Kayenta WWTP Improvements Project

Decommissioning Plan

The following decommissioning plan is intended to provide a general overview and guideline for the removal, salvage, relocation, and abandonment of the retired wastewater treatment plant. The plan includes all the equipment and structures as identified in the contract drawings and specifications for the new plant and remaining equipment and structures that were not included in the construction contract.

The decommissioning will be completed in a three phased approach:

Phase 1 will include the demolition of all equipment and structures included under the existing construction contract of the new Activated Sludge plant. This phase is already completed as of the date of this plan.

Phase 2 will include the demolition of all equipment and structures that are no longer required for operation of the new plant and which demolition will not compromise the structural integrity of any existing cell embankments. Additionally, dewatering the existing lagoons will take place.

Phase 3 will include the demolition of the remaining structures identified to pose a risk to cell embankment before dewatering, handling and disposal of the dewatered sludge, and reshaping of the cell embankments.

1. General Overview

- The work involves demolition, removal, salvage, relocation, and/or abandonment of existing wastewater treatment facilities and equipment as identified in the drawings.
- All work will be conducted in accordance with paragraph 40.g (entitled “Decommission”) of the Partial Consent Decree (PCD).
- All demolition activities should minimize disruption to the ongoing operation of the plant.

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2. Safety Requirements

- All work must comply with Federal, State, and local safety regulations.
- Hazardous materials may be present (e.g., asbestos, lead-based paint, mercury, residual sewage, chemicals). The CONTRACTOR must implement proper handling, removal, and disposal measures.
- CONTRACTOR must ensure that personnel are trained and equipped for all safety risks, including confined spaces, electrical and chemical hazards, and heavy equipment operations.

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3. Coordination

- Only materials identified in drawings or approved by the ENGINEER shall be demolished, salvaged, removed, relocated, or abandoned.
- Protect existing underground utilities and overhead during construction.
- Demolition limits must follow drawings.
- Areas outside demolition limits should remain undisturbed unless necessary for demolition. If disturbed, should be restored to original conditions.

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4. Demolition Procedures

4.1 General Demolition

- Remove all materials associated with demolished equipment and structures in accordance with Paragraph 40.g of the PCD. Completion of all decommissioning activities should not exceed July 31, 2027.
- Transport and dispose of all demolished materials offsite, to a permitted landfill; on-site burning or disposal is prohibited.
- Repair any demolition performed in excess of requirements.

4.2 Concrete, CMU, and Reinforcing Steel

- As required, cut concrete cleanly using saws or core drills.
- Cut and cap reinforcing steel as instructed by the ENGINEER and OWNER.
- For any structures abandoned in place, finish surfaces to a uniform, smooth, and level condition.

4.3 Concrete Embedded Items

- Remove anchor bolts, rebar, conduit at least 1 inch below final surface.
- Coat exposed rebar and patch concrete with approved bonding agents and non-shrink grout.
- Plug empty pipes/conduits with fireproof sealant where required.

4.4 Utilities

- In coordination with OWNER, excavate, support, or relocate electrical, water, sanitary, and storm utilities as exposed.
- Permanently close any demolished utility lines per utility owner in coordination with the OWNER.

4.5 Electrical Demolition

- Coordinate with the OWNER to disconnect and remove all electrical equipment.
- Abandon underground conduits and cables in place, in compliance with PCD paragraph 40.g, and labeling as “ABANDONED IN PLACE” on red line as-built.
- Remove conductors from conduits no longer in use; install pull tapes as needed.
- Extend or re-route circuits to remain operational as required.

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5. Salvage and Relocation

- Salvage materials as directed by OWNER; store and protect them during relocation.

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6. Abandonment of Existing Structures

6.1 Structural Abandonment

- Residual liquid remaining in any existing subgrade structures will be pumped into the existing lagoon or removed using a hydrovac and placed into the headworks of the new treatment plant. Only rainwater and static wastewater will be disposed of into the new treatment plant for processing. Any liquids suspected of chemical contamination will be tested and disposed of properly and in accordance with any applicable laws and regulations.
- Remove and salvage mechanical components per NTUA direction.
- Break walls down to 2 feet below grade; core drill floors, catch basins, and slabs to allow drainage.
- Cap and plug all relevant utilities and pipes.
- Backfill below-grade areas with approved material (<3” diameter, free of organic debris) to top of ground.

6.2 Piping and Conduits

- Cap demolished ends with watertight plugs to prevent soil or water entry.
- Pressurized services: install restrained caps or plugs.

- Gravity services: plug with minimum 6-foot concrete caps.

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7. Documentation and Inspection

- CONTRACTOR shall maintain records of demolition, salvage, relocation, and abandonment activities.
- Coordinate final inspection with ENGINEER and OWNER prior to site turnover or backfill completion.

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8. Scope of Work

Phase 1 - COMPLETE

1. Existing Headworks (this is not the old Headworks behind the Lab Bldg.)
    a. Influent control panel
        i. Follow electrical LOTO procedures.
        ii. Upgrade existing control panel.
        iii. Remove existing pumps and replace with new units.
    b. Power swap-out to new source
        i. Coordinate with NTUA for power transition.
        ii. Set up temporary pump and use manual bar screen to keep system in operation.
        iii. Follow electrical LOTO procedures.
        iv. Swap power over to the new source.
    c. Existing Mechanical Bar Screen and Washer Compactor
        i. Refer to equipment's MOPO.
        ii. Use manual bar screen to temporarily screen influent while old power is being disconnected and new power is connected.
        iii. Disconnect old power and connect to new source.
        iv. Verify that equipment is operational.
2. Generator & Structure (North of Cells 1B and 2).
    a. Confirm new generator is operational prior to demolition.
    b. Coordinate with NTUA to disconnect power to structure.
    c. Remove all existing electrical equipment including transformer, service entrance panel, meter, disconnect, and weatherhead.
    d. Demolish generator structure; salvage existing generator to NTUA.
    e. Demolition of additional electrical equipment north of structure is TBD pending COR approval.
3. Existing Cell 1A/1B.
    a. Ensure equipment is deenergized.
    b. Demo electrical per demolition procedures.
    c. Demolish electrical junction boxes between Cells A1 and 4.
    d. Remove suspended aerator and cables and place in NTUA Storage.
4. Standby Generator at Chlorination Area
    a. Salvage generator to NTUA

    b. Demolish electrical equipment per electrical procedures.
5. Existing CL2/SO2 Contact Chamber
    a. Demolish electrical equipment per electrical procedures.
    b. Demolish structure per structural abandonment and demolition procedures.
6. Existing Lab Room (at Chlorination Area)
    a. Demolish per demolition procedures.
    b. Chemicals including gas cylinders of Cl2 and SO2 salvaged for future use at other plants or return to vendor.
7. Existing Effluent Sampler and Shed
    a. Relocate sampler and shed to new disinfection location.
    b. Demolish foundation per demolition procedures.
8. Existing Chemical Building.
    a. Coordinate chemical disposal with NTUA prior to work.
    b. Demolish per above demolition and safety procedures.

Phase 2 – Solicitation in progress

1. Demolition and removal of CFID Electrical Distribution Equipment
    a. Feeder Cables – savaged/recycled
    b. Distribution Cabinets – savaged/recycled
    c. Distribution Panel – savaged/recycled
2. Demolition and removal of existing manual bar screen
    a. Removal of the bar screen
    b. Removal of the concrete vault
    c. Cut and cap associated piping 3’ from existing vault
    d. Backfill and compact using AB material with 12’ lifts. 95% density required
3. Demolition and removal of existing Parshall flume
    a. Removal of electrical flow meter
    b. Removal of concrete structure
    c. Cut and cap associated piping 3’ from existing vault
    d. Backfill and compact using AB material with 12’ lifts. 95% density required
4. Demolition and removal of contact chamber
    a. Removal of concrete structure
    b. Cut and cap associated piping 3’ from existing vault
    c. Backfill and compact using AB material with 12’ lifts. 95% density required
5. Demolition and of (4) EEF manhole vaults
    a. Cut (4) concrete vaults 3’ below surface elevation
    b. Remove concrete, broken concrete must be crushed and can be placed inside vault
    c. Fill concrete structure with AB material to surface existing finish grade around structure.
    d. Backfill and compact using AB material with 12’ lifts. 95% density required
6. Demolition and removal of aeration blowers located at Cell #4
    a. Aerator Drive Cabinets – savaged/recycled
    b. Aerator Drives – savaged/recycled
    c. Aerator Conduits
    d. Aerator Wiring – savaged/recycled
    e. Aerators – savaged/recycled
    f. Removal of concrete structure
    g. Cut and cap associated piping
7. Demolition and removal of MLSS pump station
    a. MLSS pump station Drive Cabinets

b. MLSS pump station Drives – savaged/recycled
c. MLSS pump station Conduits
d. MLSS pump station Wiring – savaged/recycled
e. MLSS Pump Removal – savaged/recycled
f. Removal of concrete structure
g. Cut and cap associated piping

8. Demolition and removal of EEF pump station
    a. EEF pump station Drive Cabinets – savaged/recycled
    b. EEF pump station Drives – savaged/recycled
    c. EEF pump station Conduits
    d. EEF pump station Wiring – savaged/recycled
    e. EEF pump station – savaged/recycled
    f. Removal of the concrete structure
    g. Cut and cap associated piping

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9. Dewatering and Sludge Handling

Phase 3 – IN PROGRESS

The dewatering and sludge handling will take place in accordance with NTUA's "Kayenta Lagoon Water Removal and Dewatering Evaluation Report." The controlled dewatering of Lagoon Cells 1A, 1B, 2, 3, and 5 has commenced since the new plant performance began meeting the NPDES permit limits on March 9, 2026.

1. Liquids will be dewatered through a combination of natural evaporation and pumping lagoon water to the headworks of the new treatment plant at rates proportional to influent flow to prevent hydraulic overloading or biological upset of the Activated Sludge Treatment Process.
2. Lagoon Cell 4 shall not be dewatered under this plan. Sludge was removed from Cell 4 in 2024, and the cell was converted to a Continuous Flow Intermittent Discharge (CFID) system in 2025. Cell 4 will be retained as the emergency bypass lagoon for the new activated sludge treatment plant.
3. Lagoon Cell 6 shall not receive liquids under this dewatering program. The cell is currently abandoned. The dried sludge was removed in 2024 and disposed of under the Chinle biosolid disposal project. NTUA intends to convert Cell 6 into a permanent biosolid surface disposal facility. This project plan was approved by US EPA, August 26, 2026. Cell 6 shall only receive dried sludge after regulatory approval and construction of the biosolids facility.
4. Sludge in Cells 1A, 1B, 2, 3, and 5 shall be allowed to dewater through natural evaporation after the cells are sufficiently dewatered. Once sufficiently dried, NTUA will use machinery to remove and transport portions of the sludge to the newly constructed sludge drying beds for additional drying and temporary storage, shape the sludge remaining in the cells into windrows to enhance drying efficiency and managed to control odors, vectors, and dust.
5. All historical sludge quantities identified in the prior sludge assessment performed by H&S Environmental, LLC in 2020, shall be increased by ten percent (10%) per year to account for continued deposition since the last characterization. NTUA crews are conducting a new sludge depth assessment to compare current conditions to the 2020 baseline.

Table 1: Estimate of current sludge accumulation by cell in dry tons.

	Average Actual Measured Sludge Blanket Thickness (ft) (2020)	Tons of Dry Solids (2020)	Tons of Dry Solids (2026)
Cell # 1A	**2.360**	**394**	**591**
Cell # 1B	**1.760**	**318**	**477**
Cell # 2	**0.580**	**118**	**177**
Cell # 3	**0.810**	**325**	**488**
Cell # 5	**0.800**	**169**	**254**

6. Prior to final sludge disposal, additional laboratory testing for heavy metals and regulated constituents shall be conducted to confirm compliance with 40 CFR Part 503. All dried sludge from Cells 1A, 1B, 2, 3, and 5 shall be transported to Cell 6 for permanent disposal following approval and construction of the biosolids disposal facility. If the biosolids disposal facility at the Kayenta location cannot be constructed prior to the deadline established in this plan, the sludge will be transported and disposed of at the approved Chinle Biosolids Disposal Facility.
7. All synthetic liners will be removed, segmented and hauled to an approved disposal facility.
8. Cell walls will be reshaped by grading to a slope that poses no safety hazard.

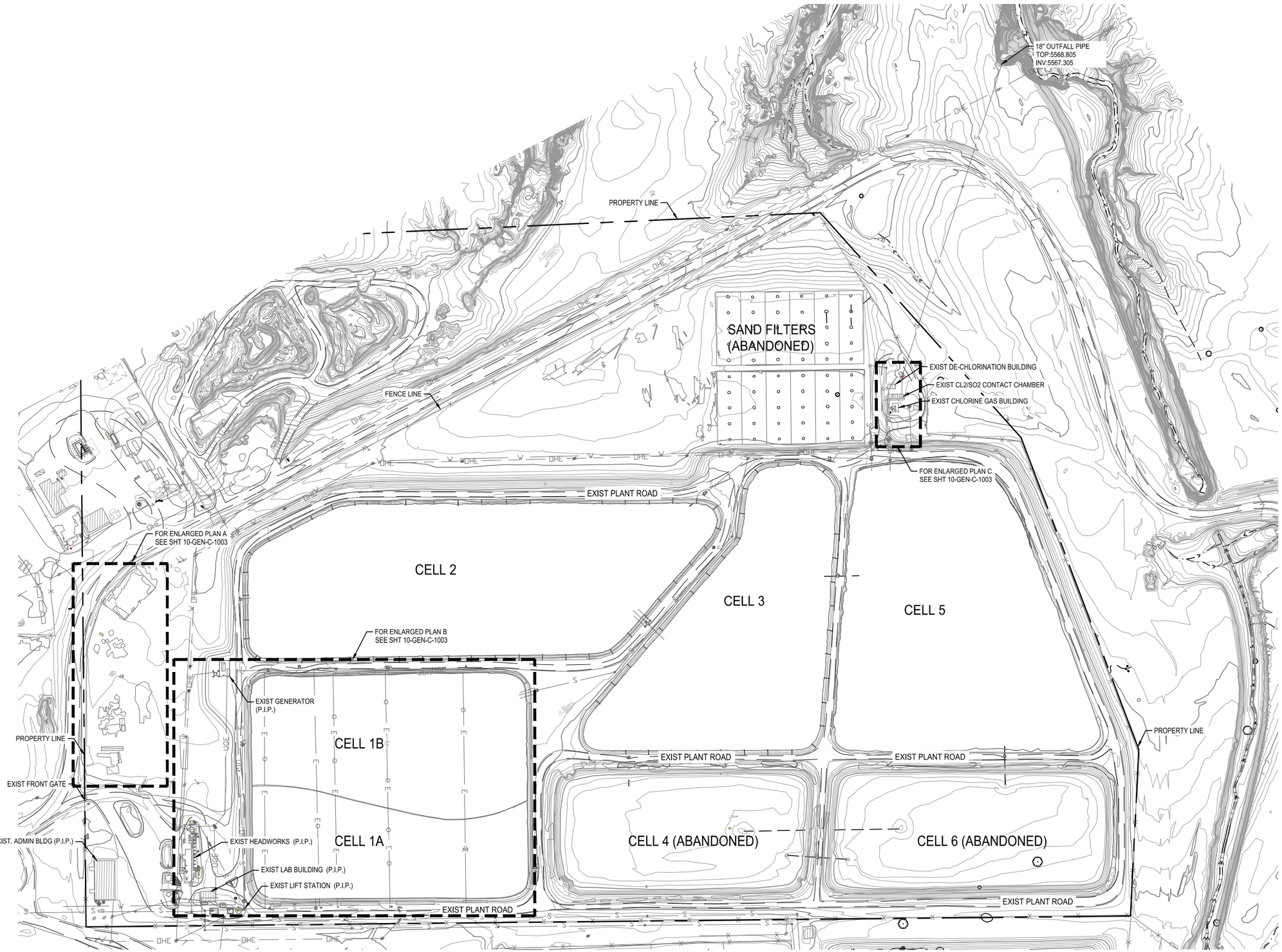
10. Schedule

Phase 1 – Complete May 2026

Phase 2 – Completion Deadline February 1, 2027
Bid phase – August 2026 duration 60-days
Construction – October 2026 duration 120-days

Phase 3 – Completion Deadline July 31, 2027
Dewatering – Completion Deadline November 1, 2026
Sludge management – November 2026 thru May 2027
Grading and remaining structure demolition
Bid phase – February 2027 duration 60-days
Construction – Start date TBD based on sludge management

Attachment 1: Demolition Plan Set



wsp

4221 BALLOON PARK RD NE
ALBUQUERQUE, NM 87109

Registered Professional Engineer
44307
JERRY C. BISH
11-04-22
ARIZONA, U.S.A.

PROJECT:

KAYENTA WWTP IMPROVEMENTS PROJECT

NAVAJO TRIBAL UTILITY AUTHORITY

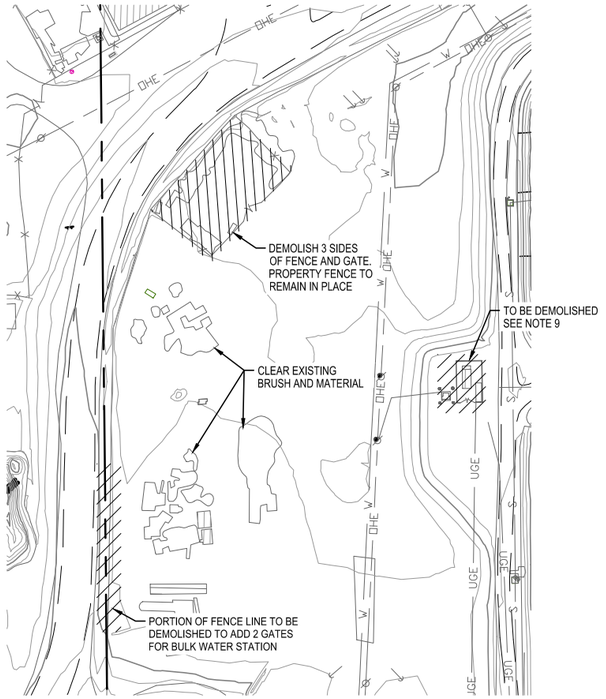
WSP PROJECT No:
2151700032

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED BY:	DDM
DRAWN BY:	DDM
CHECKED BY:	JCB
DATE:	04NOV2022

SHEET TITLE:
EXISTING SITE PLAN

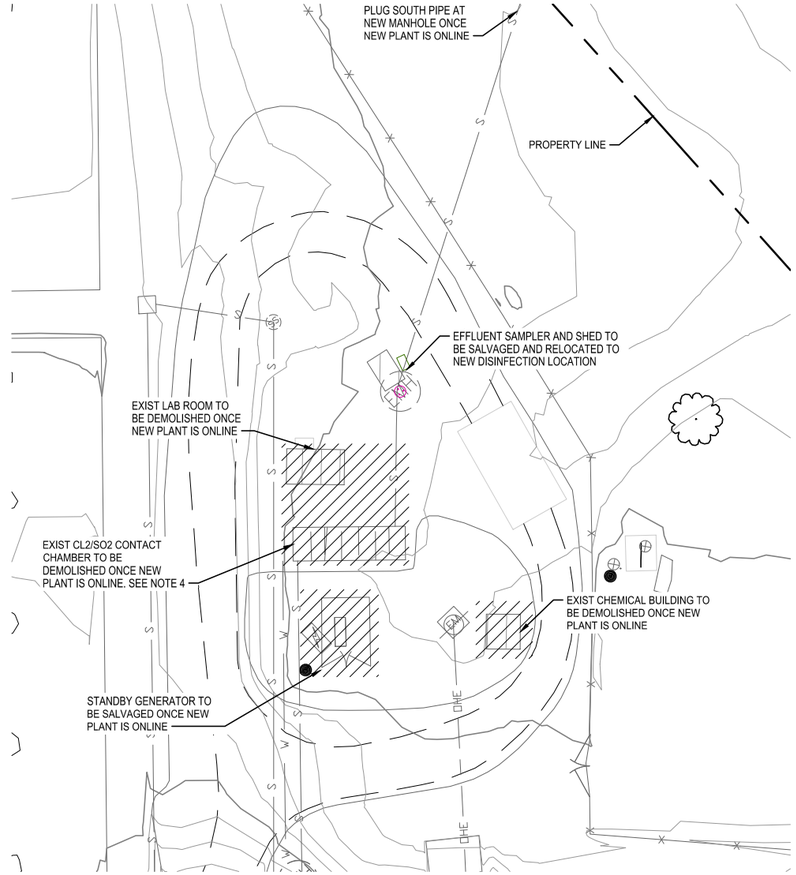
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10-GEN-C-1002	0
SHEET 9 OF 223	



ENLARGED PLAN A

0 30' 60' 120'

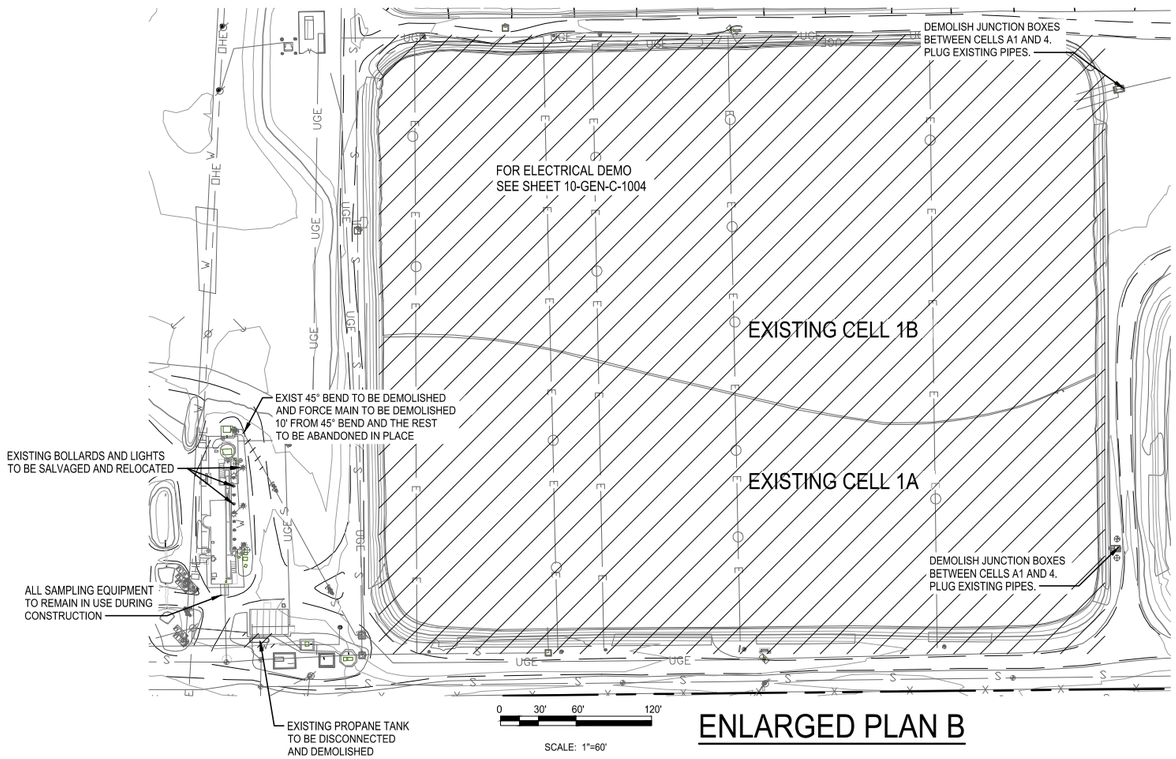
SCALE: 1"=60'



ENLARGED PLAN C

0 10' 20' 40'

SCALE: 1"=20'



0 30' 60' 120'

SCALE: 1"=60'

ENLARGED PLAN B

DEMOLITION NOTES:

1. CONTRACTOR TO DEMO, ABANDON, OR RELOCATE EQUIPMENT IN USE ONCE NEW PLANT IS OPERATIONAL.
2. CELL 4 WILL BE USED AS EMERGENCY STORAGE AS PART OF NEW PLANT.
3. ALL EXISTING EQUIPMENT IN CELL 1 TO BE REMOVED. THIS INCLUDES THE SUSPENDED AERATOR CABLES AND AERATORS.
4. BELOW GRADE BASINS TO BE DEMOLISHED TO 3' BELOW GRADE, HOLES TO BE DRILLED INTO BOTTOM, THEN BACKFILLED TO MATCH GRADE.
5. CONTRACTOR SHALL PROTECT THE EXISTING UNDERGROUND AND OVERHEAD UTILITIES, INCLUDING BUT NOT LIMITED TO POWER, TELEPHONE, CABLE, WATER, GAS, AND SEWER, DURING THE CONSTRUCTION. UNLESS SPECIFIED, ALL UTILITIES SHALL REMAIN IN SERVICE DURING CONSTRUCTION TO SUPPORT THE EXISTING TREATMENT PLANT. CONTRACTOR IS RESPONSIBLE TO PLAN CONSTRUCTION ACTIVITIES AND SEQUENCE SUCH THAT THERE IS MINIMUM UTILITY SHUTDOWN REQUIRED. CONTRACTOR SHALL SUBMIT SEQUENCING PLAN AND COORDINATE ANY POTENTIAL SHUTDOWNS WITH THE OWNER AND OPERATORS AT MINIMUM 48 HOURS PRIOR TO PROCEDURE.
6. CONTRACTOR SHALL NOT OPEN/CLOSE VALVES OR GATES, OR SHUTDOWN ANY EQUIPMENT THAT MIGHT IMPACT THE OPERATION WITHOUT THE OWNER AND THE OPERATOR APPROVAL.
7. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING UTILITIES. LOCATIONS SHOWN IN THESE PLANS ARE BASED ON HISTORIC AS BUILTS AND MIGHT BE DIFFERENT FROM ACTUAL CONDITIONS. CONTRACTOR SHALL FIELD VERIFY ALL UTILITIES WITHIN THE CONSTRUCTION BOUNDARIES. SHOULD ANY DAMAGE OCCUR TO AN EXISTING UTILITY DURING THE PROGRESS OF WORK, CONTRACTOR SHALL REPAIR THE DAMAGE AT NO ADDITIONAL COST TO THE OWNER.
8. CONTRACTOR IS RESPONSIBLE FOR RELOCATION OF THE EXISTING UTILITIES REQUIRED TO MINIMIZE DOWNTIME OF EXISTING TREATMENT FACILITIES.
9. CONTRACTOR SHALL DISCONNECT AND DEMOLISH THE EXISTING GENERATOR BUILDING. THE EXISTING GENERATOR SHALL BE SALVAGED AND TURNED OVER TO THE OWNER PER SPECIFICATION SECTION 024100. CONTRACTOR SHALL MAKE SURE THERE IS NO DISCONNECT IN THE SERVICE AND THAT THE NEW BACKUP GENERATOR IS OPERATIONAL DURING THIS ACTIVITY.
10. REMOVE THE EXISTING FENCE TO THE EXTENT SHOWN.
11. CONTRACTOR SHALL DEMOLISH THE EXISTING OVERHEAD ELECTRIC POLES AT THE END OF ALL CONSTRUCTION. ALL UTILITIES SHALL REMAIN IN SERVICE DURING THE CONSTRUCTION.
12. CONTRACTOR IS REQUIRED TO SUBMIT DETAILED MAINTENANCE OF PLANT OPERATIONS PLANS (MOPO) FOR APPROVAL BY THE OWNER AND ENGINEER.

wsp
4221 BALLOON PARK RD NE
ALBUQUERQUE, NM 87109

Registered Professional Engineer
44307
TERRY C. BISH
11-28-22
ARIZONA, U.S.A.

PROJECT:
KAYENTA WWTP IMPROVEMENTS PROJECT

NAVAJO TRIBAL UTILITY AUTHORITY

WSP PROJECT No:
2151700032

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGNED BY:	DDM
DRAWN BY:	DDM
CHECKED BY:	JCB
DATE:	04NOV2022

SHEET TITLE:
DEMOLITION PLAN 1

SHEET NUMBER:	REV. #
10-GEN-C-1003	0
SHEET 10 OF 223	

Attachment 2: Place holder for Sludge Mass and Volume Calculations for the Kayenta Wastewater Lagoon System (2020)

•Performance Evaluations
•Troubleshooting & Optimization
•Hydraulics Optimization
•Training

H&S Environmental, LLC.

2122 East Leland Circle Mesa, AZ 85213 1 (480) 274-8410

June 12, 2020

Wendell Murphy
NAVAJO TRIBAL UTILITY AUTHORITY
Civil Engineering & Technical Services
P.O. Box 170
Fort Defiance AZ, 86504

RE: Report on June 2, 2020, Sludge Blanket Profiling of the Kayenta Wastewater Lagoon System

Wendell,

On June 2, 2020, personnel from H&S Environmental, L.L.C .& E.T.I. entered Cells 1-4, and Dry Cells # 1 & # 2 of Kayenta's wastewater lagoon system to determine sludge volume and mass for each treatment cell.

One hundred forty-two (142) sludge depth measurements were made along with collecting thirty-four (34) sludge core samples to produce sixteen (16) composite sludge samples. These sixteen (16) sludge samples were delivered to (Eurofins) TestAmerica in Phoenix to be analyzed for Total Percent Solids and used to estimate the sludge mass in dry tons.

Three different math models and one math formula are used in this report to derive average sludge volume and mass for each treatment cell. The following is a report on our findings.





Figure 1 & 2. Core Sampling Cell # 1 and Measuring Remaining Sludge in Dry Cell # 1 of the Kayenta Wastewater Pond System

Section 1 – Summary of Findings

Summary:

	Average Actual Measured Sludge Blanket Thickness (ft)	Average Actual Measured Water Depth (ft)	Average Depth of Remaining Water Cap (ft)	Percent of Volume Occupied by Sludge (%)	Volume of Sludge (gallons) from Model # 3
Cell # 1A	2.36	11.44	9.08	20.6%	1,508,400
Cell # 1B	1.76	11.32	9.56	15.5%	1,117,503
Cell # 2	0.58	11.36	10.78	5.1%	884,791
Cell # 3	0.81	9.34	8.53	8.7%	709,243
Cell # 4	0.8	8.78	7.98	9.1%	617,167
Cell # 5	0.309	Dry Cell	Dry Cell	Dry Cell	262,032
Cell # 6	0.174	Dry Cell	Dry Cell	Dry Cell	163,673

Table 1. Volume Data from Model # 3. Average Sludge Blanket Thickness and Water Depth for Each Treatment Cell. An average of twenty-three (23) Sampling Locations Were Used to Determine the Average Sludge Blanket Thickness and Average Water Depth for Each Treatment Cell

Section 2 – Calculations for Volume and Mass

Model # 1 Sludge Volume Calculations for Kayenta's Cell # 1A

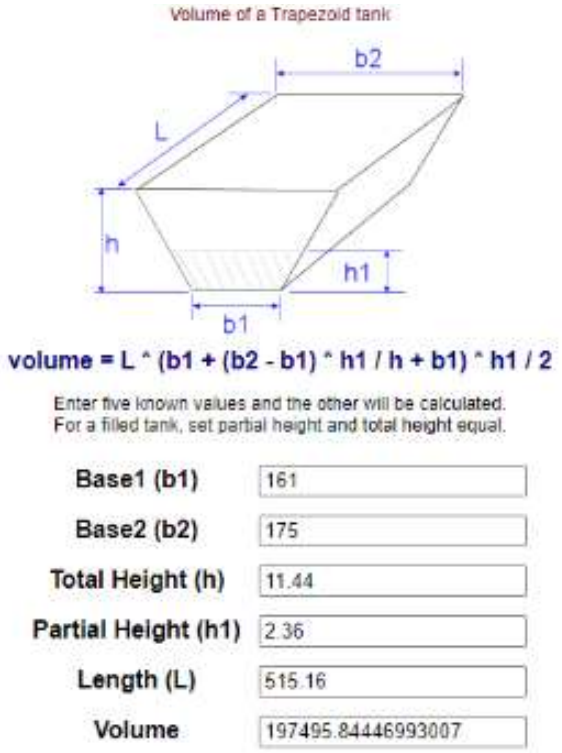


Figure 3. Model # 1 for Determining Sludge Volumes in Cells 1-4 Plus Dry Cells 1 & 2

Cell # 1: 1,447,270 gallons of sludge

This model was used on Cell 1B and Cells 2-4 and Dry Cells 1 & 2 as well. The results are reported in Table 2 below.

Section 2 – Calculations for Volume and Mass

Model # 2

Using the shape of a truncated prism, with 3:1 slope the sludge volume for Cell -1A in Model # 2 calculates as follows:

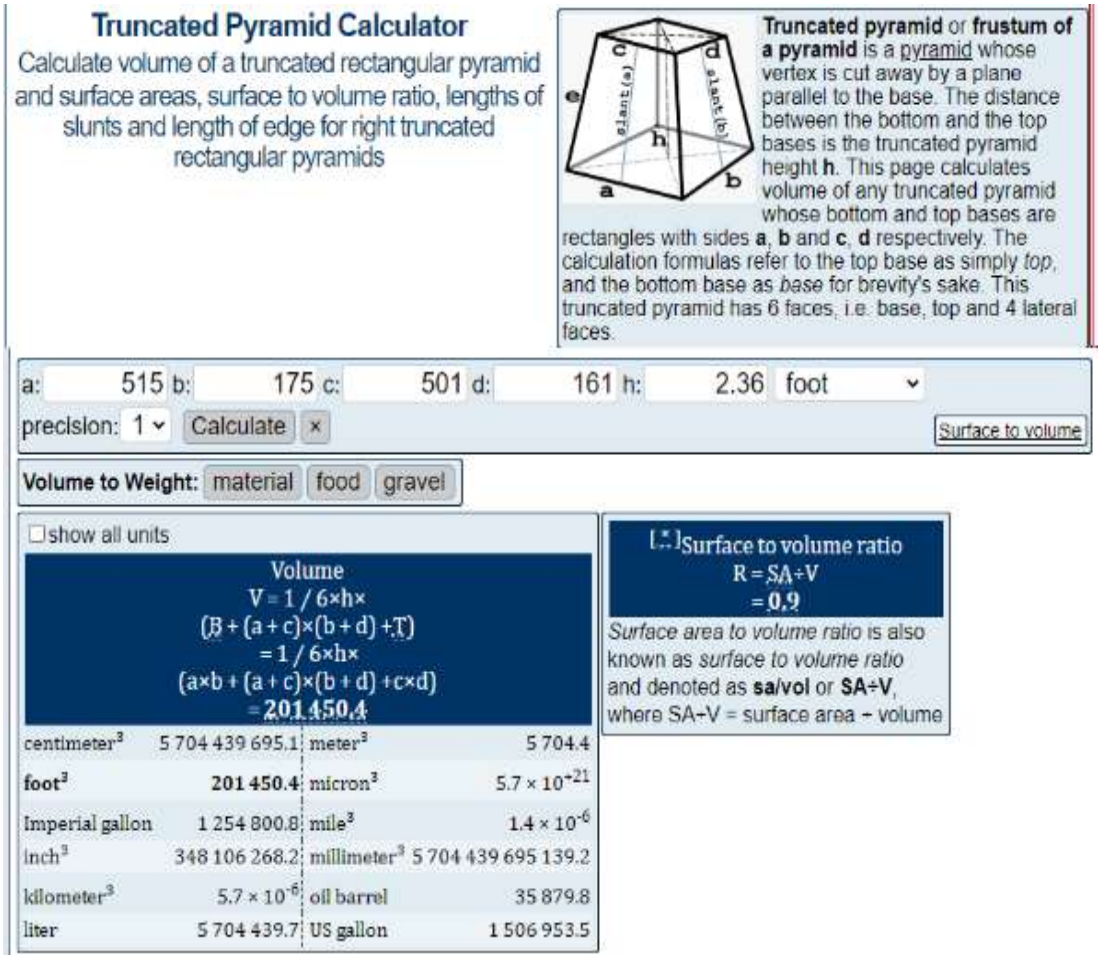


Figure 4. Model # 2 Used for Determining Sludge Volumes in Cells 1-4 plus Dry Cells 1 & 2

Total Cell # 1 Sludge Volume Using Model # 2:

1,506,954 gallons of sludge

This model was used on Cell 1B and Cells 2-4 and Dry Cells 1 & 2 as well. The results are reported in Table 2 below.

Please refer to the graphics at the end of this report for sludge blanket thickness locations throughout each treatment cell, and please note that average sludge blanket thickness and average Total Solids (%) is used to determine sludge volume and mass.

Section 2 – Calculations for Volume and Mass

Model # 3

Model # 3 Sludge Volume Calculator for Kayenta AZ , H&S Environmental, LLC									
Elevations are calculated based on measured pond depth. Eroded Slopes Exist									
Shape is rectangular with rounded edges and eroded sloped sides using									
average sludge depths									
Item	**Units**	**Cell # 1A**	**Cell # 1B**	**Cell # 2**	**Cell # 3 minus a fraction**	**Cell # 4 minus a fraction**	**Dry Cell # 1 Old Cell # 1**	**Dry Cell # 2 Old Cell # 2**	**Total**
Bottom Length	feet	**501**	**502**	**802**	**534**	**537**	**490**	**545**	
Bottom Width	feet	**161**	**162**	**252**	**434**	**380**	**230**	**230**	
Side Slopes	1 to	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
Average Sludge Depth	feet	**2.36**	**1.76**	**0.58**	**0.81**	**0.8**	**0.309**	**0.174**	
As-Built Bottom Elevation	feet	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	
As-Built Top-of-Bank Elevatic	feet	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**	**14.00**	
Bottom Area	sq ft	80,661	81,324	202,104	231,756	204,060	112,700	125,350	
Top of Sludge Length	feet	515.16	512.56	805.48	538.86	541.8	491.854	546.044	
Top of Sludge Width	feet	175.16	172.56	255.48	438.86	384.8	231.854	231.044	
Top of Sludge Area	sq ft	90,235	88,447	205,784	236,484	208,485	114,038	126,160	
Sludge Volume	cu ft	201,658	149,399	118,288	94,818	85,509	35,031	21,881	**706,584**
Sludge Volume	gallons	**1,508,400**	**1,117,503**	**884,791**	**709,243**	**617,167**	**262,032**	**163,673**	**5,262,809**
This is an estimate only. This estimate is based on badly eroded side slopes,									
a pond bottom that varies in depth, has rounded corners, veriable									
sludge blanket depths and is based on an average of 20 sample points per treatment cell									
Estimates of elivations Calculated. Pond dimensions are based on measurements from Google Earth									
Do not use this information for dredging contractor estimates									

Figure 5. Model # 3 Used to Determine Sludge Volumes in Cells 1-4 and Dry Cells # 1 & # 2

Cells 1A & B & Dry Cells 1 & 2 sludge volumes are all calculated in the same manner using three (3) math models and a math formula for calculating the volume of a rectangular frustum. The results of all three (3) models and the mathematical calculation are summarized below to give a range of sludge volume and mass. Please see the appendix for sludge thickness locations.

	Average Actual Measured Sludge Blanket Thickness (ft)	Sludge Volume from Model # 1	Sludge Volume from Model # 2	Sludge Volume from Model # 3	Sludge Volume from Mathematical Calculations	Average Estimated Sludge Volume	Average Total Solids (%)	Tons of Dry Solids
Cell # 1A	2.360	1,477,420	1,506,954	1,508,400	1,533,958	**1,506,683**	6.30	**394**
Cell # 1B	1.760	1,098,677	1,117,336	1,117,503	1,121,413	**1,113,732**	6.83	**318**
Cell # 2	0.580	880,920	876,163	884,791	877,132	**879,751**	3.30	**118**
Cell # 3	0.810	708,999	712,813	709,243	709,656	**710,178**	11.00	**325**
Cell # 4	0.800	616,603	631,422	617,167	508,763	**593,489**	6.35	**169**
Cell # 5	0.309	261,591	262,171	262,032	262,031	**209,565**	96.00	**1049**
Cell # 6	0.174	163,453	163,661	163,673	163,670	**130,891**	97.00	**665**

Table 2. A Summary of Individual Treatment Cell Sludge Volumes and the Total Sludge Volume for Wastewater Treatment Cells 1-4 and Dry Cells 1 & 2 as Calculated by Three Math Models and Mathematical Formula

Section 2 – Calculations for Volume and Mass

Supporting Formula and Calculations for Sludge Volume and Mass:

The Formula for Calculating Treatment Cell Sludge Volumes

$$\text{Sludge Volume } (ft^3) = \left[\frac{W \times L + (W - 2SH) \times (L - 2SH)}{2}\right] \times H$$

W = width of lagoon (ft)
L = length of lagoon (ft)
S = slope (ratio of horizontal to vertical distances on the interior sides of lagoon).
3:1, the slope is taken as 3.
H= height of liquid or depth of liquid in the lagoon. (ft)

Figure 6. Formula Used for Calculating the Sludge Volume of a Truncated Pyramid or (Rectangular Frustum)

Cell # 1A Sludge Volume Calculation:

Result: $\left[\frac{175 \times 515 + (175 - 2(3)(.2.36)) \times (515 - 2(3)(2.36))}{2}\right] \times 2.36 \times 7.48 \text{ gal/ft}^3 =$ **1,533,958 gallons**

Cell # 1B Sludge Volume Calculation:

Result: $\left[\frac{173 \times 513 + (173 - 2(3)(1.76)) \times (513 - 2(3)(1.76))}{2}\right] \times 1.75 \times 7.48 \text{ gal/ft}^3 =$ **1,121,413 gallons**

Cell # 2 Sludge Volume Calculation:

Result: $\left[\frac{256 \times 806 + (256 - 2(3)(0.58)) \times (806 - 2(3)(0.58))}{2}\right] \times 0.58 \times 7.48 \text{ gal/ft}^3 =$ **887,132 gallons**

Cell # 3 Sludge Volume Calculation:

Result: $\left[\left[\frac{439 \times 539 + (439 - 2(3)(.81)) \times (539 - 2(3)(.81))}{2}\right] \times .81 \times 7.48 \text{ gal/ft}^3\right] /2 =$ **709,656 gallons**

Cell # 4 Sludge Volume Calculation:

Result: $\left[\left[\frac{504 \times 547 + (504 - 2(3)(0.80)) \times (547 - 2(3)(0.80))}{2}\right] \times 0.80 \times 7.48 \text{ gal/ft}^3\right]/2$ Minus a triangular segment of area:308,583 gallons = **508,763 gallons**

Dry Cell # 1 Sludge Volume Calculation:

Result: $\left[\frac{232 \times 492 + (232 - 2(3)(0.309)) \times (492 - 2(3)(0.309))}{2}\right] \times 0.309 \times 7.48 \text{ gal/ft}^3 =$ **262,276 gallons**

Dry Cell # 2 Sludge Volume Calculation:

Result: $\left[\frac{231 \times 546 + (231 - 2(3)(0.174)) \times (546 - 2(3)(0.174))}{2}\right] \times 0.174 \times 7.48 \text{ gal/ft}^3 =$ **163,628 gallons**

Section 2 – Calculations for Volume and Mass

The Formula for Calculating Sludge Mass

Tons of Solids, Cell -1A = $\frac{201{,}658\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times .0627\ \%\ Solids}{2{,}000\ lbs./ton}$ = **394 dry tons**

Tons of Solids, Cell -1B = $\frac{149{,}399\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times 0.0683\ \%\ Solids}{2{,}000\ lbs./ton}$ = **318 dry tons**

Tons of Solids, Cell - 2 = $\frac{118{,}288\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times 0.032\%\ Solids}{2000\ lbs./ton}$ = **118 dry tons**

Tons of Solids, Cell -3 = $\frac{94{,}818\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times .110\ \%\ Solids}{2{,}000\ lbs./ton}$ = **325 dry tons**

Tons of Solids, Cell -4 = $\frac{85{,}509\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times 0.0635\ \%\ Solids}{2{,}000\ lbs./ton}$ = **169 dry tons**

Tons Solids, Dry Cell -1 = $\frac{35{,}031\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times 0.96\%\ Solids}{2000\ lbs./ton}$ = **1,049 dry tons**

Tons Solids, Dry Cell -2 = $\frac{21{,}881\ (ft^3) \times 7.48\ gal/ft^3 \times 8.34\ lbs./gal \times 0.97\%\ Solids}{2000\ lbs./ton}$ = **622 dry tons**

Section 2 – Calculations for Volume and Mass

Sample Name	Total Solids Result (%)
Cell-1A Composite # 1	4.2
Cell-1A Composite # 2	6.0
Cell-1A Composite # 3	8.6
Average	**6.27**
Cell-1B Composite # 1	7.2
Cell-1B Composite # 2	7.2
Cell-1B Composite # 3	6.1
Average	**6.8**
Cell -2 Composite # 1	3.1
Cell -2 Composite # 2	3.5
Average	**3.3**
Cell -3 Composite # 1	10
Cell -3 Composite # 2	12
Average	**11**
Cell -4 Composite # 1	5.9
Cell -4 Composite # 2	6.8
Average	**6.35**
Dry Cell # 1 Sample # 1	96
Dry Cell # 1 Sample # 2	96
Average	**96**
Dry Cell # 1 Sample # 1	97
Dry Cell # 1 Sample # 2	97
Average	**97**

Table 3. Summary of Core Sample Results Used to Determine the Mass of Sludge in Each Treatment Cell. Please see attached for TestAmerica Lab Results

Section 3 – Notes and Conclusions for the Calculation of Volume and Mass

NOTES

In the estimation of sludge mass, the following considerations must be made.

Because of blow sand and dirt entering the surface of each treatment cell, and grit and gravel entering the primary cells from the collection system, adjustments must be made to the estimated sludge mass. The bottom three (3) inches of the sludge at the very bottom of the sludge profile cannot be collected because of the limitations of the core sampling equipment. It must be assumed that the bottom two (2) to four (4) inches could be as dense as 30% or more Total Solids.

The core sampler for Total Solids sampling may have rested on a layer of thick, dense, impenetrable sand and dirt covering the liner, causing the underestimation of Sludge blanket thickness leading to an underestimation of the sludge mass and volume.

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It is prudent to add a two (2) to four (4) inch volume factor and a twenty (20) or thirty (30) % mass factors for accumulated dirt, sand, and grit that could not be collected for Total Solids analysis.

Model and Measurement Limitations

Averages were used in the calculations. Elevation estimates were used, but actual water and sludge thickness were measured and used. The treatment cells are irregular in shape and have rounded corners. Slopes are affected by years of erosion and not true 3:1 slopes.

In some cases where the grit, gravel, and sand are thick, the survey level rod for measuring the waster depths may have rested on top of the sand grit and gravel blanket, causing an underestimation of volume and mass.

The top of the sludge blanket may vary in density due to gas activity in the blanket. This is important because we measure sludge blanket thickness. The density of the upper few centimeters of the sludge blanket varies seasonally with gas production and bioactivity. An average TS lab result was used to determine dry tons of sludge. There is some variation in density from one end of each treatment cell to the other.

Thank you for the opportunity to serve the good people of the NTUA

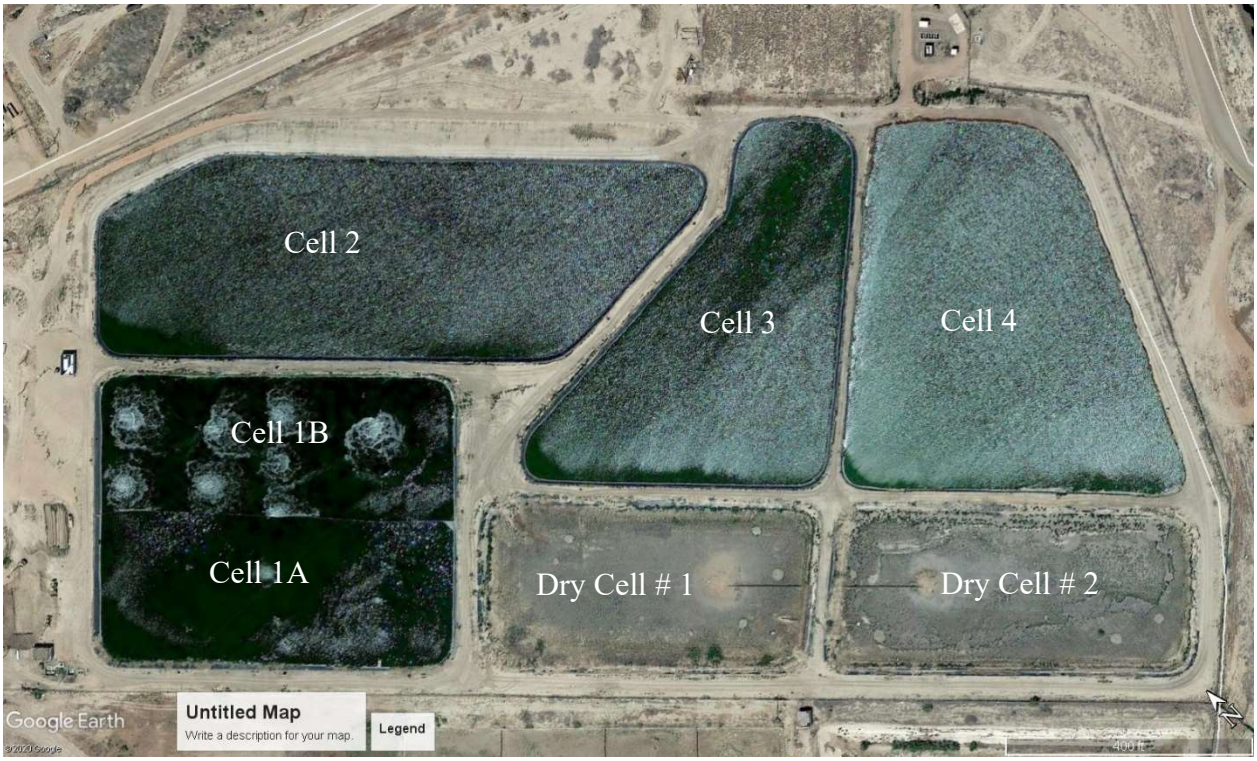
Sincerely,



Steve Harris
President
H&S Environmental, L.L.C.

Appendix

The Kayenta Wastewater Lagoon System. Two Dry Cells and four active treatment cells



Appendix Figure 1. Satellite View of the Kayenta Wastewater Lagoon System

Cell #1A Sludge Blanket Thickness Locations

N

	1	2	3	4	5	6	7	8	9
A	4.00	1.50	1.33	1.25	1.50	1.58	0.83	1.67	4.33
B	3.50	3.83	3.00	1.00	1.75	2.67	0.33	2.17	4.25
C	1.92	4.08	2.50	1.67	2.00	1.83	1.08	4.00	4.08

Cell # 1B Sludge Blanket Thickness Locations

N

	1	2	3	4	5	6	7	8
A	1.42	1.67	0.75	0.50	1.08	2.08	1.33	3.50
B	0.67	1.83	0.50	1.00	2.17	0.83	2.00	3.75
C	0.50	0.67	1.00	0.83	2.75	3.33	3.83	4.17

Cell # 2 Sludge Blanket Thickness Locations

N

	1	2	3	4	5	6
A	0.58	0.50	0.25	0.58	0.58	0.33
B	0.50	0.58	0.75	0.42	0.33	0.67
C	0.58	0.75	0.75	0.83	0.92	

Cell # 3 Sludge Blanket Thickness Locations

N

	1	2	3	4	5
A	0.50	0.75	1.00	1.08	0.92
B	0.67	0.42	0.67	0.83	1.08
C		0.50	0.92	0.75	1.08
D			0.92	0.92	0.83
E				0.75	0.75
F					0.92

Cell # 4 Sludge Blanket Thickness Locations

N

	1	2	3	4	5	6
A		0.92	1.00	0.92	0.92	0.50
B	0.17	0.83	0.75	0.67	0.83	0.58
C	0.42	1.25	0.58	0.67	1.00	0.92
D	0.92	1.33	0.83	0.75	0.83	0.83

Dry Cell # 1 Sludge Blanket Thickness Locations

N

	1	2	3	4	5
A	0.17	0.13	0.33	0.33	0.33
B	0.42	0.42	0.29	0.33	0.21
C	0.33	0.33	0.35	0.42	0.40

Dry Cell # 2 Sludge blanket Thickness Locations

N

	1	2	3	4	5	6
A	0.17	0.17	0.17	0.29	0.17	
B	0.13	0.10	0.25	0.17	0.42	0.21
C	0.13	0.08	0.06	0.13	0.17	

Attachment 3: Kayenta Lagoon Water Removal Report Final UPDATE 071726

Kayenta Lagoon Water Removal and Dewatering Evaluation Report

Executive Summary

UPDATE: July 2026, NTUA has experienced a reduction lagoon levels of approximately 3-feet or 33% of the original volume due to natual evaporation. Conditions have been hot, dry and windy in the area, providing optimal conditions for maximum evaporation. As a result, pumping durations will be significantly reduced from the original anticipated estimates.

NTUA evaluated multiple options for removal of water from the existing Kayenta wastewater lagoons as part of the lagoon decommissioning and closure effort associated with the new Kayenta Wastewater Treatment Plant. Alternatives evaluated included natural evaporation, mechanical evaporation systems, hauling offsite, and direct pumping of lagoon water into the headworks of the new wastewater treatment plant for treatment and permitted discharge.

Based on operational feasibility, potential environmental impacts, schedule, cost, and overall project efficiency, NTUA has determined that the preferred approach is to pump lagoon water from the existing lagoons into the headworks of the new wastewater treatment plant for treatment and discharge through the permitted treatment process.

In the proposed approach, water will initially be pumped from Cell 1 into the headworks at an estimated rate of approximately 200 to 300 gallons per minute (gpm). As water levels in Cell 1 are reduced, water from the remaining lagoon cells will be pumped directly into Cell 1 to maintain continuous pumping operations and centralized water management.

Using the currently estimated total free water volume (in all existing cells) of approximately 26.8 million gallons, NTUA estimates that lagoon water removal can be completed within approximately 62 to 96 days under continuous operation, depending on actual pumping rates and operational conditions.

This approach greatly reduces the overall project duration compared to natural evaporation methods. NTUA consultant Brown and Caldwell estimated that natural evaporation of the lagoons would require approximately two and a half years.

The selected pumping and treatment approach provides NTUA with a controlled, reliable, and operationally manageable solution that accelerates lagoon closure activities, supports sludge removal operations, reduces long-term environmental impacts, and allows the overall decommissioning effort to proceed on a reasonable schedule.

Barring unforeseen disruptions or complications, NTUA expects to complete lagoon water removal within the schedule identified in this report and to proceed into sludge management, lagoon closure, liner removal, grading, and final site restoration activities thereafter.



Figure 1: Kayenta WWTP lagoons to be retired.

Project Background

The Kayenta Wastewater Treatment Plant replacement project includes decommissioning and closure of the existing wastewater lagoon system. The lagoon system contains significant quantities of free water and accumulated sludge requiring management prior to final closure activities.

A previous evaluation prepared by EES Consulting estimated the lagoon system currently contains approximately 26,800,000 gallons of free water and 3,600,000 gallons of sludge at approximately 6% solids.

The purpose of this report is to evaluate the proposed strategy of pumping lagoon water into the new treatment plant headworks for processing and discharge and compare this approach against natural evaporation timelines.

Proposed Water Removal Strategy

NTUA proposes to remove lagoon water by utilizing the new wastewater treatment plant treatment process rather than relying solely on natural evaporation or extensive offsite hauling operations.

Water will initially be pumped from Cell 1 into the headworks of the new wastewater treatment plant, where it will be incorporated into the normal treatment process and discharged in accordance with the facility's permit requirements. As water levels in Cell 1 are reduced, water from the remaining lagoon cells will be pumped directly into Cell 1 to maintain continuous pumping operations and maximize operational efficiency. Throughout the dewatering project, Cell 1 will serve as the centralized pump-down and water management cell, allowing NTUA to systematically consolidate and remove water from the entire lagoon system. Pumping and treatment operations will continue until the free water has been substantially removed from all lagoon cells, allowing subsequent sludge removal, lagoon decommissioning, and site restoration activities to proceed.

This approach allows NTUA to maximize pumping efficiency by maintaining continuous pumping operations without the need to repeatedly shut down, relocate, and reconfigure pumps. It also improves the effective use of staff resources by minimizing the labor required to move pumping equipment and piping between lagoon cells. In addition, consolidating water management through Cell 1 helps maximize natural evaporation by maintaining the greatest practical water surface area in the remaining lagoon cells throughout the drawdown process, allowing evaporation and pumping to occur simultaneously and further accelerating overall water removal. NTUA expects that the additional volumes of wastewater being pumped from the lagoons into the new treatment plant will not adversely affect the plant's ability to continue to comply with applicable permit requirements.

Pumping Rate and Removal Duration Analysis

Based on the estimated water volume determined by field measurements, it is estimated that 26,800,000 gallons of water need to be removed from the cells before drying of the sludge can begin. According to engineering estimates based on permit limits, new plant design, and historical flow data, the new plant can handle accepting 200 – 300 gpm of inflow of water from the existing lagoons, in addition to the wastewater routinely piped into the Kayenta facility from the surrounding community, without negative impact to the plant performance or violating permit limitations. Depending on operational constraints, it is estimated that through pumping alone the water can be fully removed from all the lagoon cells in approximately 62 – 96 days from initiation.

UPDATE: Natual Evaporation began March 9, 2026, when the replacement plant began discharging. As of July 16, 2026, levels have dropped nearly 33% (approximately 3-feet). This information is based on measurements taken from the lagoons during the initial dewatering analysis which took place in February 2026. Pumping times will be reduced from the estimations in the table below.

Rate (gpm)	Gallons per Day	# of days to complete pumping
300	432,000	62
250	360,000	74
200	280,000	96

These estimates assume continuous operations (24x7) and may vary depending on operational conditions, maintenance, and treatment plant capacity.

Natural Evaporation Comparison

NTUA partnered with the engineering firm, Brown and Caldwell, to evaluate natural evaporation timelines for the lagoon cells based on the current volumes, surface areas, and environmental conditions specific to the region (e.g. avg temperatures and precipitation). The analysis concluded that it would take 2 ½ years to completely remove the existing water from the lagoons, which would be significantly longer than other methods considered.

Cell 1	Cell 2	Cell 3	Cell 6
2 years 6 months	2 years 6 months	1 year 8 months	1 year 8 months

Natual Evaporation began March 9, 2026, when the replacement plant began discharging. As of July 16, 2026 levels have dropped nearly 33% (approximately 3-feet).

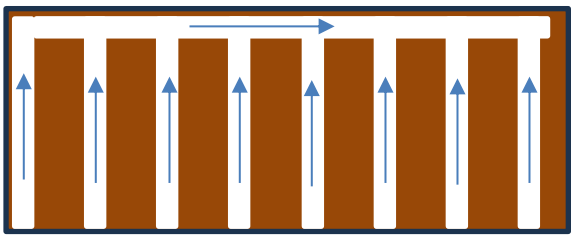
Sludge Drying Evaluation

Based on measurements, the lagoon system is estimated to contain approximately 3,600,000 gallons of sludge with 6% being solids.

Total Sludge (gallons)	Water 94% (gallons)	Solids 6% (gallons)
3,600,000	3,384,000	216,000

It is estimated that through natural evaporation the sludge drying process would take approximately 2 - 4 years before the sludge is suitable for handling and disposal. NTUA continues to explore options for reducing the time needed to dry the sludge for handling and disposal. Options include utilizing the drying beds of the new facility, mechanically turning and shaping the sludge to maximize natual evaporation rates, and mechanical means (centrifugal water removal).

Brown & Caldwell has supported removing portions of the existing sludge to increase surface area and channel water away from the sludge to maximize drying efficiency. Removed sludge would be placed on the drying beds and periodic removal of free liquid would be completed with a hydrovac as needed to keep the channels free of liquid.



Conclusion

NTUA evaluated multiple alternatives for lagoon water management and determined that pumping lagoon water directly into the headworks of the new Kayenta Wastewater Treatment Plant for treatment and discharge is the preferred alternative.

Based on estimated pumping rates of 200 to 300 gallons per minute and an estimated lagoon free water volume of approximately 26.8 million gallons, NTUA expects lagoon water removal operations to require approximately 62 to 96 days under continuous operation.

By comparison, natural evaporation alone was estimated to require between approximately 1 year and 8 months to 2.5 years for each cell, depending on the lagoon cell's size.

NTUA therefore intends to proceed with the pumping and treatment approach in order to accelerate lagoon decommissioning, support sludge management activities, reduce environmental impacts, and advance final lagoon closure and site restoration activities on an achievable and controlled schedule.