout the ponds. Because of these issues and the added operational requirements recycling water brings, pond-based facilities (almost without exception) do not recycle.

the pond the resulting bottom sludge will exert a detrimental effect on effluent quality that will become more significant with time.

- *Extend Flow Path* – Increase time for treatment by changing the water's flow path. Baffles and series routing can prevent flow from short-circuiting to the outlet. Extending the flow path in this way also works to settle out solids early in the system, reducing sludge deposits in later cells, thereby reducing stabilization by-products from feeding back into the water. But in an aggressively mixed pond, such as Cell 2 at Tuba City,[30] **short-circuiting is rarely a limiting factor in** effective **treatment**. There is plenty of time to convert waste organics and organic by-products to biomass, regardless of the flow path. And short-circuiting does not reduce the surface area for the volatilization of ammonia. Some benefits may be realized if solids can be retained early in the system. It will cost less than $50,000 to install a full-width, adjustable baffle across Cell 2.

- *Hold Effluent* – Use Cell 3 to hold treated effluent when the quality is not acceptable for release.[31] Water quality can vary with season and temperature. Algae will naturally decrease at times. By monitoring a pond's water an operator can determine when the water is poor quality and cease discharge, instead diverting flows to storage. When water is good quality a batch discharge can be made. However, temporarily holding effluent **might not work**. Because the biological processes within a pond are uncontrollable, there is no guarantee the water in the holding pond will ever achieve the permitted quality. Only minor servicing and refurbishing of flow boxes (estimated at $10,000) is required to divert flows to holding. Some cleaning of the Cell 3 may be required at about $40,000.

- *Multilevel Draw-off* - The quality of the effluent exiting the plant might be improved by actively using the multilevel draw-off on Cell 3.[32] An operator can use a multilevel draw-off to alternate the water stratum from which effluent is taken. Because the multilevel discharge has outlet pipes[33] at various depths, successful draw-off requires operators to regularly monitor water at varying depths through a pond's water column and then select the level with the clearest water. Clear water is then tapped by using manual valves to open the pipe at the matching level. The draw-off structure **needs repairs** but could soon be ready to use and multilevel discharge can begin immediately.

- *Shorten Retention Time* - Shorten the retention time to both reduce the energy required to aerate and mix and to reduce the opportunity for algae to propagate. Shortened retention can be achieved by using a baffle on Cell A for about $50,000. Short retention allows individual treatment processes to be separated, without requiring more overall pond volume. Normally, shortened retention is **not used by itself** to improve treatment, but is combined with other improvements and upgrades.

- *Separate Processes* - Distinct unit processes (conversion of organics, settling of solids, sludge stabilization and storage, and nitrification, etc.) are assigned to specific small cells or little ponds

[30] The Tuba City wastewater facility's hydraulic retention time is 30.6 days in the active Cell 2 and 61.6 days if all cells are used.
[31] A new large pond could also be constructed. But there are siting and right-of-way issues.
[32] If it turns out the draw-off structure on Cell 3 will take significant refurbishing, there is also a multi-level draw-off on Cell 2 that can be used instead.
[33] Two pipes are not operational. One of these pipes must be fixed to provide draw-off options throughout the water column.

where more controlled environments are created. Separated processes are used to create *dual-powered, multicellular* (DPMC) and other systems. A DPMC system has an aerated and mixed pond followed by a settling pond.[34] DPMC systems are often referred to in the literature as "high-performance aerated pond systems." High-performance ponds are **a feasible technology** and can normally meet 45 mg/L BOD and 90 mg/L TSS effluent concentrations, especially when sludge is regularly removed from the settling cell and deposited in a sludge stabilization and storage lagoon. But high-performance ponds cannot be relied upon to remove total ammonia below 5.0 mg/L. It will cost $1.6 Million to install a high-performance pond system in Cell A.

- *Settle and Remove Solids* - When organic contaminants in wastewater are converted into biomass the biomass settles. In ponds, this creates bottom sludge. But the contaminants, now in a different organic form, never really leave the pond. When the sludge then stabilizes, decomposition by-products are released back into the water column. The by-products contaminate the water again and fertilize algae. **Effluent quality can be improved** if the biomass is both settled and removed. A quiescent separate cell, without mechanical aeration or mixing, allows efficient settling. At Tuba City, solids can be settled in Cell A2. Regular sludge removal is to be performed by pumping or dredging from Cell A2 to Cell 1. Purchasing and installing a dredge will cost about $300,000.

- *Stabilization and Store Sludge* – Pond systems require little handling of sludge and biosolids. This reduced operational effort is a key advantage of ponds over other types of wastewater treatment. The depths of ponds are **ideal for storing and stabilizing solids**. And an aerated water column over the bottom sludge converts sludge stabilization off-gases to non-odorous compounds before they can escape to the atmosphere. But the sludge must be stabilized in a detached reactor, separated from the main waste stream to prevent the reintroduction of degradable compounds back into the water. A detached sludge pond can be created at Tuba City by using Cell 1 for stabilization and storage. Pumping sludge to a dedicated storage and stabilization pond is inexpensive but creates long-term sludge disposal issues.

- *Polish Effluent* – Add a process onto the end of the plant to further treat (polish) the effluent before discharge. Polishing processes can include filters and attached growth reactors. Fine sand, small synthetic media, constructed wetlands, and membranes can physically filter the water and reduce TSS and its associated BOD. Attached growth reactors (e.g. trickling filters/bio-towers, rock filters, floating media,[35] and coarse sand filters) are friendly to biofilms of nitrifying bacteria and can improve biological nitrification. A small moving bed bio-reactor process would be about $2 Million to construct. However, when filters or attached growth processes follow ponds, they are often overwhelmed by TSS (algae and other microorganisms that flourish in pond waters) and can clog. And biological nitrification processes are affected by cold weather[36] and **cannot be relied upon** for consistent oxidation of ammonia.

- Process Alteration – Continue to use the existing Tuba City wastewater facility infrastructure but change the treatment technology. Some ponds have been converted to extended aeration or sequencing batch reactor (SBR) systems by shortening the retention time, resequencing flow, changing or increasing the

[34] Rich, Linvil G., High Performance Aerated Lagoon Systems, *American Academy of Environmental Engineers*, Annapolis, MD (1999)
[35] Moving bed bio-reactors (MBBRs) and integrated fixed film and activated sludge (IFAS) processes are examples.
[36] Biological nitrification is strongly impaired when water temperatures fall below 10°C/50°F. This is typically October through April for the Tuba City facility.

mechanical aeration and mixing, and adding recycle. For instance, a continuous-flow intermittent-discharge (CFID) system is an innovative technology that combines an extended aeration cell with an SBR cell in a single pond. Another example is using baffles and changes in the flow path to rearranging ponds while filling some with media, to create an integrated fixed-film and activated sludge (IFAS) system. While changing a pond system's treatment technology is less expensive than a new plant, it is expensive. Both a CFID or IFAS system (like most innovative technologies) are based on sound theory, but they are **still experimental** with sequencing and biomass parameters not definitely established. Installing a CFID system in existing Cell A is estimated to cost $500,000. The cost of an IFAS system is near $7.5Million.

- New Plant - Build a new plant with a better treatment process. Activated sludge plants **can dependably treat wastewater** to Tuba City's permit limits, including total ammonia. An activated sludge plant will dependably and consistently meet permit limits for all parameters by controlling process variability through sludge recycle to maintain high concentrations of biomass and by providing aggressive aeration and mixing to support the biomass' activity. Because activated sludge reactors are small, they can provide a shielded environment that prevents both cold water temperatures and algae growth. And new plants are energy efficient and straightforward to operate. Plus, improved effluent quality will make effluent reuse possible. A new plant is estimated to cost $41 Million[37] to construct; however, relocation of the new facility is being proposed at additional cost.

- Change Disposal – Continue to use the existing Tuba City wastewater facility by discontinuing the discharge of wastewater to waters of the United States (Moenkopi Wash) and instead dispose of treated effluent through evaporation and land application. About 235 acres of ponded water surface area is required for complete evaporation of Tuba City's wastewater. Nearly 270 acres are needed for land application, with an effluent distribution network and application system.[38] Land available for acquisition is uncertain. The land in the area is dedicated to traditional uses (e.g. farming and grazing). If available, nearby **land parcels are expensive**. The cost of constructing synthetically lined lagoons capable of completely retaining the Tuba City flows is $25 Million, not including land.

A simple and straightforward solution may be adequate in the short-term. Immediate use of multilevel draw-off might obtain compliance for all parameters except ammonia. If using the draw-off structure doesn't work, combining three other process improvements (separating processes, shortened retention times, and removing sludge) together could have the most potential to improve effluent quality. For the long-term, an activated sludge wastewater treatment plant is the dependable and sure way to achieve compliance. This long-term option concurs with the selected alternative presented in the Smith PER (2014).[39]

---

[37] Brown and Caldwell Engineering, Tuba City Wastewater Treatment Plant Preliminary Engineering Report, *Navajo Tribal Utility Authority*, Ft. Defiance, AZ (October 2022).

[38] In most jurisdictions, the limiting concern in determining land application rates of wastewater is groundwater protection. And for municipal wastewater the parameter of concern is nitrogen loading to the soil. The NNEPA has not issued groundwater protection guidelines but have reported that they are being considered. This value was determined from assuming 20 mg/L of total nitrogen in the treated effluent applied at a rate of 200 lbs./acre of total nitrogen (as nitrogen) per annum as permitted in New Mexico.

[39] The PER evaluated three treatment options: a sequencing batch reactor (SBR), a long retention time flow-through activated sludge (extended aeration), and continuous-feed intermittent-discharge (CFID) basin.

### 4.2 Operations

Key to a short-term solution is the ability to use the multi-level draw-off structure on Cells 2 and 3. If the isolation valves associated with the draw-off structure are seized shut they must be replaced. If the valves work, they must be exercised. Exercising the isolation valves on these draw-off structures and throughout the plant is necessary to make sure the valves are operational when needed. A line item for valve exercising is on the operation and maintenance checklist.

To support the long-term solution of a new plant, the NTUA has experience with activated sludge technology at both the Shiprock and Window Rock wastewater facilities. And both plants comply with their permits. The NTUA also operates two smaller activated sludge facilities at Northern Edge and Twin Arrows Casinos near Farmington, NM, and Flagstaff, AZ respectively. Experienced operators from each of these facilities can be called to lead and train additional staff. In selecting a new plant, emphasis should be placed on a technology that is straightforward and economical to operate. Similarity of processes with Shiprock or Window Rock can facilitate cross-training.

### 4.3 Conclusion

Actively using the multilevel draw-off can be used immediately to improve effluent quality. If additional short-term improvements are needed to treatment, then using Cell A to separate unit processes with short retention times, and settling and removing sludge from the system, can be implemented. Meanwhile, a new activated sludge plant can be built to dependably meet the permit requirements for the long-term.

Imperative in this strategy is the continued dialogue between NTUA and EPA. NTUA will make good faith efforts to meet all NPDES permit requirements. NTUA compliance efforts will entail monitoring all NPDES permit requirements for trending improvements toward compliance and making operational and/or facility adjustments to meet this objective. If trends toward compliance become stalled, NTUA will investigate additional alternatives to reach compliance and discuss options and recommendations with EPA.

***Table 7: Tuba City WWTP – Improvement Option Summary Table***

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| Process Improvement | | | | | | |
| Aeration and mixing<br>*Install mechanical aerators on Cell 2 in addition to those on Cells A and 1.* | Uses existing pond infrastructure.<br>Increases organic load capacity.<br>Discourages algae growth by:<br>o Reduces $CO_2$ by releasing to the atmosphere.<br>o Decreases light penetration by suspending solids. | Aerators have capital equipment costs.<br>A lot of power is required to aerate and mix resulting in high operational costs.<br>Increased maintenance. | Difficult to predict and highly variable.<br>No increased performance is expected. | $50,000 installation cost | Aerators of sufficient power and oxygen transfer ability are already installed on Cell 1.<br>Aerators can be moved to Cell A to support a different treatment scheme. | Redundant process. Do not use as either a short-term or long-term measure. |
| Extend flow path<br>*Install baffle in Cell 2.* | Uses existing pond infrastructure.<br>Retains solids earlier in system.<br>Does not significantly increase operational effort.<br>Can reduces short circuiting if needed. | Capital cost. | Difficult to predict and highly variable.<br>After 8 months:<br>o There will be less than 5% reduction in BOD during spring turnover event. There is a good chance no reduction will be seen.<br>o No reduction in annual total ammonia out of the plant.<br>BOD reduction will become smaller with time and sludge accumulation. | $50,000 installation cost. | Install one long baffle in Cells 2, creating two sub-cells with no sludge removal.<br>Because of the already long retention time, reducing short circuiting will not improve treatment. But retaining solids earlier in the system will.<br>Unless flow-through scheme is changed, baffles will increase retention time and algae. | Will not substantially improve treatment.<br>Do not use as either a short-term or long-term measure. |
| Hold Effluent<br>*Use Cell 3 to hold poor quality effluent.* | Uses existing pond infrastructure.<br>Low cost. | Requires active water quality monitoring and flow diversion by operators.<br>Upgrades to the existing multi-level outfall on Cell 2.<br>Limited volume for storage unless additional pond constructed. | Difficult to predict. Depends on pond variability and operational attention.<br>Water quality in holding pond may not improve (may worsen with time).<br>o Might not comply with 45 mg/L BOD.<br>o Might comply with TSS at 90 mg/L but could also make TSS worse.<br>Extremely bad discharge events can be avoided. | $10,000 construction cost | Provides effluent storage to avoid discharge when water quality is poor.<br>Convert Cell 3 to hold non-compliant effluent).<br>Can discharge from Cell 2 and hold in Cell 3.<br>There may not be enough volume for poor quality water in Cell 3. | Water quality sampling and testing are expensive and time consuming.<br>Do not use as either a short-term or long-term measure. |

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| Multilevel draw-off<br>*Use existing structure on Cell 3.* | Uses existing pond infrastructure.<br>No capital cost. Draw-off structure already in place.<br>No power costs.<br>No mechanical parts.<br>Low-tech operation. | Requires active monitoring of water quality and stratification by operators.<br>Difficult to determine water quality at depths.<br>Often the water column in ponds does not stratify. At other times the stratification changes quickly. | Difficult to predict. Depends on pond variability and operational attention.<br>Perhaps 25% reduction in annual average TSS with attentive operation.<br>Perhaps 10% reduction in annual average BOD with attentive operation.<br>If water quality improves it will be immediate. | No cost. | Use the existing draw-off structure on Cell 2.<br>Should be effective at improving water quality when used correctly.<br>*If the Cell 3 draw-off structure is in poor condition, there is also a structure on Cell 2 that might be used.* | Should improve effluent quality at no cost.<br>Use as the immediate solution. |
| Shorten retention time<br>*Use baffles to create 2 smaller cells in Cell A.* | Uses existing pond infrastructure and existing floating aerators.<br>Retains solids earlier in system.<br>Does not significantly increase operational effort. | Capital costs for new piping and baffles.<br>There may be costs associated with repositioning aerators. | Difficult to predict and highly variable.<br>After 1 month:<br>o Perhaps 20% reduction in BOD during spring turnover event.<br>o No reduction in annual total ammonia out of the plant.<br>BOD reduction will become smaller with time and sludge accumulation. | $50,000 construction cost | Install one baffle across Cell A to create two Cell A1 and Cell A2.<br>May briefly improve water quality out of Cell A but will not by itself improve effluent out of the plant. | Can be coupled with other options.<br>Use as part of short-term solution. |
| Separate Processes<br>*Aerate/mix in Cell A1. Settle in Cell A2.* | Uses existing pond infrastructure and existing floating aerators to create a high-performance pond.<br>Does not significantly increase operational effort. | Capital costs for new piping and baffles.<br>There may be costs associated with repositioning aerators. | Treatment will be improved, perhaps substantially at first.<br>Treatment performance will decrease with time and sludge deposition in the settling.<br>Probably won't impact total ammonia. | $600,000 to aerate Cell A1.<br>Plus costs listed above for piping, and baffles.<br>Plus costs to purchase & install a horizontal dredge.<br>Total est. cost $1.6 M. | Cell A1 to be reactor basin with appropriate aeration times and aeration/mixing regime.<br>Cell A2 to be settling basin. | Will convert organics and settle solids efficiently.<br>Can be coupled with other options.<br>Use as part of short-term solution. |
| Remove Solids<br>*Dredge solids from Cell A2 and place into Cell 1.* | Uses existing pond infrastructure. | Capital costs for new dredge.<br>Increased operation required to monitor sludge depths, move dredge, and alter discharge location. | If combined with "shortened retention" and "separate processes" options above, can produce effluent that consistently meets 45 mg/L BOD and 90 mg/L TSS but meeting ammonia limits will remain a challenge. | $300,000 cost for purchase and installation of floating dredge. | Use the baffle configuration described in shorten retention time option above.<br>Use floating dredge to remove solids from bottom of Cell A2.<br>Use Cell 1 for sludge storage and stabilization. | Will remove solids outside treatment stream.<br>Can be coupled with other options.<br>Use as part of short-term solution. |

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| Stabilize & Store Sludge<br>*Use Cell 1 as sludge pond.* | Uses existing pond infrastructure.<br>Will store and stabilize solids far into the future. | None.<br>May need light (low hp) mechanical aeration in future. | If combined with "remove solids" option above, can sequester solids from the water treatment stream for longer stabilization. | $25,000 for overflow return piping.<br>+ $75,000 if light aeration is added | Use the baffle configuration described in "Separate Processes" option above.<br>Aerators must be moved off Cell 1. Light aeration may be added in the future if odors occur.<br>Overflow water out of Cell 1 goes in pipe to Cell 2. | Will manage solids.<br>Can be coupled with other options.<br>Use as part of both short and long-term solutions. |
| Polishing Effluent<br>*Install MBBR/IFAS in new shallow pond for nitrification.* | Uses existing pond infrastructure.<br>Will nitrify efficiently if effluent water quality is good and water is not cold. | Capital costs for blowers, media, and pond preparation.<br>Increases operation and maintenance requirements.<br>Increases power costs.<br>Will produce sludge to be managed.<br>Algae accumulation can congest the media. | If provided with good effluent quality from Cell 2 or Cell 3 may meet permit requirements (even for ammonia) except in winter. | $2.2 Million*<br>*includes costs to create new shallow cell | Water quality from Cell 2 or Cell 3 will need to be good.<br>Nitrification will slow (or even cease) in winter unless heated. | May not remove ammonia in cold weather.<br>Do not use as either short-term or long-term solution. |
| Process alteration | | | | | | |
| Continuous-flow intermittent-discharge (CFID) pond system<br>*Install CFID in Cell A.* | Uses existing pond infrastructure.<br>Good to very good effluent quality.<br>Can be constructed within existing cells. | Sophisticated operation due to sequencing and recycle.<br>Moderate maintenance effort required (sequencing aerators, pumps, and controls).<br>The technology is innovative and has no standard operating parameters. | Use Cells A1 and A2 created in "shorten retention time" option above to create aeration, sequencing, and sludge cells.<br>Might consistently meet permit requirements, even for total ammonia. | $500,000 construction cost<br>In addition to the costs required to convert the system to a high-performance pond. | Capital cost is moderate with changes to onsite power controls, sequencing aerators, and pumps, and decanting device.<br>Lack of standard operating parameters means a lot of trial and error. | May not remove ammonia in cold weather to required levels.<br>Use as contingency short-term Solution. |
| Integrated fixed-film & activated sludge (IFAS) system<br>*Install IFAS in Cell A.* | Uses existing pond infrastructure.<br>Very good effluent quality.<br>Can be constructed within existing cells. | Capital cost.<br>Significant modifications to the plant are required.<br>Sophisticated operation.<br>Significant maintenance.<br>The technology is still establishing standard operating parameters. | Should consistently meet permit requirements, even for total ammonia. | $7.5 Million construction cost | Capital cost is high with earthwork, bank lining, media, changes to onsite power, blowers, and pumps.<br>Lack of standard operating parameters means a lot of trial and error. | Might meet permit as operating experience is gained.<br>Do not use as either short-term or long-term measure. |

| | Advantages | Disadvantages | Expected performance | Estimated Cost | Comments | Decision |
|---|---|---|---|---|---|---|
| New Plant | | | | | | |
| Activated sludge<br>*Construct new plant.* | Very good effluent quality. | High capital cost.<br>Sophisticated and expensive operation.<br>Significant maintenance effort.<br>Complete new construction is required. | Will consistently meet permit requirements, even for total ammonia.<br>NTUA has experience in operating two existing activated sludge plants. | $41 Million construction cost | A small footprint is required. Many siting options are available.<br>Clearly defined operating parameters will assist operators. | Will consistently meet permit requirements.<br>Use as long-term solution. |
| Change Disposal | | | | | | |
| Complete retention<br>*Construct new ponds.* | No effluent.<br>Low maintenance and simple operation requirements. | Significant construction cost.<br>Large land parcel(s) required. | N/A - Eliminates need for NPDES permit. | $30 Million construction cost (does not include land costs) | New ponds with significant surface area (150+ acres) require new, large right-of-way. | Too large.<br>Too expensive.<br>Do not use as either short-term or long-term measure. |

## 5. PATHWAY TO COMPLIANCE

After reviewing the Tuba City plant's history of violations, recent gains in operation and treatment, and regulatory objectives still to be accomplished, the following strategy is proposed to achieve full-time compliance. Compliance with the facility's NPDES permit must occur as quickly as possible. The strategy is a multi-step solution.

The first step consists of immediate actions aimed at short-term improvements in effluent quality. The last step involves a dependable, long-term solution by constructing a new activated sludge wastewater treatment facility. The strategy will take time and money, but the steps are necessary to achieve consistent compliance with discharge standards that, in the case of ammonia, are an order of magnitude more stringent than the plant's current treatment ability.

### 5.1 Treatment

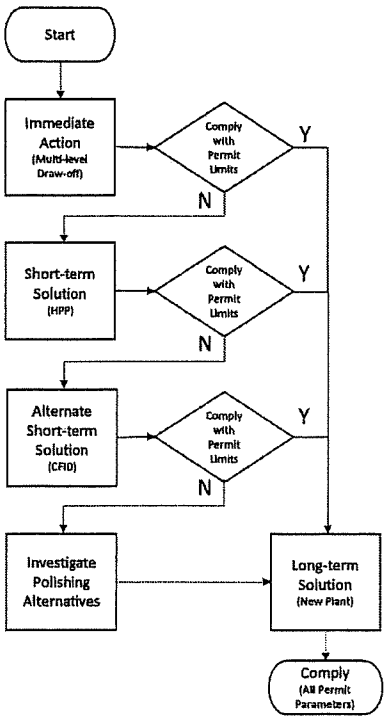
The wastewater treatment technology employed at Tuba City will be changed from aerated ponds to activated sludge through a multistep process. During the conversion, sewage must continue to be managed and the performance of the existing facility improved, even though discharged effluent will **remain non-compliant**. Full compliance with the facility's NPDES permit, to be provided by a new plant, must be attained as quickly as possible. Steps to improve the performance of the existing plant are listed and discussed below and shown in Figure 2.

- Starting Place - Recent improvements to the Tuba City plant, and the facility's operation and maintenance practices, have elevated both treatment ability and effluent quality while continuing to use the traditional flow scheme. Thus, the wastewater ponds are operating at near optimum levels. Not counting the water level lowering maintenance event in 2019, the BOD limit was exceeded only four times since the new aerators went online. And the TSS limit was exceeded only once, including 2019. Ammonia remains a persistent problem. But the enhanced treatment to be provided in the following immediate and short-term improvements are important interim steps towards the long-term solution of a new plant and ultimate compliance.

- Asset Management - To plan for the long-term operation and maintenance of the Tuba City wastewater system, an asset management program is required by Part II.H of the permit. Asset management can begin on the collection system but must wait on the treatment facilities until a new plant is up and running. NTUA has a work order program to manage its assets at the current lagoon facility as described in the Asset Management Plan submitted to EPA.

- Immediate Action (multi-level draw-off) – Improve the effluent water quality by regularly monitoring the water strata within Cell 2 or Cell 3 and using the corresponding multi-level alternating discharge structure to tap into a clear layer. This will be most

***Figure 2: Tuba City WWTP – Pathway to Compliance***



important during the months of April through August. A three-month startup and orientation period will be used.

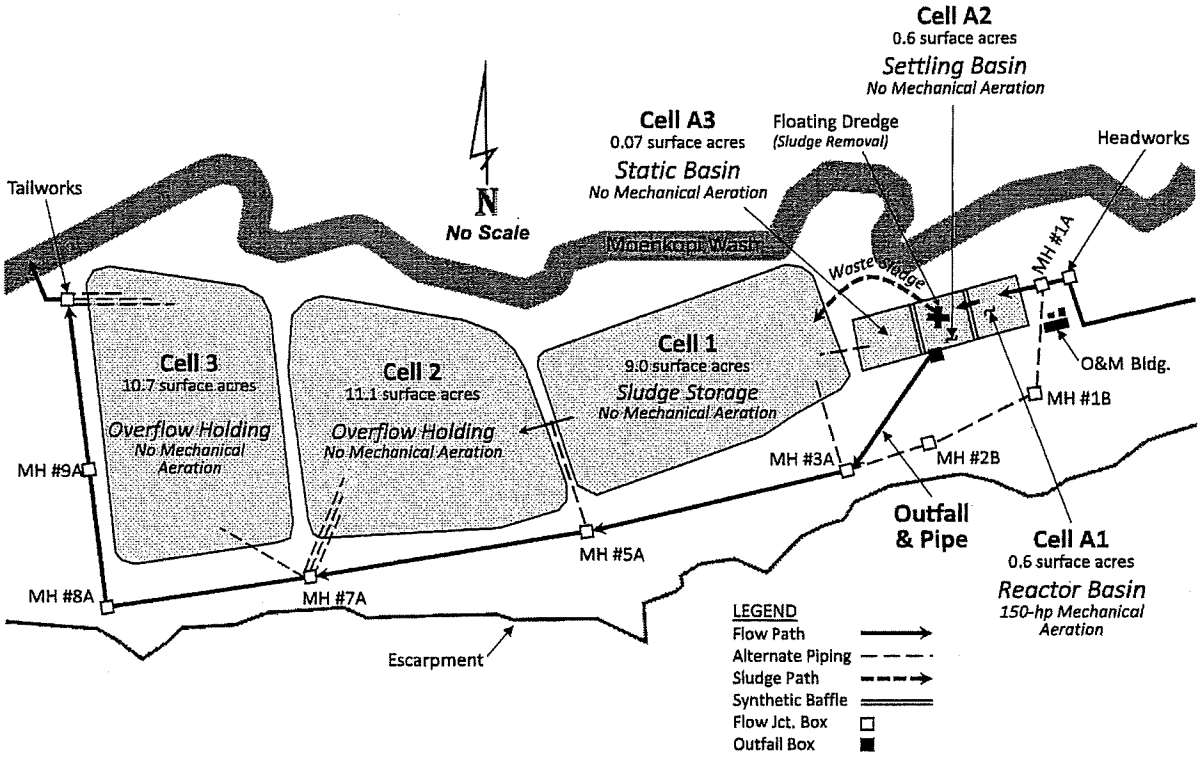
- Short-term Solution (High-Performance Aerated Lagoon System with Sludge Removal) – If after a startup period of 6 months, if two consecutive non-compliant samples (not due to O&M deficiencies) are returned, it will be assumed limits cannot be attained by using the multi-level draw-off structures. In such an event, the aeration, mixing, and settling can be pulled back into Cell A (see Figure 3 below). This will support the combining of three improvement options: separating processes, shortened retention times, and removing sludge. Aeration and mixing[40] would be located at the front of Cell A and solids settling located towards the back, divided by a baffle. There is adequate retention time in Cell A to carry out all these processes.[41] Removed (dredged) sludge will be deposited in Cell 1 for stabilization and storage. Outflow from the settling basin would be discharged to MH #3A via existing piping to Moenkopi Wash through the existing outfall. Modifications to the plant's interior power distribution network and piping changes will be required. This combination of improvements and the resulting treatment scheme is a High-Performance Aerated Lagoon System[42] combined with sludge removal and stabilization. Constructing a high-performance pond system will take 6 months.

[40] The amount of mechanical aeration was determined by Smith, in their NPDES Permit Compliance plan (2015), to meet the demands of oxidizing both BOD and ammonia. Smith's loading assumptions and air transfer rate were conservative. Thus, the amount of mechanical aeration at the Tuba City plant today is more than adequate for treatment and can be moved within the plant to support condensed treatment schemes.

[41] Per Rich 1999 residence times for a high-performance pond systems are 1.5 days in reactor basin and less than 3 days in the settling basin for 4.5 days. More than 4.5 days allows for increased algae growth.

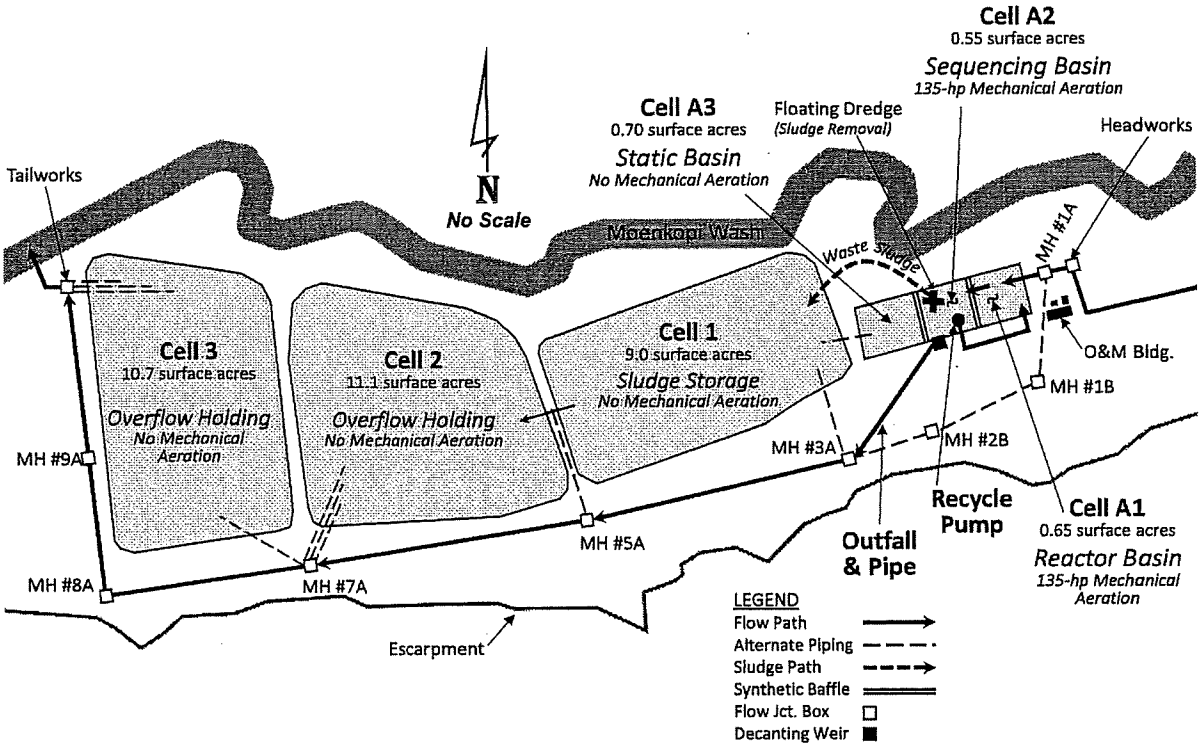
[42] Rich 1999, Chapter 5 – Also referred to as a dual-powered multicellular (DPMC) system in the literature.

***Figure 3: Tuba City WWTP – Short-term Solution (High Performance Aerated Lagoon System with Solids Removal, Cell A)***




- Alternate Short-term Solution (Continuous-feed, Intermittent Discharge) - If after a startup period of 12 months the short-term solution does not improve effluent quality, a contingency solution that converts the short-term solution to a CFID system will be implemented (see Figure 4). A CFID scheme can be located completely within Cell A. In addition to the process options included in the short-term solution, a CFID system incorporates the sequencing of aeration, anoxic mixing, and quiescent settling into Cell A1, plus the recycle from Cell A2 back to Cell A1. Converting the high-performance lagoon system to a CFID will take 6 months.

***Figure 4 : Alternate Short-term Solution (Continuous-feed Intermittent Discharge)***




- Long-term Solution (new plant) – The NTUA will build a new activated sludge plant. The new plant is estimated to cost $41 million to construct.[43] Securing funding and locating the new plant will be key challenges.

    - *Funding* – The NTUA will seek funding from various sources to reduce the project's impact on sewer customers. Grants are preferred but loans may be necessary. A United States Department of Agriculture (USDA) grant application will be submitted. The USDA has Native American set-aside money for infrastructure projects provided in both grants and loans. A Clean Water Act – Indian Set-aside application will also be submitted utilizing the US Indian Health Service's Sanitation Deficiency System. Grants and loans will also be sought from the State of Arizona and the Navajo Nation. An aggressive effort is planned to secure the necessary funding.

    - *Location* – The Tuba City community and the wastewater treatment facility are located on opposite sides of Moenkopi Wash. Access to the plant is via a small three-ton, single-lane bridge constructed in 1964. The wash near the plant is unstable and actively meandering. Wastewater is delivered to the plant by a gravity-flow sewer that crosses over the wash. The sewer is elevated by a 300-foot-long pipe trellis, also constructed in 1964. Part of the trellis (144 feet) is a truss and pipe hanger system and part (156 feet) consists of concrete and steel piers. The original 18-inch steel pipe is deteriorated and has been vandalized. The trellis' integrity is a concern but a catastrophic failure is not imminent. Repairs are proposed. The wash has meandered near Cells 2 and 3 threatening embankment failures. The NTUA has performed slope shoring work to reduce

[43] Smith PER (2014)

the rate of erosion, but the banks long-term stability is far from assured. Discharge to the wash is made, downstream of the plant, via a pipe through another unstable slope. Due to the instability of the channel, the NTUA is considering relocating the facility to the town-side of the wash. The smaller footprint of an activated sludge plant will simplify the siting and land acquisition that must occur. A town-side location might also provide effluent reuse opportunities. Once a new site is identified, land and right-of-way acquisition will require 50 months. Historical, cultural, and environmental clearances required for acquisition of right-of-way may create unanticipated delays.

- *Design and Construction* – The NTUA has solicited proposals and selected an engineering firm to provide the design. Once the design is complete, construction will be competitively bid to competent construction companies. Competent contractors will have a record constructing similar sized water or wastewater plants within budget and on schedule.

- *Startup* – New activated sludge plants can take several months after first accepting sewage to build the bio culture required to perform effective treatment. The NTUA will shorten this startup period by seeding the plant with bacteria from the Twin Arrows, Shiprock, or Window Rock activated sludge plants.

- *Decommission Existing Facility* – All cells will have biosolids that will require disposal. The NTUA is currently preparing a disposal plan for submission to Region 9 and NNEPA for approval. Once sewage is diverted to the new facility and the plant is up and running the old pond-based plant can be closed out. The ponds will be allowed to empty by evaporation or by pumping or hauling liquid to the new plant. Bottom sludge will remain in place until dried and disposed of in accordance with the requirements of EPA Part 503. As an economic measure, buildings will be abandoned in-place. Other concrete structures that are not needed for emergencies and are above ground will be abandoned in place. Unneeded concrete structures, greater than two feet below the surface, will be backfilled and left in place. All debris will be temporarily stockpiled on the site, and then hauled to a permitted landfill.

- *Sludge Management* - A new activated sludge plant treating Tuba City's 560,000 gallons per day of domestic sewage will produce about 5,000 gallons per day of aerobically digested sludge with a solids content of 1.5%. The sludge can be dewatered using a belt filter press or centrifuge. About 2.0 cubic yards per day of dewatered biosolids, at 15% solids content, can be expected off a belt filter press. That is about 800 pounds of dried biosolids each day. Dewatered solids can be hauled by the NTUA, or a contracted hauling company, to either the: Painted Desert Landfill near Joseph City, Arizona; Red Rock Landfill near Thoreau, New Mexico; or Crouch Mesa Landfill near Farmington, New Mexico. Painted Desert Landfill is the closest in proximity at 150 miles away. The large volume in Cells 1, 2 and 3 at the Tuba City wastewater plant can provide onsite sludge storage and stabilization. For this, digested sludge could be pumped directly from the aerobic digesters bypassing the filter press. A minimum water cap will be required to avoid odors. Sludge from the pond will eventually require disposal. These cells will remain is use or properly closed within two years of suspension of use. The preferred disposal method is land application, however, additional equipment and access to land will be required. NTUA will need to work with the Nation and local Chapter officials to obtain required approvals and access to adequate land. A final decision on how to manage sludge from the new plant has not been made.

- *Emergency Operation* – The current ponds will be maintained. In the event of an upset or interruption of treatment at the new plant, water will be diverted to the ponds and retained for

disposal through infiltration and evaporation, instead of discharging to Moenkopi Wash. The piping and necessary flow structures will be left in place. The site's perimeter fencing will be maintained.

### 5.2 Operations

Tuba City's operations and maintenance practices recently came into compliance with the permit's requirements. Compliance of operation and maintenance practices must be maintained through the completion of construction. Good operation and maintenance practices can be built upon to provide quality operation and maintenance of a new plant.

- Current and Interim Operation – There will be a period of several years until a new plant can be brought online. Good operation and reporting practices developed at the facility will continue, contributing to the best treatment possible during the short-term solution. NTUA will provide monthly updates on progress, conclusions, and any proposed changes in operations as they monitor water quality and progress through the flow chart shown in Figure 2 with Region 9 and NNEPA. NTUA will contract with a consulting firm to provide technical guidance during interim operations.

- Training for Interim (Short-term) Operations – The NTUA operates wastewater pond facilities at many locations across the Navajo Nation. The NTUA's new wastewater pond operation and maintenance training program may have been spurred by AOCs from Region 9 and the NNEPA, but it was envisioned as filling the wider need to better operate the Authority's many pond-based wastewater facilities. This training will be continued and improved as a basis from which future operators are trained for the NTUA's wastewater pond facilities.

- Operation & Maintenance Manual – The existing Tuba City WWTP O & M manual will continue to be reviewed and used during the short-term solution. However, the manual will be modified and revised to reflect the high-performance pond system and the CFID system, if needed. A new O & M Manual will be provided by the design engineer when the new plant goes online.

- Monitoring and Reporting – Good operational practices at the Tuba City facility will be continued during the short-term solution. Key among the good practices is weekly monitoring of the stratification in the pond immediately prior to the multi-level discharge. Monitoring stratification is required to access the clearest water layer. Regular monthly compliance sampling and testing will continue uninterrupted.

- Training for Future (Long-term) Operation – A Level IV Operator will be required for the new activated sludge plant. Before startup, the NTUA will create a training program to develop and prepare the operators, Jimmi Dugi and Jason Watson, to run the new Tuba City facility. Formal education from federal, state (AZ and NM), and in-house NTUA classes and workshops will be combined with mentoring from the experienced staff at the Shiprock and Window Rock plants. Plant management and oversight may be contracted to specialty firms if needed. The design engineer, plus the manufacturers, suppliers, and vendors of equipment and controls will be required by specification to participate in startup, troubleshooting, and hands-on operator training of the new plant.

- Emergency Operations – During the immediate solution's multi-level draw-off approach the emergency operating procedures detailed in the existing Tuba City WWTP O & M manual will continue to be reviewed by the operations staff and followed. The emergency procedures will be updated to reflect the short-term solutions of a high-performance pond system and a continuous-feed intermittent-discharge system as

needed. Eventually, for the long-term solution's new plant, a new O & M manual, with emergency procedures, will be provided.

- Sludge (biosolids) Management – Biosolids in all cells and all future biosolids produced will be disposed of in accordance with 40 CFR Part 503. NTUA is in the process of investigating possible disposal options for the existing on-site biosolids in the cells and future biosolids produced from the activated sludge plant. These options may include hauling to a landfill, permanent on-site surface disposal, or land application.

- Qualifications – A Level 4 wastewater certification is required to operate the current Tuba City facility. The NTUA will continue efforts to attract and retain experienced, qualified operators. A Level 4 certification is required for the new plant.

### 5.3 Schedule to Compliance

It is estimated that funding, engineering, right-of-way acquisition, and construction of the new plant will take 40 months[44] to complete after approval of this Compliance Plan.

### 5.4 Summary

To achieve compliance with the Tuba City NPDES Permit a multi-step pathway is proposed. The existing aerated pond system that uses a multi-level draw-off structure, is the best fit technology to improve effluent quality at the Tuba City plant in the short-term. If the draw-off does not provide effluent that meets the BOD and TSS permit limits then the plant will be converted to a high-performance pond system and a continuous-fee intermittent-discharge system successively, if needed. Discharge will continue to be made through the existing permitted outfall in Moenkopi Wash. Biosolids planning for the new plant over the long term will be conducted. A new activated sludge plant will be constructed and brought online to dependably meet permit requirements in the long term. And along the way operation and maintenance activities will keep step with the technology implemented along the compliance pathway. The total costs for the projects are estimated to be $44M.

[44] Smith PER (2014), Table 19a estimates 40 months for engineering and construction.

## *APPENDIX A - TUBA CITY CALCULATIONS*

**DESIGN FOR INTERIM MEASURES**

**High-Performance Pond (HPP)**

The initial interim compliance strategy for Tuba City is to convert Cell A to a high-performance pond (HPP) system and utilize Cell 1 to store sludge produced via the HPP system.

The HPP system proposed here modifies the Tuba City aerated lagoon system according to concepts developed by Linvil Rich[1], with the addition of a sludge removal system. The HPP will be located entirely within Cell A. The design parameters for an HPP system at Tuba City and a conceptual design schematic follow.

1. Average daily flow rate between January 2010 and March 2021 is 0.56 Mgal/day. The design flow rate is 0.6 MGD. Average organic loading for the same period was BOD=320 mg/L. For design, nitrogen loading is assumed to have a TKN=51 mg/L. The HPP is designed for BOD, TSS, and ammonia removal to meet the discharge limits outlined in the current Tuba City National Pollution Discharge Elimination System (NPDES) permit.
2. Cell A will be modified. The geometry at water surface of Cell A is:
    a. L = 534'
    b. W = 157'
    c. Total Working Volume = 5.5 Mgal
3. Use floating baffles to create two treatment sub-cells, Cell A1 and A2.
    a. The HPP in Cell A is created by two hanging baffles that separate Cell A1 and Cell A2 and Cell A2 and Cell A3. The baffles are installed in a north-south configuration.
    b. Flow will be in series through Cell A1 to Cell A2.
    c. Cell A1 is aggressively aerated/mixed to prevent short-circuiting, provide ample oxygen, and prevent solids from settling. The conversion of sewage organics into biomass is accomplished in this cell.
    d. Flow between A1 and A2 is provided by a window in the baffle wall.
    e. Cell A2 serves as a clarifier to separate solids from the bulk liquid phase to produce a clear effluent preceding disinfection. Mixing is not provided in Cell A2.
    f. A large part of Cell A is not required for the operation of the HPP. The volume remaining after the creation of Cells A1 and A2 is Cell A3. Cell A3 is separated from Cell A2 by a baffle. The cell will not have discharge, other than evaporation. Cell A3 will be full because of slow seepage around the floating baffle from Cell A2. Odors will not result from Cell A3 because there is no organic loading.
    g. Dimension of each compartment in Cell A:

[1] Rich, Linvil, High Performance Aerated Lagoon Systems, American Academy of Environmental Engineers, Annapolis, MD (1999)

A baffle is installed 85 ft from the bottom line of the east wall of Cell A to form Cell A1. Total volume of Cell A1 is 0.96 Mgal. Detention time in Cell A1 is 1.61 days.

Cell A2 is between the two baffles. The distance between the two baffles is 85 ft. This is a liquid clarification cell. Clarified liquid leaves the HPP at the end of Cell A2. The volume of Cell A2 is 0.88 Mgal. Detention time in Cell A2 is 1.47 days.

Total detention time in the HPP is 3.08 days.

4. Aeration/mixing will be modified. A diffused air system will be utilized to aerate and mix the entire reactor cell. Cell A2 will not be equipped with mixing or aeration. A dredge will be installed in Cell A2 to remove sludge periodically.
    a. Cell A1 - Complete suspension and mixing will be provided by a Biolac diffused air system. Oxygen will be supplied to oxidize incoming organic matter and nitrogen. This amount will meet the minimum air requirement for complete mixing.
    b. Cell A2 – Mixing is not required.
5. Hydraulic Retention Time (HRT) – All incoming organics are converted to biomass in a pond within 2 days. HRT for the reactor cell, Cell A1, is 1.61 days. Since Cell A2 serves as clarifying basin to separate water from the solids and hence produce clear effluent. Algae control requires the retention time not exceed 4 days total[2].
6. An HPP is a lagoon system, therefore, there is no recycle. Recycle is problematic for lagoons because it can exacerbate algae/TSS problems.
7. Water level is controlled by a stop log weir inside an effluent discharge box. Outflow of treated effluent will overflow the stop log and then free fall into the effluent compartment where it will exit the HPP.
8. Sludge Removal – Solids are removed from the bottom of Cell A2 by using a movable dredge. Details of the dredge can be found in the construction plans that accompany this document.
9. The dredged sludge will be deposited into Cell 1 for long-term stabilization.

[2]Hydraulic retention should be limited to 4.5 days total: (1) Reactor Pond - Rich (pg. 50) notes that sewage organics are converted to biomass and formed into floc in 1.5 days but best if under 3 days (pg. 109). (2) Settling Pond - Rich (pg. 79) also notes algae (showing up as effluent TSS) begins to become a problem after 2 to 2.5 days. (3) Two ponds in series: Reactor Pond and Settling Pond = 1.5 days + 2.5 days or 2 days + 2 days. Therefore, 4 days total time is recommended (Rich, Figure 3.3).

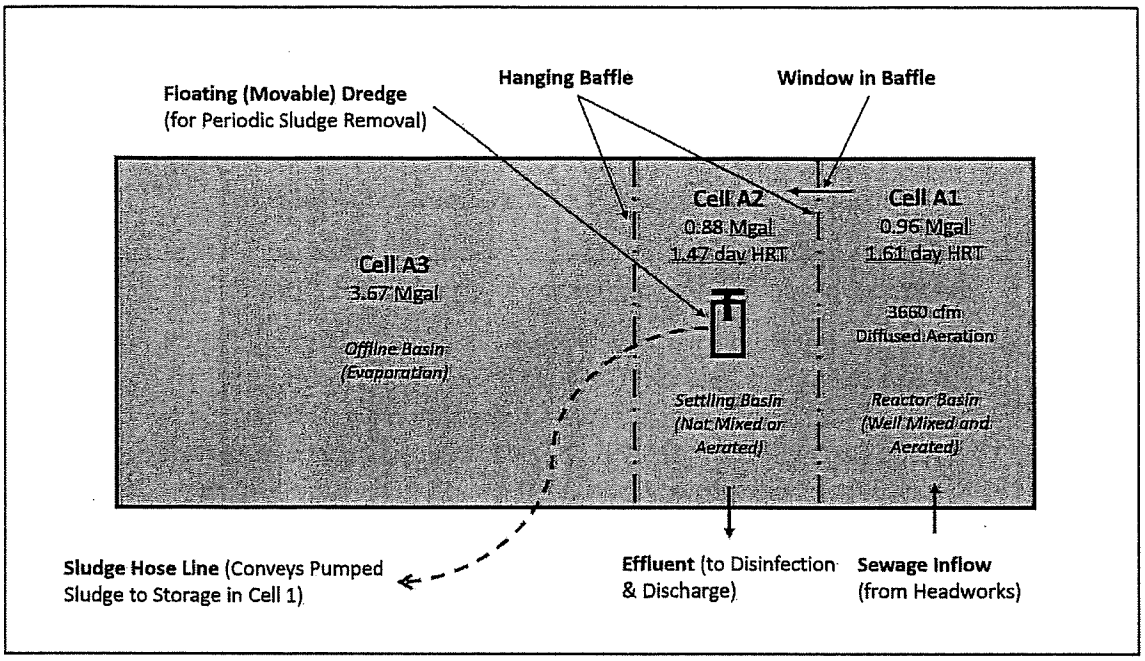



**Figure A-1, High-Performance Pond (HPP) Schematic**

**Continuous-Feed Intermittent Discharge (CFID) Basin**

A continuous-feed intermittent discharge (CFID) will be implemented if the installed HPP fails to produce effluent that meets the NPDES permit requirements.

The CFID is designed to use in-basin sequencing (aeration/mixing, settling, and decant) similar to sequencing batch reactor technology (SBR) to uncouple the bacteria/solids retention time (SRT) form the hydraulic retention time (HRT). As in an SBR, the discharge is intermittent and dependent upon treatment sequencing. Unlike an SBR sewage inflow is continuous. The sequencing is operated by an automatic timer and water level switches through a programmable logic controller (PLC). Uncoupling the SRT and HRT allows bacteria to remain in the system much longer with beneficial treatment effects, especially nitrification. The design parameters for a CFID basin at Tuba City and a conceptual design schematic follow.

1. Average daily flow rate between January 2010 and March 2021 is 0.56 Mgal/day. The design flow rate is 0.6 MGD. The average organic loading for the same period was BOD=320 mg/L. For design, nitrogen loading is assumed to be TKN=51 mg/L. The CFID is designed for BOD, TSS, and ammonia removal to meet the discharge limits outlined in the current Tuba City National Pollution Discharge Elimination System (NPDES) permit.
2. Cell A will be modified. The geometry at water surface of Cell A is:
    a. L = 534'
    b. W = 157'
    c. Total Working Volume = 5.5 Mgal
3. Use floating baffles to create two treatment sub-cells, Cell A1 and A2.

a. Flow will be in series through Cell A1 to Cell A2.

b. Cell A1 is aggressively aerated/mixed to prevent short-circuiting, provide ample oxygen, and to prevent solids from settling. The conversion of sewage organics into biomass is accomplished in this cell.

c. Flow between A1 and A2 is provided by a window in the baffle wall.

d. Cell A2 is a reactor cell as well. It is a sequencing operation with each sequence cycle consists of 4 hours aeration, 1 hour of settling, and 1 hour decanting.

e. Cell A2 sequences from aeration (4 hours) to quiescent settling (1 hour) and decanting (1 hour) during a six-hour cycle[3]. During the aeration sequence the cell is aggressively aerated/mixed. In the setting sequence, solids drop out of solution to the bottom and clarified water will rise to the top. During the decanting sequence, clear water is removed from near the water surface.

f. Cell A3 - A large part of Cell A is not required for the operation of a CFID Basin. The volume remaining after the creation of Cells A1 and A2 is Cell A3. The cell will not have discharge, other than evaporation. Water level in Cell A3 will fluctuate with sequencing because of slow seepage around the floating baffle from Cell A2. Odors will not result from Cell A3 because there is no organic loading.

g. The dimensions of each cell are identical to the HPP configuration.

4. Aeration/Mixing will be modified

a. Cell A1 - Complete suspension is provided by a Biolac defusor system that provides oxygen to degrade both organics and nitrogen. This air supply will also meet minimum complete mixing requirement. The diffused air system requires 4 cfm/1000 cf for complete mixing. Mixing intensity in Cell A1 is 30 cfm/1000 cf.

b. Cell A2 – Complete suspension, mixing/aeration will be provided by two 25 hp aspirating aerators. Mixing/aeration (30 hp/Mgal minimum) is required for 4 out of every 6 hours.

5. Hydraulic Retention Time

a. Cell A1 - All incoming organics are converted to biomass in a pond within 1.61 days.

b. Cell A2 – Four 6-hour sequencing (aeration, settling, and decant) cycles are provided each 24-hours. Discharge occurs after 4 hours aeration and 1 hour settling at a flow rate 6 times the inflow for an hour. Clarified liquid overflows a floating weir that also serves as a decanter before disinfection and discharge.

c. Algae control requires the retention time not exceed 4 days total[4].

---

[3] Rich, Example 6-1, Step 15 for Average Dry Weather Flow (ADWF)

[4] Hydraulic retention should not exceed 4.5 days total: (1) Reactor Pond - Rich (pg. 50) notes that sewage organics are converted to biomass and formed into floc in 1.5 days but best if under 3 days (pg. 109). (2) Settling Pond - Rich (pg. 79) also notes algae (showing up as effluent TSS) begins to become a problem after 2 to 2.5 days. (3) Two ponds in series: Reactor Pond and Settling Pond = 1.5 days + 2.5 days or 2 days + 2 days Therefore, 4 days total time is recommended (Rich, Figure 3.3).

6. A recycle flow rate equal to the inflowing sewage rate (Q) is initially specified. The rate can be adjusted during operation to optimize treatment. MLSS recycle is synchronized with the operation of the Biolac aeration system.
7. Outflow of treated effluent from Cell A2 and water levels are controlled by using an SBR-type floating weir. Discharge is timed to fit the decant sequence.
8. Sludge Removal – Solids are removed from Cell 1B by wasting a small fraction of recycle mixed liquor suspended solids via the recycle pump daily. Waste sludge will be deposited into Cell 1 for long-term stabilization.

**Sludge Handling**

1. The volume of sludge pumped to Cell 1 is estimated to be about 20,000 gal/day and flow will be allowed to equalize across Cells 1, 2, and 3. The evaporation rate for these cells is estimated to be about 6 times that amount or 120,000 gal/day.

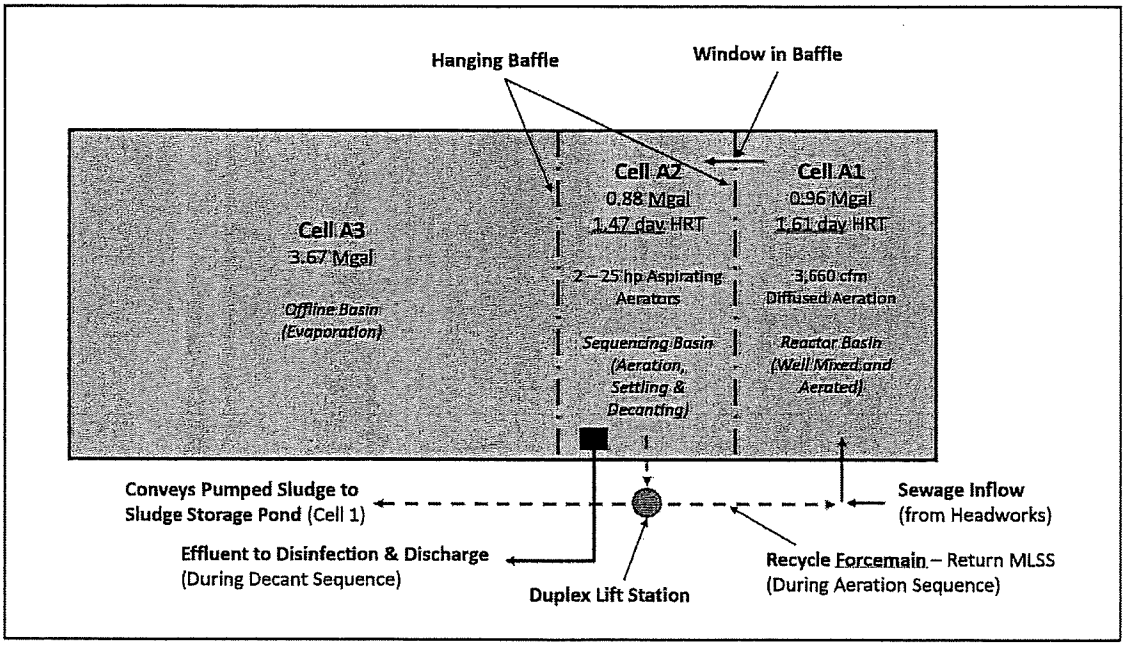



**Figure A-2, Continuous-Feed Intermittent-Discharge (CFID) Basin Schematic**

# APPENDIX B. GIS DATA

## APPENDIX B. GIS DATA

| Chinle Interconnection Points | | | | | |
|---|---|---|---|---|---|
| **District** | **Point Number** | **Latitude** | **Longitude** | **Description** | **Direction of Sewer Flow** |
| Chinle, AZ | Point 1 | 36.160907 | -109.604407 | Chinle Indian Health Services | Exiting from non-NTUA system entering NTUA systems |
| | Point 2 | 36.157338 | -109.585489 | Chinle Unified School District | Exiting from non-NTUA system entering NTUA systems |
| | Point 3 | 36.158355 | -109.577932 | Chinle Unified School District | Exiting from non-NTUA system entering NTUA systems |
| | Point 4 | 36.158138 | -109.577154 | Chinle Unified School District | Exiting from non-NTUA system entering NTUA systems |
| | Point 5 | 36.159688 | -109.578136 | Chinle Unified School District | Exiting from non-NTUA system entering NTUA systems |
| | Point 6 | 36.152164 | -109.556462 | Indian Health Services Hospital Housing | Exiting from non-NTUA system entering NTUA systems |
| | Point 7 | 36.150606 | -109.554557 | Navajo Nation Department of Corrections | Exiting from non-NTUA system entering NTUA systems |
| | Point 8 | 36.150623 | -109.554269 | Chinle Unified School District | Exiting from non-NTUA system entering NTUA systems |
| | Point 9 | 36.149661 | -109.548235 | Holiday Inn Canyon De Chelly | Exiting from non-NTUA system entering NTUA systems |
| | Point 10 | 36.146546 | -109.544087 | Thunderbird Lodge and Cottonwood Campground | Exiting from non-NTUA system entering NTUA systems |

| Chinle Sewer Collection System Flow Tote Locations | | | |
|---|---|---|---|
| **Manhole Name** | **Manhole #** | **Latitude** | **Longitude** |
| Chinle NHA NTUA Area | B46 | 36.166112° | -109.581910° |
| Chinle East Corner | C35 | 36.158054° | -109.569149° |
| Chinle South Hopsital Area | A26 | 36.161171° | -109.586401° |
| Chinle Main South | A17 | 36.159831° | -109.585958° |

| Chinle Rain Gauge Locations | | |
|---|---|---|
| **Name** | **Latitude** | **Longitude** |
| Chinle Rain Gauge-District Office | 36.162450° | -109.580937° |
| Chinle Rain Gauge-Water Tanks | 36.151268° | -109.549702° |

| Chinle Manhole Locations | | | | |
|---|---|---|---|---|
| **District** | **Name** | **latitude** | **longitude** | **mgrs** |
| CH | A01 | 36.1498 | -109.59563 | 12SXF2633601476 |
| CH | A02 | 36.15037 | -109.59475 | 12SXF2641401541 |
| CH | A03 | 36.1513 | -109.59351 | 12SXF2652401645 |
| CH | A04 | 36.15224 | -109.59226 | 12SXF2663501751 |
| CH | A05 | 36.15315 | -109.59106 | 12SXF2674201854 |
| CH | A06 | 36.1539 | -109.58999 | 12SXF2683701938 |
| CH | A07 | 36.15419 | -109.58964 | 12SXF2686801972 |
| CH | A08 | 36.15461 | -109.58909 | 12SXF2691702019 |
| CH | A09 | 36.1547 | -109.58897 | 12SXF2692802029 |
| CH | A10 | 36.15511 | -109.58845 | 12SXF2697402075 |
| CH | A11 | 36.15521 | -109.58831 | 12SXF2698602086 |
| CH | A12 | 36.1555 | -109.5879 | 12SXF2702302119 |
| CH | A13 | 36.15638 | -109.58665 | 12SXF2713302218 |
| CH | A14 | 36.15732 | -109.5854 | 12SXF2724402324 |
| CH | A15 | 36.15821 | -109.58549 | 12SXF2723502422 |
| CH | A16 | 36.15855 | -109.58552 | 12SXF2723202460 |
| CH | A17 | 36.15983 | -109.58596 | 12SXF2719002602 |
| CH | A18 | 36.161 | -109.58641 | 12SXF2714802731 |
| CH | A19 | 36.16121 | -109.58724 | 12SXF2707202753 |
| CH | A20 | 36.16145 | -109.58881 | 12SXF2693102777 |
| CH | A21 | 36.16164 | -109.59042 | 12SXF2678602797 |
| CH | A22 | 36.16179 | -109.59187 | 12SXF2665502811 |
| CH | A23 | 36.16241 | -109.59328 | 12SXF2652702879 |
| CH | A24 | 36.16149 | -109.5848 | 12SXF2729202787 |
| CH | A25 | 36.16143 | -109.58515 | 12SXF2726002781 |
| CH | A26 | 36.16117 | -109.58641 | 12SXF2714802750 |
| CH | A27 | 36.16134 | -109.58719 | 12SXF2707702768 |
| CH | A28 | 36.16141 | -109.5881 | 12SXF2699402774 |
| CH | A29 | 36.16149 | -109.58914 | 12SXF2690102781 |
| CH | A30 | 36.16173 | -109.5904 | 12SXF2678702807 |
| CH | A31 | 36.16159 | -109.5912 | 12SXF2671602790 |
| CH | A32 | 36.16151 | -109.59252 | 12SXF2659702780 |
| CH | A33 | 36.16142 | -109.59389 | 12SXF2647402768 |
| CH | A34 | 36.16133 | -109.59524 | 12SXF2635302756 |
| CH | A35 | 36.16126 | -109.59661 | 12SXF2623002747 |
| CH | A36 | 36.16116 | -109.59795 | 12SXF2610902734 |
| CH | A37 | 36.16108 | -109.59964 | 12SXF2595702723 |
| CH | A38 | 36.16098 | -109.60101 | 12SXF2583402709 |
| CH | A39 | 36.16095 | -109.60191 | 12SXF2575302705 |
| CH | A40 | 36.16087 | -109.60285 | 12SXF2566902695 |
| CH | A41 | 36.16087 | -109.60336 | 12SXF2562302695 |
| CH | A42 | 36.16091 | -109.60441 | 12SXF2552802698 |
| CH | A43 | 36.16006 | -109.60494 | 12SXF2548202603 |
| CH | A44 | 36.15942 | -109.60527 | 12SXF2545402532 |
| CH | A45 | 36.15842 | -109.60593 | 12SXF2539602420 |
| CH | A46 | 36.15861 | -109.60654 | 12SXF2534102440 |
| CH | A47 | 36.15906 | -109.60767 | 12SXF2523902488 |
| CH | A48 | 36.15933 | -109.60838 | 12SXF2517402518 |
| CH | A49 | 36.15957 | -109.60897 | 12SXF2512002543 |
| CH | A50 | 36.15942 | -109.60905 | 12SXF2511402526 |
| CH | A51 | 36.15958 | -109.60944 | 12SXF2507802543 |
| CH | A52 | 36.15942 | -109.60977 | 12SXF2504802525 |
| CH | A53 | 36.15961 | -109.61015 | 12SXF2501402546 |
| CH | A54 | 36.15987 | -109.61073 | 12SXF2496102574 |
| CH | A55 | 36.15891 | -109.61114 | 12SXF2492702467 |
| CH | A56 | 36.15417 | -109.59218 | 12SXF2663901966 |
| CH | A57 | 36.1543 | -109.58973 | 12SXF2686001983 |
| CH | A58 | 36.15484 | -109.58967 | 12SXF2686402043 |
| CH | A59 | 36.15382 | -109.58908 | 12SXF2691901931 |
| CH | A60 | 36.1548 | -109.58908 | 12SXF2691702040 |
| CH | A61 | 36.15535 | -109.58903 | 12SXF2692102101 |
| CH | A62 | 36.15435 | -109.58842 | 12SXF2697801991 |
| CH | A63 | 36.15527 | -109.58844 | 12SXF2697402093 |
| CH | A64 | 36.15566 | -109.58841 | 12SXF2697702136 |
| CH | A65 | 36.15524 | -109.58783 | 12SXF2702902090 |
| CH | A66 | 36.1564 | -109.58897 | 12SXF2692502218 |
| CH | A67 | 36.15738 | -109.5901 | 12SXF2682102325 |
| CH | A68 | 36.15652 | -109.59125 | 12SXF2671902228 |
| CH | A69 | 36.15557 | -109.58754 | 12SXF2705402127 |
| CH | A70 | 36.15618 | -109.58672 | 12SXF2712702196 |
| CH | A71 | 36.15874 | -109.58445 | 12SXF2732802483 |

| | | | | |
|---|---|---|---|---|
| CH | A72 | 36.15838 | -109.58437 | 12SXF2733502443 |
| CH | A73 | 36.15823 | -109.58436 | 12SXF2733702427 |
| CH | A74 | 36.15758 | -109.58407 | 12SXF2736402355 |
| CH | A75 | 36.15891 | -109.58368 | 12SXF2739702503 |
| CH | A76 | 36.16051 | -109.58487 | 12SXF2728702678 |
| CH | A77 | 36.16021 | -109.58398 | 12SXF2736802646 |
| CH | A78 | 36.16027 | -109.58765 | 12SXF2703702649 |
| CH | A79 | 36.1595 | -109.58795 | 12SXF2701202563 |
| CH | A80 | 36.16271 | -109.59013 | 12SXF2681002916 |
| CH | A81 | 36.15871 | -109.60841 | 12SXF2517202448 |
| CH | A82 | 36.1583 | -109.60915 | 12SXF2510702403 |
| CH | A83 | 36.15819 | -109.6093 | 12SXF2509302389 |
| CH | A84 | 36.15785 | -109.6101 | 12SXF2502202351 |
| CH | A85 | 36.1599 | -109.60711 | 12SXF2528802582 |
| CH | A86 | 36.15871 | -109.61029 | 12SXF2500302446 |
| CH | A87 | 36.15795 | -109.6107 | 12SXF2496702362 |
| CH | A88 | 36.1572 | -109.61107 | 12SXF2493502278 |
| CH | A89 | 36.1573 | -109.61173 | 12SXF2487602288 |
| CH | A90 | 36.15777 | -109.61152 | 12SXF2489402340 |
| CH | A91 | 36.15851 | -109.61128 | 12SXF2491502423 |
| CH | A92 | 36.15793 | -109.61215 | 12SXF2483702357 |
| CH | A93 | 36.15891 | -109.61178 | 12SXF2486902467 |
| CH | A94 | 36.16117 | -109.60504 | 12SXF2547102726 |
| CH | A95 | 36.1605 | -109.60539 | 12SXF2544102651 |
| CH | A96 | 36.16175 | -109.6049 | 12SXF2548302790 |
| CH | A97 | 36.16221 | -109.60483 | 12SXF2548802841 |
| CH | A98 | 36.16262 | -109.60484 | 12SXF2548702887 |
| CH | A99 | 36.16231 | -109.60619 | 12SXF2536602851 |
| CH | B01 | 36.18824 | -109.58751 | 12SXF2700405752 |
| CH | B02 | 36.18692 | -109.58725 | 12SXF2703005605 |
| CH | B03 | 36.1869 | -109.58751 | 12SXF2700605602 |
| CH | B04 | 36.18674 | -109.58833 | 12SXF2693305584 |
| CH | B05 | 36.18653 | -109.58942 | 12SXF2683605559 |
| CH | B06 | 36.18648 | -109.58985 | 12SXF2679705553 |
| CH | B07 | 36.1863 | -109.59087 | 12SXF2670505532 |
| CH | B08 | 36.18669 | -109.59093 | 12SXF2669905575 |
| CH | B09 | 36.18692 | -109.59099 | 12SXF2669405600 |
| CH | B10 | 36.18729 | -109.59104 | 12SXF2668905642 |
| CH | B11 | 36.18766 | -109.59109 | 12SXF2668305683 |
| CH | B12 | 36.1859 | -109.59078 | 12SXF2671405487 |
| CH | B13 | 36.18559 | -109.59104 | 12SXF2669205452 |
| CH | B14 | 36.18472 | -109.59171 | 12SXF2663205355 |
| CH | B15 | 36.18394 | -109.59148 | 12SXF2665405269 |
| CH | B16 | 36.1829 | -109.59109 | 12SXF2669105155 |
| CH | B17 | 36.18183 | -109.59069 | 12SXF2672905036 |
| CH | B18 | 36.18073 | -109.59031 | 12SXF2676504915 |
| CH | B19 | 36.1798 | -109.58991 | 12SXF2680204811 |
| CH | B20 | 36.1787 | -109.58961 | 12SXF2683104691 |
| CH | B21 | 36.17757 | -109.58926 | 12SXF2686404565 |
| CH | B22 | 36.17661 | -109.58884 | 12SXF2690304460 |
| CH | B23 | 36.17545 | -109.58843 | 12SXF2694304332 |
| CH | B24 | 36.17448 | -109.58805 | 12SXF2697804224 |
| CH | B25 | 36.17334 | -109.58771 | 12SXF2701104098 |
| CH | B26 | 36.17234 | -109.58729 | 12SXF2705003988 |
| CH | B27 | 36.17127 | -109.58694 | 12SXF2708303870 |
| CH | B28 | 36.1702 | -109.58654 | 12SXF2712103752 |
| CH | B29 | 36.16911 | -109.5862 | 12SXF2715403631 |
| CH | B30 | 36.16809 | -109.58575 | 12SXF2719503519 |
| CH | B31 | 36.16698 | -109.58543 | 12SXF2722603396 |
| CH | B32 | 36.16595 | -109.58504 | 12SXF2726203282 |
| CH | B33 | 36.16487 | -109.58464 | 12SXF2730003162 |
| CH | B34 | 36.16384 | -109.58426 | 12SXF2733703049 |
| CH | B35 | 36.16253 | -109.58383 | 12SXF2737702904 |
| CH | B36 | 36.16213 | -109.58183 | 12SXF2755702862 |
| CH | B37 | 36.16165 | -109.58052 | 12SXF2767602811 |
| CH | B38 | 36.16148 | -109.57964 | 12SXF2775502793 |
| CH | B39 | 36.16132 | -109.57865 | 12SXF2784502777 |
| CH | B40 | 36.16118 | -109.5779 | 12SXF2791202762 |
| CH | B41 | 36.1611 | -109.57713 | 12SXF2798202754 |
| CH | B42 | 36.16106 | -109.57652 | 12SXF2803702751 |
| CH | B43 | 36.16106 | -109.57642 | 12SXF2804602751 |
| CH | B44 | 36.16599 | -109.58402 | 12SXF2735403287 |
| CH | B45 | 36.16601 | -109.5829 | 12SXF2745503292 |
| CH | B46 | 36.16611 | -109.58191 | 12SXF2754403304 |
| CH | B47 | 36.1661 | -109.58136 | 12SXF2759303303 |
| CH | B48 | 36.16626 | -109.58064 | 12SXF2765803322 |
| CH | B49 | 36.16592 | -109.58 | 12SXF2771603285 |
| CH | B50 | 36.16562 | -109.57934 | 12SXF2777603253 |
| CH | B51 | 36.16471 | -109.57934 | 12SXF2777703152 |
| CH | B52 | 36.16468 | -109.57866 | 12SXF2783903150 |
| CH | B53 | 36.16471 | -109.57798 | 12SXF2790003154 |
| CH | B54 | 36.16473 | -109.57739 | 12SXF2795303156 |
| CH | B55 | 36.16452 | -109.57697 | 12SXF2799103134 |
| CH | B56 | 36.16417 | -109.57683 | 12SXF2800403096 |
| CH | B57 | 36.16559 | -109.58119 | 12SXF2761003247 |
| CH | B58 | 36.16501 | -109.58096 | 12SXF2763103183 |
| CH | B59 | 36.16431 | -109.58073 | 12SXF2765303105 |
| CH | B60 | 36.16347 | -109.58039 | 12SXF2768503013 |
| CH | B61 | 36.16335 | -109.57935 | 12SXF2777903001 |
| CH | B62 | 36.1632 | -109.57862 | 12SXF2784402985 |
| CH | B63 | 36.16294 | -109.5777 | 12SXF2792802958 |
| CH | B64 | 36.16283 | -109.57683 | 12SXF2800702946 |
| CH | B65 | 36.16512 | -109.58043 | 12SXF2767903196 |
| CH | B66 | 36.16447 | -109.57934 | 12SXF2777803125 |
| CH | B67 | 36.16447 | -109.57963 | 12SXF2775103125 |
| CH | B68 | 36.16399 | -109.57934 | 12SXF2777803072 |
| CH | B69 | 36.16388 | -109.57936 | 12SXF2777703060 |
| CH | B70 | 36.16401 | -109.5787 | 12SXF2783603076 |
| CH | B71 | 36.16374 | -109.57791 | 12SXF2790703046 |
| CH | B72 | 36.16374 | -109.57712 | 12SXF2797903047 |
| CH | B73 | 36.16473 | -109.5852 | 12SXF2725003146 |
| CH | B74 | 36.16452 | -109.58611 | 12SXF2716903122 |
| CH | B75 | 36.16344 | -109.58573 | 12SXF2720503002 |
| CH | B76 | 36.16256 | -109.58541 | 12SXF2723502905 |
| CH | B77 | 36.16223 | -109.58526 | 12SXF2724902869 |

| | | | | |
|---|---|---|---|---|
| CH | B78 | 36.16236 | -109.58475 | 12SXF2729502884 |
| CH | B79 | 36.16237 | -109.58456 | 12SXF2731202885 |
| CH | B80 | 36.16393 | -109.58493 | 12SXF2727603058 |
| CH | B81 | 36.16187 | -109.58357 | 12SXF2740102831 |
| CH | B82 | 36.16193 | -109.5832 | 12SXF2743502839 |
| CH | B83 | 36.1617 | -109.58197 | 12SXF2754602814 |
| CH | B84 | 36.16151 | -109.58057 | 12SXF2767202796 |
| CH | B85 | 36.16122 | -109.58062 | 12SXF2766802763 |
| CH | B86 | 36.16122 | -109.57868 | 12SXF2784202766 |
| CH | B87 | 36.16196 | -109.5779 | 12SXF2791202849 |
| CH | B88 | 36.16226 | -109.57795 | 12SXF2790602882 |
| CH | B89 | 36.16187 | -109.57721 | 12SXF2797402839 |
| CH | B90 | 36.16246 | -109.5772 | 12SXF2797302905 |
| CH | B91 | 36.16182 | -109.57657 | 12SXF2803202835 |
| CH | B92 | 36.16228 | -109.57656 | 12SXF2803202886 |
| CH | C01 | 36.14659 | -109.54396 | 12SXF3099001189 |
| CH | C02 | 36.14657 | -109.54424 | 12SXF3096501186 |
| CH | C03 | 36.14669 | -109.5454 | 12SXF3086001198 |
| CH | C04 | 36.14733 | -109.54649 | 12SXF3076101267 |
| CH | C05 | 36.14772 | -109.54725 | 12SXF3069201310 |
| CH | C06 | 36.14797 | -109.54768 | 12SXF3065301337 |
| CH | C07 | 36.14857 | -109.54787 | 12SXF3063501404 |
| CH | C08 | 36.14966 | -109.54818 | 12SXF3060601524 |
| CH | C09 | 36.14966 | -109.5484 | 12SXF3058501524 |
| CH | C10 | 36.14955 | -109.54925 | 12SXF3051001510 |
| CH | C11 | 36.14958 | -109.55036 | 12SXF3040901513 |
| CH | C12 | 36.14963 | -109.55117 | 12SXF3033601516 |
| CH | C13 | 36.14948 | -109.55152 | 12SXF3030501500 |
| CH | C14 | 36.14952 | -109.55214 | 12SXF3024901503 |
| CH | C15 | 36.14964 | -109.55301 | 12SXF3017101515 |
| CH | C16 | 36.14995 | -109.55327 | 12SXF3014601550 |
| CH | C17 | 36.15059 | -109.55424 | 12SXF3005901619 |
| CH | C18 | 36.1517 | -109.55582 | 12SXF2991401740 |
| CH | C19 | 36.1522 | -109.55648 | 12SXF2985501795 |
| CH | C20 | 36.15258 | -109.557 | 12SXF2980701836 |
| CH | C21 | 36.15317 | -109.55776 | 12SXF2973701901 |
| CH | C22 | 36.15371 | -109.55863 | 12SXF2965901959 |
| CH | C23 | 36.15433 | -109.55978 | 12SXF2955402027 |
| CH | C24 | 36.15448 | -109.56 | 12SXF2953302043 |
| CH | C25 | 36.15463 | -109.5603 | 12SXF2950702059 |
| CH | C26 | 36.15492 | -109.56098 | 12SXF2944502090 |
| CH | C27 | 36.15514 | -109.5616 | 12SXF2938902114 |
| CH | C28 | 36.15531 | -109.56171 | 12SXF2937902133 |
| CH | C29 | 36.1558 | -109.56296 | 12SXF2926602185 |
| CH | C30 | 36.15613 | -109.56382 | 12SXF2918802221 |
| CH | C31 | 36.15626 | -109.56422 | 12SXF2915102234 |
| CH | C32 | 36.15671 | -109.56544 | 12SXF2904102283 |
| CH | C33 | 36.15714 | -109.56667 | 12SXF2892902329 |
| CH | C34 | 36.15761 | -109.56791 | 12SXF2881702379 |
| CH | C35 | 36.15806 | -109.56914 | 12SXF2870502427 |
| CH | C36 | 36.15836 | -109.5701 | 12SXF2861902460 |
| CH | C37 | 36.15867 | -109.57094 | 12SXF2854302493 |
| CH | C38 | 36.15901 | -109.57219 | 12SXF2843002529 |
| CH | C39 | 36.15915 | -109.57327 | 12SXF2833202543 |
| CH | C40 | 36.15927 | -109.57401 | 12SXF2826602555 |
| CH | C41 | 36.15951 | -109.57422 | 12SXF2824702582 |
| CH | C42 | 36.15953 | -109.57431 | 12SXF2823802583 |
| CH | C43 | 36.15986 | -109.57647 | 12SXF2804302618 |
| CH | C44 | 36.14636 | -109.54391 | 12SXF3099501163 |
| CH | C45 | 36.14794 | -109.54552 | 12SXF3084701336 |
| CH | C46 | 36.14897 | -109.55032 | 12SXF3041401445 |
| CH | C47 | 36.14814 | -109.54949 | 12SXF3049001353 |
| CH | C48 | 36.14732 | -109.54984 | 12SXF3046001262 |
| CH | C49 | 36.15176 | -109.55561 | 12SXF2993401747 |
| CH | C50 | 36.15126 | -109.55746 | 12SXF2976701689 |
| CH | C51 | 36.15098 | -109.55771 | 12SXF2974501658 |
| CH | C52 | 36.15066 | -109.55758 | 12SXF2975801622 |
| CH | C53 | 36.15303 | -109.55788 | 12SXF2972701885 |
| CH | C54 | 36.15294 | -109.55803 | 12SXF2971301874 |
| CH | C55 | 36.15301 | -109.55858 | 12SXF2966401882 |
| CH | C56 | 36.15228 | -109.55869 | 12SXF2965501800 |
| CH | C57 | 36.15126 | -109.55926 | 12SXF2960601686 |
| CH | C58 | 36.15015 | -109.55928 | 12SXF2960601564 |
| CH | C59 | 36.14926 | -109.55995 | 12SXF2954701464 |
| CH | C60 | 36.14828 | -109.56002 | 12SXF2954201355 |
| CH | C61 | 36.14731 | -109.56009 | 12SXF2953801247 |
| CH | C62 | 36.1471 | -109.5601 | 12SXF2953701224 |
| CH | C63 | 36.14639 | -109.55962 | 12SXF2958101146 |
| CH | C64 | 36.14574 | -109.55944 | 12SXF2959801074 |
| CH | C65 | 36.14512 | -109.55932 | 12SXF2961101005 |
| CH | C66 | 36.14484 | -109.55923 | 12SXF2961900975 |
| CH | C67 | 36.14882 | -109.55904 | 12SXF2962901416 |
| CH | C68 | 36.14802 | -109.55909 | 12SXF2962701328 |
| CH | C69 | 36.148 | -109.55868 | 12SXF2966401325 |
| CH | C70 | 36.14756 | -109.55842 | 12SXF2968701277 |
| CH | C71 | 36.14726 | -109.55948 | 12SXF2959301243 |
| CH | C72 | 36.14653 | -109.55924 | 12SXF2961601161 |
| CH | C73 | 36.14687 | -109.55873 | 12SXF2966001200 |
| CH | C74 | 36.14585 | -109.55898 | 12SXF2964001087 |
| CH | C75 | 36.14592 | -109.55862 | 12SXF2967201095 |
| CH | C76 | 36.14538 | -109.55876 | 12SXF2966001035 |
| CH | C77 | 36.14542 | -109.55812 | 12SXF2971801040 |
| CH | C78 | 36.14485 | -109.55873 | 12SXF2966400977 |
| CH | C79 | 36.14495 | -109.55824 | 12SXF2970800987 |
| CH | C80 | 36.15465 | -109.55989 | 12SXF2954402062 |
| CH | C81 | 36.15448 | -109.5604 | 12SXF2949802042 |
| CH | C82 | 36.15361 | -109.56081 | 12SXF2946301945 |
| CH | C83 | 36.15486 | -109.56079 | 12SXF2946202084 |
| CH | C84 | 36.15495 | -109.56172 | 12SXF2937902093 |
| CH | C85 | 36.15523 | -109.56225 | 12SXF2933102123 |
| CH | C86 | 36.15519 | -109.56126 | 12SXF2941902119 |
| CH | C87 | 36.15591 | -109.56393 | 12SXF2917802196 |
| CH | C88 | 36.15672 | -109.5634 | 12SXF2922402286 |
| CH | C89 | 36.15714 | -109.56253 | 12SXF2930202335 |
| CH | C90 | 36.15753 | -109.56194 | 12SXF2935502378 |

| | | | | |
|---|---|---|---|---|
| CH | C91 | 36.15704 | -109.5608 | 12SXF2945802326 |
| CH | C92 | 36.1566 | -109.5597 | 12SXF2955702278 |
| CH | C93 | 36.15606 | -109.55862 | 12SXF2965602220 |
| CH | C94 | 36.15559 | -109.55748 | 12SXF2975902169 |
| CH | C95 | 36.15636 | -109.55657 | 12SXF2983902255 |
| CH | C96 | 36.15695 | -109.5668 | 12SXF2891902308 |
| CH | C97 | 36.1588 | -109.57229 | 12SXF2842102506 |
| CH | C98 | 36.16019 | -109.57651 | 12SXF2804002654 |
| CH | C99 | 36.15942 | -109.57653 | 12SXF2803902569 |
| CH | D01 | 36.15811 | -109.57713 | 12SXF2798702423 |
| CH | D02 | 36.15693 | -109.57779 | 12SXF2793002291 |
| CH | D03 | 36.15686 | -109.57846 | 12SXF2786902282 |
| CH | D04 | 36.15626 | -109.57923 | 12SXF2780102215 |
| CH | D05 | 36.15582 | -109.57992 | 12SXF2774002165 |
| CH | D06 | 36.15535 | -109.58052 | 12SXF2768602111 |
| CH | D07 | 36.15482 | -109.58126 | 12SXF2762002052 |
| CH | D08 | 36.15429 | -109.58192 | 12SXF2756201993 |
| CH | D09 | 36.15451 | -109.58249 | 12SXF2751002016 |
| CH | D10 | 36.15396 | -109.58331 | 12SXF2743701954 |
| CH | D11 | 36.15973 | -109.57815 | 12SXF2789302601 |
| CH | D12 | 36.15836 | -109.57795 | 12SXF2791202450 |
| CH | D13 | 36.15701 | -109.57787 | 12SXF2792202300 |
| CH | D14 | 36.15665 | -109.57721 | 12SXF2798202261 |
| CH | D15 | 36.15569 | -109.57864 | 12SXF2785502152 |
| CH | D16 | 36.15531 | -109.57797 | 12SXF2791602111 |
| CH | D17 | 36.15492 | -109.57962 | 12SXF2776802065 |
| CH | D18 | 36.15461 | -109.57909 | 12SXF2781602032 |
| CH | D19 | 36.15407 | -109.5788 | 12SXF2784301972 |
| CH | D20 | 36.1543 | -109.58037 | 12SXF2770201996 |
| CH | D21 | 36.15381 | -109.57963 | 12SXF2776901942 |
| CH | D22 | 36.15343 | -109.58034 | 12SXF2770601899 |
| CH | D23 | 36.15372 | -109.58136 | 12SXF2761301930 |
| CH | D24 | 36.15318 | -109.58065 | 12SXF2767801871 |
| CH | E01 | 36.16106 | -109.60653 | 12SXF2533802711 |
| CH | E02 | 36.16159 | -109.60631 | 12SXF2535602771 |
| CH | E03 | 36.16247 | -109.60619 | 12SXF2536502868 |
| CH | E04 | 36.16248 | -109.60661 | 12SXF2532802869 |
| CH | E05 | 36.16253 | -109.60761 | 12SXF2523802873 |
| CH | E06 | 36.16196 | -109.60768 | 12SXF2523202810 |
| CH | E07 | 36.16158 | -109.60786 | 12SXF2521702768 |
| CH | E08 | 36.16292 | -109.60764 | 12SXF2523502917 |
| CH | E09 | 36.16302 | -109.60765 | 12SXF2523402927 |
| CH | E10 | 36.16304 | -109.60779 | 12SXF2522102929 |
| CH | E11 | 36.16305 | -109.60905 | 12SXF2510802929 |
| CH | E12 | 36.16319 | -109.60912 | 12SXF2510102945 |
| CH | E13 | 36.16323 | -109.60934 | 12SXF2508102949 |
| CH | E14 | 36.16317 | -109.60986 | 12SXF2503402942 |
| CH | E15 | 36.16296 | -109.61015 | 12SXF2500902918 |
| CH | E16 | 36.16267 | -109.61035 | 12SXF2499102886 |
| CH | E17 | 36.16241 | -109.60908 | 12SXF2510602858 |
| CH | E18 | 36.16192 | -109.60915 | 12SXF2510002804 |
| CH | E19 | 36.16201 | -109.60951 | 12SXF2506802813 |
| CH | E20 | 36.16187 | -109.60968 | 12SXF2505302797 |
| CH | E21 | 36.16124 | -109.61014 | 12SXF2501202727 |
| CH | E22 | 36.16077 | -109.61073 | 12SXF2496102674 |
| CH | E23 | 36.16062 | -109.61086 | 12SXF2494902657 |
| CH | E24 | 36.16039 | -109.61119 | 12SXF2491902631 |
| CH | E25 | 36.15913 | -109.61171 | 12SXF2487402491 |
| CH | E26 | 36.16174 | -109.61062 | 12SXF2496902781 |
| CH | E27 | 36.16208 | -109.61051 | 12SXF2497802820 |
| CH | E28 | 36.16231 | -109.61042 | 12SXF2498602845 |
| CH | E29 | 36.18794 | -109.59007 | |
| CH | E30 | 36.18823 | -109.59014 | |

**Chinle SSO Locations**

| Location ID / Name | Manhole ID | Latitude | Longitude | Approximate Number of Occurrence (Past 5 Years) |
|---|---|---|---|---|
| 1 | A-39 | 36.161081° | -109.601669° | 1 |
| 2 | B-75 | 36.163259° | -109.585679° | 1 |
| 3 | A-72 | 36.158468° | -109.584392° | 6 |
| 4 | D-04 | 36.156828° | -109.578278° | 2 |
| 5 | C-80 | 36.153273° | -109.558260° | 3 |
| 6 | C-82 | 36.151036° | -109.557571° | 6 |
| 7 | C-58 | 36.149192° | -109.559527° | 2 |
| 8 | C-63 | 36.146183° | -109.554812° | 1 |
| 9 | C-25 | 36.150750° | -109.554369° | 1 |
| 10 | C-08 | 36.149446° | -109.548147° | 1 |

# APPENDIX C. FLOW DATA

Flow data will be provided in Excel format due to the large file size.

# APPENDIX D. CHINLE FLOW CHARACTERIZATION

**Exhibit D-1. Chinle Wastewater Source Estimates**

| Chinle Commercial Sources | |
|---|---|
| Office/business | 46 |
| Gas station | 3 |
| Church | 4 |
| Restaurant | 5 |
| Grocery store | 1 |
| Jail/courthouse | 4 |
| Hospital/clinic | 2 |
| School | 17 |
| Hotel | 2 |
| Water tank | 1 |
| Fire station | 1 |
| **Chinle Residential Sources** | |
| Residential | 647 |
| **Total** | **734** |

*Data provided by NTUA.*

**Exhibit D-2. Chinle Flow Characterization**

| Source Category | Sources | No. of Sources | Source Breakdown | Average Counts per Source (Employees/ Students/ Beds/Toilets/ Persons) | Total Number of Employees/ Students/ Beds/Toilets/ Persons | Low (GPD) | High (GPD) | Exhibit Reference (for Water Usage Rate) | Assumption | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| **Commercial** | Office/ business | 46 | Employee | 35 | 1,610 | 21,574 | 42,826 | D-4 | Assuming 20 to 49 employees per business, 35 employees average. Assuming average size of the business as "Size Class 4" | Bureau of Labor Statistics. (2025). *Business employment dynamics data by firm size class*. https://www.bls.gov/bdm/bdmfirmsize.htm#SIZE4 |
| | Gas station | 3 | Employee | 8 | 24 | 216 | 360 | D-3 | Assuming auto service station category for water usage. | Mployer. (n.d.). Gasoline station industry—employee benefits summary. https://mployeradvisor.com/state-benefit-guides/employee-benefits-summary-for-the-gasoline-station-industry |
| | Church | 4 | Person | 350 | 1,400 | 6,566 | 13,034 | D-4 | Assuming 350 people per church, based on the data from the Church of Our Lady of Fatima, Chinle. | Jones, A. (2000). No ordinary experience. *National Catholic Reporter*. https://natcath.org/NCR_Online/archives2/2000a/012100/012100d.htm |
| | Restaurant | 5 | NA[a] | NA[a] | NA[a] | 2,753 | 5,466 | — | Average restaurant uses 300,000 gallons of water per year. | U.S. Environmental Protection Agency. (2019). *Food service–related source reduction programs*. https://www.epa.gov/trash-free-waters/food-service-related-source-reduction-programs#smb |

| Source Category | Sources | No. of Sources | Source Breakdown | Average Counts per Source (Employees/ Students/ Beds/Toilets/ Persons) | Total Number of Employees/ Students/ Beds/Toilets/ Persons | Low (GPD) | High (GPD) | Exhibit Reference (for Water Usage Rate) | Assumption | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | Grocery store | 1 | Public restroom | NA[a] | NA[a] | 1,876 | 3,724 | D-4 | Information on the Bashas' Diné Market in Chinle was not available; information on the Tuba City location was used in its place. That location has a retail space of 28,000 square feet. | Navajo Nations Shopping Centers Incorporated. (n.d.). *Your Community Partner Since 1982 – Space Tenant*. https://navajonationshoppingcenterwebsite-live-544f45c.divio-media.com/filer_public/6c/a7/6ca714b5-ecaa-4b6b-8764-774db66a31aa/nnsci_tubacity_site_23.jpg |
| | | | Employee | 50 | 50 | 670 | 1,330 | | Information on the Bashas' Diné Market in Chinle was not available; information the Ship Rock, NM location was used in its place. That location employs about 50 people. | Browne, M. (2021). Bashas' expands presence on Navajo Nation with newest Diné Market. *Supermarket News*. https://www.supermarketnews.com/finance/bashas-expands-presence-on-navajo-nation-with-newest-din-market |
| | Jail/ courthouse | 4 | Inmate | 24 | 96 | 7,200 | 14,400 | D-3 | Navajo Department of Corrections, Chinle (custody), 24 inmates. | Minton, T. D. (2015). *Jails in Indian Country, 2014*. U.S. Department of Justice. https://bjs.ojp.gov/content/pub/pdf/jic14.pdf |
| | | | Employee | 19 | 76 | 380 | 1,140 | | Navajo Department of Corrections, Chinle (custody), 19 employees. | Navajo Corrections. (n.d.). *Chinle district—adult facility*. https://corrections.navajo-nsn.gov/Districts/Chinle-District |
| | Hospital/ clinic | 2 | Bed | 60 | 120 | 20,100 | 39,900 | D-4 | Chinle Comprehensive Health Care Facility has 60 beds. | The Gypsy Nurse. (n.d.). *Chinle Comprehensive Health Care Facility*. https://www.thegypsynurse.com/blog/hospital/chinle-comprehensive-health-care-facility/ |

| Source Category | Sources | No. of Sources | Source Breakdown | Average Counts per Source (Employees/ Students/ Beds/Toilets/ Persons) | Total Number of Employees/ Students/ Beds/Toilets/ Persons | Low (GPD) | High (GPD) | Exhibit Reference (for Water Usage Rate) | Assumption | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| | School | 17 | Student | 396 | 6,724 | 100,853 | 201,705 | D-3 | Chinle Unified School (school, day, with cafeteria, gym, and shower) contains 8 schools and 3,164 students. | U.S. News. (n.d.). *Chinle Unified District*. https://www.usnews.com/education/k12/arizona/districts/chinle-unified-district-4158-105611 |
| | Hotel | 2 | Person | 82 | 164 | 6,560 | 9,840 | D-3 | Assuming 104 rooms and 60% occupancy, 62 total visitors. Assuming 20 employees. | U.S. Park Lodging. (n.d.). *Best Western Canyon De Chelly Inn.* https://www.usparklodging.com/canyondechelly/canyondechellyinn.php |
| | Fire station | 1 | Firefighter | 5 | 5 | 151 | 299 | D-4 | Assuming 2 volunteer, 3 paid firefighters; using industrial building as a source. | Navajo Nation Department of Fire and Rescue Services. (n.d.). *About NNFRS*. https://firerescue.navajo-nsn.gov/About-NNFRS |
| | Water tank | 1 | NA[a] | NA[a] | NA[a] | NA[a] | NA[a] | NA[a] | Assuming minimal wastewater flow. | — |
| **Residential** | Residential | 647 | Person | NA[a] | NA[a] | 230,480 | 457,520 | D-4 | Assuming resident population of 4,300 and using GPD rates per person. | DataUSA. (n.d.). *Chinle, AZ.* https://datausa.io/profile/geo/chinle-az |
| **Total theoretical average daily flow (GPD)** | | | | | | **399,379** | **791,544** | | | |

[a] "NA" indicates that the "Assumption" column notes, not the counts and total number values, were used in calculating the flow per sources.

**Exhibit D-3. Typical Wastewater Flow Rates from Commercial and Residential Sources**

| Wastewater Source | Unit | Low (GPD/Unit) | High (GPD/Unit) | Average (GPD/Unit) |
|---|---|---|---|---|
| Auto service station | Vehicle served | 7 | 13 | 10 |
| | Employee | 9 | 15 | 12 |
| Correctional institution | Inmate | 75 | 150 | 113 |
| | Employee | 5 | 15 | 10 |
| School, day, with cafeteria, gym, and shower | Student | 15 | 30 | 23 |
| Hotel/resort | Person | 40 | 60 | 50 |

Source: Pollution Control System's *Sewage Flow Rate Estimating Guide:* www.pollutioncontrolsystem.com/Uploads/images/Pages/SEWAGE%20FLOW%20RATE%20ESTIMATING%20GUIDE%20Nov%202014_20170105.pdf.

**Exhibit D-4. Typical Wastewater Flow Rates from Commercial and Residential Sources**

| Wastewater Source | Unit | Low (GPD/Unit, Estimated) | High (GPD/Unit, Estimated) | Average (GPD/Unit) |
|---|---|---|---|---|
| Store | Square foot of retail space (w/ public restroom) | 0.067 | 0.133 | 0.1 |
| | Employee | 13 | 27 | 20 |
| Office building | Employee | 13 | 27 | 20 |
| Hospital | All flows, per bed | 168 | 333 | 250 |
| Church, with kitchen | Person (maximum attendance) | 5 | 9 | 7 |
| Fire station | Employee | 30 | 60 | 45 |
| Dwelling | Person | 54 | 106 | 80 |

Source: Arizona Administrative Code, Chapter 9, Title 18, Table 1: https://apps.azsos.gov/public_services/title_18/18-09.pdf.

# APPENDIX E. SCHEDULE OF WORK

| Component | Estimated Quantity/Length[a] | Applicable Work Plan Section(s)[b] |
|---|---|---|
| Manholes | 344 | 4.1, 4.4, 4.4.1, 4.4.2, 4.4.3, 4.4.5, 4.4.6 |
| Sewer lines | 22.01 (miles) | 4.1, 4.2, 4.3, 4.4, 4.4.2,4.4.3, 4.4.4, 4.4.5, 4.4.6 |
| Interconnected private sanitary wastewater and stormwater collection systems | 10 | 4.4.3, 4.4.6, 4.5 |
| Lift station | 1 | 4.1, 4.6 |
| Storm sewers | Unknown | 4.4, 4.4.1, 4.4.3, 4.4.4, 4.4.5, 4.4.8 |
| WWTP | 1 | 4.4.2 |
| Cross-connections (between storm and sanitary sewer) | Unknown | 4.4, 4.4.3, 4.4.4, 4.4.5, 4.4.8, 4.5 |
| Flow monitoring locations (NTUA and interconnection points) | 14 | 4.4.2, 4.4.3, 4.4.7 |
| Rain gauge locations | 2 | 4.4.7 |

[a] Quantities are estimated based on NTUA information but may vary based on SSES findings.

[b] Sections:

4.1 Corrosion Defect Identification
4.2 Fats, Oils, and Grease
4.3 Unauthorized Connections
4.4 Gravity Sewer Inspection and Pipeline Assessment Certification Program Assessment
4.4.1 Manhole Inspection and Manhole Assessment Certification Program Assessment
4.4.2 Infiltration/Inflow Survey
4.4.3 Smoke Testing
4.4.4 Dyed Water testing
4.4.5 Closed-Circuit Television inspection of Sewers
4.4.6 Sewer Gas Monitoring
4.4.7 Micro-Monitoring
4.4.8 Storm Sewer Cross-Connections
4.5 Interconnected Private Sanitary Wastewater and Stormwater Collection Systems
4.6 Lift Station and Force Main Assessment

# APPENDIX F. ADDITIONAL RESOURCES

Indian Health Care Improvement Act, 25 U.S.C. § 1632 *et seq*., 2010. [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).]

Indian Health Service. (2019). *Sanitation Deficiency System (SDS): A guide for reporting sanitation deficiencies for American Indian and Alaska Native homes and communities*.

U.S. Environmental Protection Agency. (1985). *Infiltration/inflow: I/I analysis and project certification* (Ecology Publication No. 97-03).

U.S. Environmental Protection Agency. (2005). *Guide for evaluating capacity, management, operation, and maintenance (CMOM) programs at sanitary collection systems* (EPA 305-B-05-002).

Water Environment Federation. (2011). *Prevention and control of sewer system overflows* (MOP FD-17, 3rd ed.).