GRANT APPLICATION SUMMARY SHEET

Grant Name: DWR-ARP Non Collaborative State Water Infrastructure Grants (SWIG) 22-26

Department: WATER & SEWER

Grantor: ENVIRONMENTAL PROTECTION AGENCY

Pass-Through Grantor (If applicable): TENN. DEPT. OF ENV. & CONS.

Total Applied For $63,418,244.83

Metro Cash Match: $101,077,755.17

Department Contact: Aaron Thomas
4878872

Status: NEW

Program Description:

Major upgrades at the Dry Creek Water Reclamation Facility includes construction of a new headworks, new Biosolids Facility, other residuals management improvements, odor control improvements, and electrical improvements. This modernization will ultimately increase capacity for these areas to handle flow for the projected 20 years and refurbish a critical facility that is over 50 years in age. This project meets the critical infrastructure requirements of the SWIG grant. (Please see PER for engineering details).

Plan for continuation of services upon grant expiration:

Once completed in 2026, operating costs and long term capital maintence costs will be impacted. The Biosolids Facility will require upkeep of specialized equipment as presently used at the Central Facility. It is anticipated that operating costs will increase, but at a level, predictable value.

APPROVED AS TO AVAILABILITY OF FUNDS:

DocuSigned by: Kelly Flannery 10/12/2022
C5513D4D905E4EB...
Director of Finance KW TE **Date**

APPROVED AS TO FORM AND LEGALITY:

DocuSigned by: Tara Ladd 10/12/2022
E356FC378EF9427...
Metropolitan Attorney **Date**

APPROVED AS TO RISK AND INSURANCE:

DocuSigned by: Balogun Cobb 10/12/2022
58804BE13FD741C...
Director of Risk Management Services **Date**

DocuSigned by: John Cooper 10/12/2022
F0B3372652D0499...
Metropolitan Mayor **Date** KW

(*This application is contingent upon approval of the application by the Metropolitan Council.)*

DocuSign Envelope ID: 83DC6356-BE4F-4082-A915-609CEE012602

Grants Tracking Form

Part One

Pre-Application ○ Application ◉ Award Acceptance ○ Contract Amendment ○

Department	Dept. No.	Contact	Phone	Fax
WATER & SEWER	065	Aaron Thomas	4878872	

Grant Name:	DWR-ARP Non Collaborative State Water Infrastructure Grants (SWIG) 22-26		
Grantor:	ENVIRONMENTAL PROTECTION AGENCY	**Other:**	
Grant Period From:	11/01/22	(applications only) **Anticipated Application Date:**	10/15/22
Grant Period To:	09/30/26	(applications only) **Application Deadline:**	10/30/22
Funding Type:	FED PASS THRU	**Multi-Department Grant** ☐	**If yes, list below.**
Pass-Thru:	TENN. DEPT. OF ENV. & CONS.	**Outside Consultant Project:** ☐	
Award Type:	FORMULA	**Total Award:**	$63,418,244.83
Status:	NEW	**Metro Cash Match:**	$101,077,755.17
Metro Category:	New Initiative	**Metro In-Kind Match:**	$0.00
CFDA #		**Is Council approval required?** ☐	
Project Description:		**Applic. Submitted Electronically?** ☐	

Major upgrades at the Dry Creek Water Reclamation Facility includes construction of a new headworks, new Biosolids Facility, other residuals management improvements, odor control improvements, and electrical improvements. This modernization will ultimately increase capacity for these areas to handle flow for the projected 20 years and refurbish a critical facility that is over 50 years in age. This project meets the critical infrastructure requirements of the SWIG grant. (Please see PER for engineering details).

Plan for continuation of service after expiration of grant/Budgetary Impact:

Once completed in 2026, operating costs and long term capital maintence costs will be impacted. The Biosolids Facility will require upkeep of specialized equipment as presently used at the Central Facility. It is anticipated that operating costs will increase, but at a level, predictable value.

How is Match Determined?

Fixed Amount of $		or	25.0%	**% of Grant**	**Other:** ☑

Explanation for "Other" means of determining match:

This is a direct allocation grant. The grant requires a cofunding amount of 25% or 15,854,562. However, Project costs exceed 85,223,192, so the full project cost will be 164,496,000.

For this Metro FY, how much of the required local Metro cash match:

Is already in department budget?	yes	**Fund**	47410	**Business Unit**	Not assigned
Is not budgeted?		**Proposed Source of Match:**			Commercial Paper Proceeds

(Indicate Match Amount & Source for Remaining Grant Years in Budget Below)

Other:

Number of FTEs the grant will fund:	0.00	**Actual number of positions added:**	0.00	
Departmental Indirect Cost Rate	22.10%	**Indirect Cost of Grant to Metro:**	$36,189,120.00	
***Indirect Costs allowed?** ◉ Yes ○ No **% Allow.**	N/A	**Ind. Cost Requested from Grantor:**	$0.00	**in budget**

***(If "No", please attach documentation from the grantor that indirect costs are not allowable. See Instructions)**

Draw down allowable ☐

Metro or Community-based Partners:

Part Two

Grant Budget

Budget Year	Metro Fiscal Year	Federal Grantor	State Grantor	Other Grantor	Local Match Cash	Match Source (Fund, BU)	Local Match In-Kind	Total Grant Each Year	Indirect Cost to Metro	Ind. Cost Neg. from Grantor
Yr 1	**FY24**	**$16,488,743.66**			$26,280,216.34	47410	$0.00	$42,768,960.00	$14,500,327.03	$0.00
Yr 2	**FY25**	**$31,709,122.42**			$50,538,877.59	47410	$0.00	$82,248,000.00	$27,885,244.29	$0.00
Yr 3	**FY 26**	**$15,220,378.76**			$24,258,661.24	47410	$0.00	$39,479,040.00	$13,384,917.26	$0.00
Yr 4	**FY__**									$0.00
Yr 5	**FY__**									
Total		$63,418,244.83			$101,077,755.17			$164,496,000.00	$55,770,488.59	$0.00

Date Awarded:		**Tot. Awarded:**		**Contract#:**	
(or) **Date Denied:**		**Reason:**			
(or) **Date Withdrawn:**		**Reason:**			

Contact:
vaughn.wilson@nashville.gov

Rev. 5/13/13
5526

GCP Rec'd
10/11/22

GCP Approved
10/12/22

VW

Department of Environment & Conservation

Application Summary

How to Create New Activity

Application Type: DWR-ARP Non Collaborative Grants State Water Infrastructure Grants (SWIG) program

Purpose and Overview

GRANT OVERVIEW

Background

Tennessee's Water Infrastructure Investment Plan (WIIP) describes how the State of Tennessee plans to invest the state's American Rescue Plan (ARP) fiscal recovery funds in water infrastructure projects. These funds were authorized and appropriated by the federal American Rescue Plan Act (ARPA). The state's Financial Stimulus Accountability Group (FSAG) designated $1.35 billion for the Tennessee Department of Environment and Conservation (TDEC) to administer for this purpose. This grant manual details how TDEC is administering $1 billion through non-competitive, formula-based grants. **Funds are made available through the State Water Infrastructure Grants (SWIG) program to be used for eligible drinking water, wastewater, or stormwater projects.** SWIG refers to Tennessee's grant funding available for water, wastewater, or stormwater projects, including funding as described in the WIIP. This grant manual describes the non-competitive SWIG grant funding outlined in the WIIP. Entities eligible to apply for these non-competitive grants will need to meet minimum technical and administrative requirements and demonstrate commitment of co-funding before a grant can be awarded. The state will obligate all ARP funds by December 31, 2024 to ensure all ARP funds are fully spent by December 31, 2026.

State Goals and Priorities

An estimated $5 to $15 billion of investment in Tennessee's water infrastructure is necessary between now and 2040. These non-competitive SWIG investments are one opportunity to modernize, improve, and strengthen water infrastructure across the state. However, these investments alone will not address all outstanding needs. TDEC is focusing this non-competitive SWIG grant effort on the following goals:

- Protect and promote human health and safety and improve the quality of Tennessee's water by supporting drinking water and wastewater systems in significant non-compliance to work towards and achieve compliance;
- Improve the technical, managerial, and financial capabilities of small, disadvantaged, or underserved water infrastructure systems; and
- Address critical water infrastructure needs across the state.

TDEC identified 11 priority areas of emphasis for the WIIP. Focusing on these areas will prepare Tennessee's water infrastructure systems for long-term technical, financial, managerial, and environmental sustainability. To ensure the most critical aspects of a drinking water or wastewater treatment system are addressed, TDEC has established a subset of these priority areas of emphasis for designation as critical need areas. Critical need priority areas must be addressed in proposals either through the proposed project itself or by demonstrating that critical needs are being addressed with other resources. The additional priority areas of emphasis are optional but encouraged activities. For a complete description of priority areas of emphasis, see Section V of the Water Infrastructure Investment Plan.

Critical Need Priority Areas

- Achieving Compliance with Local, State, and Federal Drinking Water, Wastewater, and Stormwater Water Quality Requirements
- Asset Management Planning for Sustainable Drinking Water, Wastewater, and Stormwater Systems
- Water Loss Reductions for Drinking Water Systems
- Infiltration and Inflow Reductions for Wastewater Systems
- Modernization of Facilities and Equipment for Drinking Water and Wastewater Systems

Additional Priority Areas

- Water Reuse
- Green Infrastructure Best Management Practices / Managing Stormwater
- Consolidation / Regionalization for Drinking Water and Wastewater Systems
- Managing Risk / Building Resilience to Extreme Weather Events, Cybersecurity, or Other Hazards for Drinking Water and Wastewater Systems
- Planning for Replacement of Lead Service Lines for Drinking Water Systems
- Enhancing Service to Small, Underserved, or Disadvantaged Communities for Drinking Water and Wastewater Systems

Timeline, Eligibility & Funding

DEADLINE TO SUBMIT AND TIMELINES

Review Process

TDEC will review, evaluate, and recommend grant awards within 30 days of receiving a **complete** grant proposal and application. TDEC will announce grant awards and execute contracts within 60 days of grant award recommendations. Grant applicants should anticipate project management discussions with TDEC during this process, including but not limited to discussing an overview of the award, scope of services, project timelines, terms and conditions, subcontracting, the budget, and the process to reimburse for costs incurred.

Grant Timeline

The anticipated timeline for this grant offering is as follows:

April 2022: Application period for collaborative grant proposals opened
May 30, 2022: First round of collaborative grant awards announced; grant awards announcement monthly thereafter as needed
June 1, 2022: Application period for non-collaborative grant proposals opened
August 31, 2022: First round of non-collaborative grant awards announced; grant awards announcement monthly thereafter as needed
November 1, 2022: Non-competitive grant phase closes
December 31, 2022: All remaining grant awards announced and contracts executed
January 31, 2023: Competitive grant timeline and fund total announced
TBD: Application period for competitive grant proposals opened
December 31, 2024: All remaining WIIP funds awarded or otherwise obligated
September 30, 2026: All non-competitive and competitive grant agreements end

ELIGIBILITY

Grant Applicants

Eligible grant applicants include:

- all counties and incorporated cities with a water infrastructure system or MS4.
- have a designated funding allocation.

Grant proposals:

- must provide information on co-funding requirements in their proposals
- identify all eligible project owners serving the grant applicant's jurisdiction.

Grant applicants are responsible for:

- grant oversight and monitoring of activities
- submitting progress updates

- Submitting reimbursement requests

Activities associated with grant administration and oversight are eligible expenses

- Applicants can allocate up to 6% of the total grant contract

Project Owners

Projects must be implemented by:

- eligible project owners (owns or operates water infrastructure systems)
- grant applicants on behalf of project owner.

All utility systems must complete the Tennessee Infrastructure Scorecard (the "Scorecard") and submit a summary with the proposal.

Activities

Eligible activities for this grant program strongly align with State Revolving Fund (SRF) activities for drinking water, wastewater, and stormwater projects. Applicants are encouraged to review SRF eligibilities guidelines for detailed information. In addition, TDEC has narrowly expanded eligible activities for certain stormwater projects and contaminated private wells. Please refer to the Grant Manual for additional information.

FUNDING

A proposal's overall grant budget is the sum of the funding allocation and co-funding, including co-funding reductions. Grant applicants may divide their funding allocation across collaborative and non-collaborative proposals as long as the totals do not exceed the funding allocation.

Co-Funding

Every proposal must meet co-funding requirements. Co-funding amounts are determined by a **city's** or **county's Ability to Pay Index (ATPI)**.

ATPI	Co-funding Requirement
50 or less	15%
60-70	25%
80-100	35%

Co-funding sources:

- Partners
- Financial supporters
- Utility districts

Types of co-funding

- Cash; SRF loans, bonds, cash reserves, public/private partnerships
- In-kind; goods or services, labor, equipment services, material
    - In-kind contributions must be documented with an individual accountability report
- Other cash-value contributions (e.g. engineering plans and specifications) developed on or after March 3, 2021

The amount of qualifying in-kind contributions used to meet co-funding requirements must be a minimum of 15% of the overall grant budget up to the required co-funding.

Treasury's Final Rule allows for the use of ARP funds as a match for other federal and non-federal grant programs where the costs are eligible under both programs. The entire project, including ARP dollars, is then subject to the requirements of those grant programs. ARP funds, local or state, cannot be used as match for grant programs that restrict the use of federal funds to meet match requirements.

Incentives to Reduce Co-Funding

Grant applicants can reduce co-funding requirements by collaborating with a community that has a lower ATPI and/or focusing projects on the state's Priority Areas of Emphasis. Only one 5% reduction will be given for either submitting a collaborative project or meeting the priority areas of emphasis. Applicants may be eligible for a reduction in co-funding with one of the two following options.

1. *Collaborative Proposal*: Multiple entities participate in one proposal
    - Co-funding will be based on partner with the lowest ATPI and will receive an additional 5% reduction.
2. *Non-collaborative Proposal*:
    - Proposals must dedicate at least 50% of overall grant budget to priority areas of emphasis to receive a 5% co-funding reduction.

Administrative Use of Funds

Grant applicants are responsible for ensuring proper grant administration. Applicants may contract with consultants to administer the grant; however, legal liability of the terms and conditions of the grant remains with the grant applicant.

Up to 6% of the total state allocation requested may be used for reasonable and allocable administrative expenses, including pre-grant collaborative planning activities.

Selection Criteria

SUBMISSION GUIDELINES

Non-Collaborative Proposals

Eligible grant applicants may only submit one non-collaborative grant proposal, but that proposal may contain one or more projects. Non-collaborative proposals must be submitted during the non-collaborative grant proposal period. A non-collaborative project is one undertaken by a single entity (county, city, or utility) or by multiple entities (counties, cities, and/or utilities) that do not meet the threshold for partner eligibility as described in this grant guidance. Deadlines for submission are discussed in the Grant Timeline section. All proposals must be submitted by November 1, 2022, to be eligible to receive non-competitive grant dollars.

Tennessee Infrastructure Scorecard

Addressing critical water infrastructure needs across the state through SWIG grant dollars is a priority for TDEC. To assist in identifying needs, TDEC is requiring applicants to submit the Tennessee Infrastructure Scorecard su mmary with their application.

The Scorecard covers key areas of a system's technical, managerial, financial, operational, and environmental health. Several aspects of the Scorecard cover SWIG and WIIP priority areas of emphasis for the state. These areas are seen as key to responsibly operate water infrastructure and, if flagged during Scorecard completion, shall be addressed in a SWIG project proposal. Other elements in the Scorecard, such as optimization and risk and resiliency, are guiding elements that promote improved compliance and sustainability but are not considered Critical Needs for the purpose of this grant opportunity.

Every water infrastructure system included in the proposal must address critical needs that exceed thresholds according to their Scorecard. At least two (but no more than two) identified critical needs should be addressed if there are more than one critical need areas highlighted in their Scorecard summary. Critical needs shall be addressed in order of importance as identified below.

Critical Need Categories (Matrices)

1. Addressing Significant Non-Compliance
2. Asset Management Plans
3. Water Loss (for drinking water systems)
4. Inflow and Infiltration (for wastewater systems)
5. Modernization for Aging Infrastructure
6. Stormwater Management Plans

Grant applicants may submit

- One collaborative grant proposal
- maximum of three water infrastructure system types
    - drinking water, wastewater, and stormwater
- Project award type should meet the maximum extent of activities proposed for the water infrastructure system (drinking water, wastewater, stormwater).

The project award types:

- Investigation and planning;
- Investigation, planning, and design;
- Planning, design, and construction; and
- Construction only

Grant applicants are not limited to using funds only to address critical needs. If the grant applicant can demonstrate in the proposal critical need thresholds will be met, applicants can propose concurrent, additional activities as long as they do not exceed the grant applicant's funding allocation. TDEC recognizes that systems may already be addressing critical needs through capital improvement plans, projects, and corrective action plans. If efforts are already underway to address critical needs, grant applicants must demonstrate they will meet critical need requirements (as outlined in the Critical Need Matrix) with alternative funding within the timeframe established. If grant applicants sufficiently demonstrate this and commit toward meeting the thresholds in the grant agreement, non-competitive grant funds may be used for other activities.

Grant Proposal Requirements

General Information

The following general information is required as part of a complete grant proposal. Grant proposals may contain more than one project award type. All eligible grant applicants, at a maximum, can only submit one collaborative proposal and one non-competitive proposal.

Designated grant applicant
Identification of all water infrastructure systems within the grant applicant's jurisdiction or that serve citizens within the grant applicant's jurisdiction
Identification of all partners party to the grant proposal, and
Letters of support and commitment of funds from all entities identified as partners
Brief narrative of the overall proposal, including:

- how the proposal addresses State goals and priorities
- project award type(s)
- project name(s)
- a distribution of responsibilities for each subrecipient and project owner
- Proposal timeline including the start and completion dates of all individual projects

Overall grant budget, including:

- distribution of funds for each subrecipient and project owner, if collaborative
- total administrative expenses, and
- budget for each individual project

- co-funding requirements

Technical Information

Please refer to Appendix B of the grant manual for detailed information required for each project award type.

Resources and Contact

RESOURCES

The Grant Manual contains additional information and guidance for grant applicants and partners. Other useful information may include:

- Critical Need Matrices
- Additional Considerations
- Reimbursement Information
- Definitions
- Budget Notes and Example
- State Allocation Transfer Guidelines

Project Award Type Requirements

- Investigation and Planning
- Investigation, Planning, and Design
- Planning, Design, and Construction
- Construction Only (Streamlined and Standard)

APPLICATION EVALUATION

TDEC will conduct a comprehensive review of all complete grant applications and required supporting documentation. A list of required documents can be sources by Project Award Types (see References). Applications will be evaluated based solely on the data provided; therefore, project eligibility, co-funding documentation, completeness, and accuracy are important. Funding will be awarded based on the merits of the applications. Please note that TDEC may select parts of a proposal for funding and may offer to fund less than the eligible grant amounts or a smaller amount than requested in the application.

The Department will review all applications for:

completeness, accuracy, and project eligibility
how the proposal addresses Critical Needs or other Priority Areas of Emphasis

- significant non-compliance
- asset management planning
- drinking water loss
- wastewater inflow and infiltration
- modernization needs
- stormwater management plans

co-funding requirements and applicable incentives
feasibility of project completion within the grant award period

- project schedules
- project budgets

The Department anticipates a 30-day review period for grant application completeness, eligibility, and award recommendation. Once the grant is recommended for award, the Department will execute individual contracts to grant recipients within 60 days. Grant award notices will be grouped in a monthly announcement through 2022.

During the review process, TDEC staff may contact applicants concerning insufficient applications, to request additional information, to discuss alternatives, or the potential of leveraging of other funding opportunities (e.g., SRF, BIL, CDBG). Information submitted to the Grant Management System (GMS) will be the basis for grant contracts. Complete applications that include accurate budgets, project timelines and descriptions, and co-funding information is critical for timely grant award execution. It is imperative that cost estimates and timelines are realistic and align with the ARP timeframe. Budget adjustments and grant contract amendments may not be possible.

For more information, please contact: TDEC.ARP@tn.gov

Title VI Compliance

Please confirm that Applicant Organization has completed the Title VI Compliance application within the last calendar year.

Yes

Specify completion date of most recent Title VI application.

08/02/2022

General Information

Department of Environment & Conservation

Application Summary

Organization Profile

Organization: Metropolitan Government of Nashville and Davidson County
Type: County Government
Primary Contact: John Cooper
Address: 100 Metro Courthouse,Nashville, TN 37201
Address Two:
Email: john.cooper@nashville.gov
Phone: (615) 862-6000
Fax:
Website:

Application completed by

Name: Amanda Deaton-Moyer
Personal Address: 1600 2nd Avenue North, Nashville, TN 37208-2206
Personal Address Two:
Personal Email: amanda.deaton-moyer@nashville.gov
Personal Phone: 615-571-7137
Personal Fax:

Grant Contact

If funded, this is the individual responsible for proposal implementation and grant contract compliance (e.g., oversight of procurement, adherence to reporting requirements, etc.)

TN Department of Environment & Conservation

Application Summary

Name:	Aaron Thomas	**Title or Position:**	Site Engineer
Phone:	(615) 487-8872	**Email:**	aaron.thomas2@nashville.gov
Mailing Address:	61 Edenwold Road	**City:**	Madison
State:	TN	**Zip:**	37115

Budget and Attachments

Funding Conditions

Total state allocation requested for this proposal (in $)
$63,418,244.83

All partners should identify any and all State ARP Allocation dollars used for this project. This includes the grant applicant. If more than one entity is contributing State ARP funds please enter it here. All State ARP partner contributions should total the amount in the Total State Allocation box above.

Total Grant Administration Costs, not to exceed 6% of total state allocation (in $)

Note: The sum of Proposal Administration Costs and Individual Project Management Costs cannot exceed 6% of the total state allocation. All Proposal Administration Costs and Individual Project Management Costs (by project) should be detailed in the Budget Line Item Detail.

634182

Budget Worksheet Considerations
The following considerations apply to the budget worksheet:

1) The Grant Contract column total should equal the total allocation requested.

2) The percentage for required co-funding should be documented in the field labeled Match % Requirement. Applicants are required to calculate the Grantee Match (Co-Funding) for each Line-item Category as applicable.

3) Co-Funding requirements are based on matching the total allocation funds requested, not the proposal budget. Therefore, Co-Funding percentages by budget category will be slightly less than the overall Co-Funding requirement. Please see Budget Notes and Example for further instructions.

4) The Co-Funding amount is based on the total state allocation.

5) The budget total should equal the total state allocation amount plus the Co-Funding amount.

6) The overall proposal budget should include all individual project budget costs. Individual project costs will be broken down in the Drinking Water, Wastewater, and Stormwater infrastructure tabs.

PLEASE NOTE: Depreciation is not an eligible expense.

TN Department of Environment & Conservation

Application Summary

Budget Worksheet

Policy 03 Object Line-item reference	Expense Object Line-item Category (1)	Grant Contract	Grantee Match	Total Project
Enter Match % Requirement:	0%			
1.2	Salaries, Benefits & Taxes	$0.00	$0.00	$0.00
4, 15	Professional Fee, Grant and Award (2)	$0.00	$634,182.00	$634,182.00
5, 6, 7, 8, 9, 10	Supplies,Telephone, Postage and Shipping, Occupancy, Equipment, Rental and Maintenance, Printing and Publications	$0.00	$0.00	$0.00
11, 12	Travel, Conferences and Meetings	$0.00	$0.00	$0.00
13	Interest (2)	$0.00	$0.00	$0.00
14	Insurance	$0.00	$0.00	$0.00
16	Specific Assistance To Individuals	$0.00	$0.00	$0.00
17	Depreciation (2)	$0.00	$0.00	$0.00
18	Other Non-Personnel (2)	$0.00	$0.00	$0.00
20	Capital Purchase (2)	$63,418,244.83	$101,077,755.17	$164,496,000.00
22	Indirect Cost	$0.00	$0.00	$0.00
24	In-Kind Expense	$0.00	$0.00	$0.00

25	**Grant Total**	**$63,418,244.83**	**$101,711,937.17**	**$165,130,182.00**

Budget Line Item Details

Budget Line Item Detail

Professional Fee, Grant and Award	Amount
Grant Administration	$634,182.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

	$0.00
	$0.00
	$0.00
$634,182.00	

Interest	Amount
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

$0.00

Application Summary

Depreciation	Amount
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

$0.00

Other Non-Personnel	Amount
	$0.00
	$0.00
	$0.00

Department of Environment & Conservation

Application Summary

	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
$0.00	

Capital Purchase	Amount
Headworks Improvements	$24,320,000.00
Sludge Thickening Improvements	$8,570,000.00
Digested Sludge Storage Improvements	$3,690,000.00
Waste Gast Improvements	$650,000.00
New Biosolids Drying Facility	$79,670,000.00

New High Pressure Effluent Building	$5,370,000.00
Odor Control Improvements	$3,280,000.00
Plant Electrical Improvements	$11,560,000.00
Exist Chlorination Building Demolition	$450,000.00
Filter Building Demolitions	$260,000.00
Edenwold Connector Road Relocation	$1,020,000.00
Plant Sitework	$4,200,000.00
Contingency (15%)	$21,456,000.00
	$0.00
$164,496,000.00	

Salaries, Benefits and Taxes	Amount
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
$0.00	

Travel, Conferences	Amount
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

	$0.00
$0.00	

Indirect Costs	Amount
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

$0.00

In Kind Expenses	Amount
	$0.00

	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
$0.00	

Supplies	Amount
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00

	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
	$0.00
$0.00	

Total Budget Project Information

List Project IDs for each project included in this proposal. Project IDs are established in the Drinking Water, Wastewater, and Stormwater tabs and should be referenced here. Provide the following information:

-
- SWIG Project Management costs may include individual project management and administration, pre-grant planning, and other indirect costs associated with managing a project that will be funded by this grant proposal.
- SWIG Investigation and Planning costs including, but not limited to, professional fees, services, investigation costs for asset condition for AMPs, Water Loss Control Plans, I/I Reduction Plans, costs incurred for system mapping, and development of preliminary engineering reports that will be funded by this grant proposal.

- SWIG Design costs associated with developing plans and specifications, professional fees, and other costs associated with the project design phase that will be funded by this grant proposal.
- SWIG Construction costs including costs of securing permits, all construction materials and services, and any other costs associated with the project construction phase that will be covered by this grant proposal.
- List any Other Funding Source(s) that will contribute to the funding of the individual project.

Total Project costs shall include all costs associated with a project that will be funded by this grant proposal as well as any additional funding sources. Grant contracts will only reflect the SWIG portion of project costs.

All expenses to be funded by the SWIG program that are associated with these water infrastructure projects should be captured in one of the four SWIG cost categories listed above and should be totaled in the Total SWIG Project Costs column.

Project ID	SWIG Project Management Costs	SWIG Investigation and Planning Costs	SWIG Design Costs	SWIG Construction Costs	Total SWIG Project Costs	Other Funding Source(s)	Total Project Costs

General Proposal Info

Applicant Info

Authorized representative for proposal.

UEI Number: Applicants may obtain their UEI Number by logging into their Grants.gov account, clicking the My Account link at the top of the page, clicking the Manage Profiles tab on the next screen and looking under the UEI column header for the UEI for each profile that is registered with SAM (SAM.gov).

Population Served: Enter population served, including all partner populations, covered in this proposal.

ATPI: Provide the ATPI for the Applicant. ATPI = Ability to Pay Index, available online.

Applicant Name (City or County):	Metropolitan Nashville Davidson County	**Mailing Address:**	1600 Second Ave N

TN Department of Environment & Conservation

Application Summary

City:	Nashville	**State:**	Tennessee
Zip:	37221	**Phone Number:**	(615)862-4782
Email Address:	amanda.k.deaton@gmail.com	**DUNS Number:**	605166941

UEI Number:	LGZLHP6ZHM55	**Population Served:**	141696

ATPI:	60	**Total State Allocation Requested (in $):**	$63,418,244.83

Description of Proposal

Brief description of the overall proposal, including how the proposal addresses critical needs, state goals and priorities. Proposal description should include overall proposal timeline and should specify if individual projects will be staggered or will all run concurrently.

This proposal is for one (1) streamlined construction only project at the Dry Creek WRF to replace the current headworks and install a Class A Biosolids Facility. Dry Creek WRF has an ageing headworks system in need of replacement and is undersized. It would also like to reduce the risk of limited disposal opportunities for its class b biosolids and increase the capacity of the biosolids equipment to meet the next 20 year projections. This plant was originally built in the 1960s with a trickling filter but was rebuilt in 1966 with conventional activated sludge, and currently serves a population of approximately 141,696 people. In the 1979 and 1991 there were additional expansions to the existing headworks. Some of the original equipment proposed for replacement is 43-56 years old and has exceeded 80% of its design capacity. Dry Creek WRF is rated at a treatment capacity of 24 MGD average daily with a 63 MGD peak flow. The existing headworks currently receives peak flows of 85 MGD which will overload the Parshall flumes and Grit tanks. This project will replace the existing aerated grit tank with a more efficient grit removal system, add upstream screening, increase the influent Parshall flume size, and increase the capacity of the headworks system to treat and process the projected peak flows before sending it to the plant’s EQ tank.

This project will also include the construction of a new class A biosolid facility building which will include the replacement of existing thickening and dewatering equipment, refurbished from a 1991 installation. The new biosolids facility will require the replacement of the main switchgear, installed in 1991.

One of the goals of this proposal is to replace the at capacity and aging infrastructure by allocating at least 25% of the budget to asset replacement to meet the critical needs at the Dry Creek Facility and provide resiliency and mitigate disposal risks for solids handling by moving to a class A biosolid.

Construction is expected to start in April 2024 and complete in August 2026.

These modernizations of the plant will increase capacity and replace aging infrastructure at the end of life in the headworks and electrical, as well as increase the capacity to meet future demands for solids handling.

Covered Water Infrastructure Systems

Indicate which water infrastructure systems are covered by this proposal. Each system should be entered on a separate line. Please provide the Utility ID Code used to complete an Infrastructure Scorecard for each system. Proposal Applicant should be listed first. Utility ID Codes will be referenced throughout the application.

Utility ID Code	Utility System Covered by Proposal	ATPI
1464	Metro Water Services	60

County(ies) Served by this Proposal

Select all that apply

Davidson, Robertson, Sumner

Scorecard Info

Responsible Party Utility ID Code	1464
PWSID or Permit Number	TN0020648

TN Department of Environment & Conservation

Application Summary

Asset Management												
Asset Management Plan	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
GIS Mapping	>75%											
Inventory and Condition Assessment	<50%											
Planned O&M and Work Order Assessment	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Meter Testing & Change outs	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Capital Improvement Plan & Budget	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One

IT Infrastructure	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Water Loss												
Unaccounted Water Loss	N/A											
Millions of Gallons/year												
Production Cost/year ($)												
Inflow and Infiltration												
Inflow and Infiltration (%)	42%											
Millions of Gallons/year	2770.35											

Treatment Cost/year ($)	2991978											
Modernization												
DW Plant>80% Capacity	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Age of DW Plant												
% of lines > 50 years												
WW Plant > 80% Capacity	No	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Age of WW Treatment Plant	50+ Plant											
% of lines > 50 years												
Compliance												

DW Violations	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
State Mandated Compliance Order (Water)	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Meeting Order Requirements (Water)	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Meeting WW Permit Requirements	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
State Mandated Compliance Order (WW)	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
Meeting Order Requirements (WW)	Yes	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One

Department of Environment & Conservation

Application Summary

Stormwater												
SW Management Plan	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One
System-Wide Map	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One	Select One

Scorecard Upload

Upload a copy of Scorecards for all responsible parties that own or operate a water infrastructure system.
File Name should be in the format of: Responsible Party Utility ID Code-Document Title (e.g. Utility ID 1234-Example UD Scorecard Summary).
File Description should contain the Responsible Party Utility ID Code. (e.g. Utility ID 1234).

ARP_Scorecard.pdf
198.6 KB - 09/08/2022 4:17PM

Total Files: 1

Infrastructure Expenditure Categories

TN Department of Environment & Conservation

Application Summary

Drinking Water Infrastructure Projects

List Project IDs for all drinking water infrastructure projects included in this proposal, as listed in the Drinking Water tab. Project IDs are established in the Drinking Water, tab and should be referenced here.

Select one expenditure category that applies to each project. Projects should only be listed once.

Project ID	Expenditure Category

Wastewater Infrastructure Projects

List Project IDs for all wastewater infrastructure projects included in this proposal, as listed in the Wastewater tab. Project IDs are established in the Wastewater tab and should be referenced here.

Select one expenditure category that applies to each project. Projects should only be listed once.

Project ID	Expenditure Category
CW-COStr-1	Clean Water: Centralized Wastewater Treatment

Stormwater Infrastructure Projects

List Project IDs for all storm water infrastructure projects included in this proposal, as listed in the Stormwater tab. Project IDs are established in the Stormwater tab and should be referenced here.

Select one expenditure category that applies to each project. Projects should only be listed once.

Project ID	Expenditure Category

Drinking Water

Are you applying for Drinking Water Infrastructure?
No

Wastewater

Are you applying for Wastewater Infrastructure?
Yes

Wastewater Project Award Type(s)

Please select project Award Type(s) based on the maximum extent of activities intended for each water infrastructure system represented in this proposal. Each system may only select one project Award Type. Note that each project Award Type may include multiple projects.

Construction Only (Streamlined)

If the applicant or any covered water infrastructure systems have significant non-compliance (SNC), describe if SNC is being addressed through other means or detail which project(s) listed below will address the SNC.

For each Award Type selected above, provide the corresponding details below. Note that if an Award Type is not included for wastewater infrastructure in this proposal, that section may be left blank.

Investigation and Planning

Individual Project details

Upload your detailed individual project budget(s)

Use the provided template to complete a budget for each individual project. Uploaded file name should be in the format of Project ID-Document Title (e.g. WW-IP-1-Project Budget).

Individual Project Budget Template

Upload maps of the area of interest and location of activities

File Name should be in the format of Project ID-Document Title (e.g. WW-IP-1-Project Map).

List the Responsible Party Utility ID Code in the description box of your upload.

Investigation, Planning and Design

Individual Project details

Upload your detailed individual project budget(s)

Use the provided template to complete a budget for each individual project. Uploaded file name should be in the format of Project ID-Document Title (e.g. WW-IPD-1-Project Budget).

Individual Project Budget Template

Upload maps of the area of interest and location of activities

File Name should be in the format of Project ID-Document Title (e.g. WW-IPD-1-Project Map).

List the Responsible Party Utility ID Code in the description box of your upload.

Planning, Design and Construction

Individual Project details

Required Permits/Authorizations

List the permit(s) or authorization required for each individual project in the Planning, Design, and Construction Award Type. If a project requires multiple permit(s)/authorization, add an entry for each permit/authorization required with the corresponding Project ID number.

Project ID	Required Permit/Authorization

Upload your detailed individual project budget(s)

Use the provided template to complete a budget for each individual project. Uploaded file name should be in the format of Project ID-Document Title (e.g. WW-PDC-1-Project Budget).

Individual Project Budget Template

Upload maps of the area of interest and location of activities

File Name should be in the format of Project ID-Document Title (e.g. WW-PDC-1-Project Map).

List the Responsible Party Utility ID Code in the description box of your upload.

Construction Only (Standard)

Individual Project details

Required Permits/Authorizations

List the permit(s) or authorization required for each individual project in the Construction Only (Standard) Award Type. If a project requires multiple permit(s)/authorization, add an entry for each permit/authorization required with the corresponding Project ID number.

Project ID	Required Permit/Authorization

Upload your detailed individual project budget(s)

Use the provided template to complete a budget for each individual project. Uploaded file name should be in the format of Project ID-Document Title (e.g. WW-COStd-1-Project Budget).

Individual Project Budget Template

Upload map of project area

File Name should be in the format of Project ID-Document Title (e.g. WW-COStd-1-Project Map).

List the Responsible Party Utility ID Code in the description box of your upload.

Upload Preliminary Engineering Report

File Name should be in the format of Project ID-Document Title (e.g. WW-COStd-1-PER).

List the Responsible Party Utility ID Code in the description box of your upload.

Upload Engineering Plans and Specifications

Upload engineering plans and specifications for projects other than those addressing non-compliance issues.

File Name should be in the format of Project ID-Document Title (e.g. WW-COStd-1-Engineering Plans).

List the Responsible Party Utility ID Code in the description box of your upload.

Upload Enforcement and Compliance CAP/ER and approved CAP/ER documents, including plans and specifications and a construction budget and schedule (if applicable)

File Name should be in the format of Project ID-Document Title (e.g. WW-COStd-1-CAP_ER).

List the Responsible Party Utility ID Code in the description box of your upload.

Construction Only (Streamlined)

TN Department of Environment & Conservation

Application Summary

Individual Project details

Required Permits/Authorizations

List the permit(s) required for each individual project in the Construction Only (Streamlined) Award Type. If a project requires multiple permit(s), add an entry for each permit required with the corresponding Project ID number.

Project ID	Required Permit/Authorization
WW-COStr-1	General NPDES Permit for Construction Stormwater Discharges (CGP)

Upload your detailed individual project budget(s)

Use the provided template to complete a budget for each individual project. Uploaded file name should be in the format of Project ID-Document Title (e.g. WW-COStr-1-Project Budget).

Individual Project Budget Template

WW-COStr-1_Project_Budget.xlsx
1464 Metro Water Services
23.7 KB - 09/16/2022 12:27PM

Total Files: 1

TN Department of Environment & Conservation

Application Summary

Upload map of project area

File Name should be in the format of Project ID-Document Title (e.g. WW-COStr-1-Project Map).

List the Responsible Party Utility ID Code in the description box of your upload.

WW-COStr-1_Project_Map.pdf
1464 Metro Water Services
1.8 MB - 09/16/2022 1:08PM

Total Files: 1

Upload Enforcement and Compliance CAP/ER and approved CAP/ER documents, including plans and specifications and a construction budget and schedule (if applicable)

File Name should be in the format of Project ID-Document Title (e.g. WW-COStr-1-CAP_ER).

List the Responsible Party Utility ID Code in the description box of your upload.

WW-COStr-1_PER_Cover-Sec01.pdf
1464 Metro Water Services
910.8 KB - 09/16/2022 12:46PM

WW-COStr-1_PER_Sec02-04.pdf
1464 Metro Water Services
1.5 MB - 09/16/2022 12:47PM

WW-COStr-1_PER_Sec05-08.pdf
1464 Metro Water Services
1.7 MB - 09/16/2022 12:47PM

WW-COStr-1_PER_Sec09-18.pdf
1464 Metro Water Services
1.4 MB - 09/16/2022 12:46PM

Total Files: 4

StormWater

Are you applying for Stormwater Infrastructure?
No

Authorization

Authorized Signature

If the Awarded Local Government will be allowing individuals other than the principal executive officer or ranking elected official (i.e. mayor or utility director) to sign off on contract related items, the below information must be provided for each individual. An Authorization Letter from the principal executive officer or ranking elected official specifying individual(s) listed in the grant proposal have the authority to sign in place of the principal executive officer or ranking elected official must be uploaded below.

Printed Name	Title	Phone	Date Signed	Email	Name of Person Granting Authorization to Certify

If you have signatory authority from the principal executive officer or ranking elected official, please fill out the information fields above and upload proof of signatory authority on grant applicant letterhead or another form of official executed documentation.

Self Debarment Verification

TN Department of Environment & Conservation

Application Summary

Please verify that your organization is not on the federal debarment list.
The Awarded Organization is required to check the debarment status of their organization along with the officers, directors, owners, partners, employees, or agents of the applicant organization, and ensure each is (are) not presently debarred, suspended, proposed for debarment, or declared ineligible for an award by any State or Federal agency. Debarment verification includes contracted entities from which grant proposal expenditures of goods or services for a project are made, no matter if there are multiple purchases at different times, equal to or greater than $25,000. Grantees should access the SAMS website prior to making a recommendation of award, purchasing of goods, or securing of services to meet grant requirements and to insure any and/or all funds associated with the grant project will be eligible for reimbursement. Grant reimbursements will not be processed if the debarment status verification have not been completed.

- NOTE: If active exclusions and/or delinquent federal debt are shown, the organization cannot receive a grant contract or grant funds. If no active exclusion and no delinquent federal debt are shown, the awarded organization may receive grant funds as long as all other grant policies and procedures are followed.
- Search organizations and entities to confirm they are not on the Debarment List by going to System for Award Management (SAM)

Upload Debarment Status Verification

Even if there are no search results, you still must upload a pdf showing your search results.

SAM_Verification.docx
179.6 KB - 09/12/2022 11:19AM

Total Files: 1

What name was searched?
Metropolitan Government of Nashville & Davidson County

Please complete the below certification information

I certify to the best of my knowledge and belief that the data above is correct and I have searched my organization in the SAM system.

Name of person who searched the SAM system

Vaughn Wilson

Date

09/12/2022

Pre-Application Submission Authorization

Please upload a signed letter on Applying Organization letterhead from the authorized signatory for the Applicant indicating the approval of the submission.

Applicant Acknowledgements

General Correspondence

Signature

Date

Tennessee Association of Utility Districts
Vital for Tennessee's future

TN Department of Environment & Conservation

In the Summary section, Scorecard results are combined to assist communities in identifying areas of critical water infrastructure needs. Systems are encouraged to use this information to support Business Action Plans, address management issues, and identify a range of cost saving actions and efficiencies. Areas highlighted in red indicate opportunities for improvement where communities can work towards appropriate levels of operational performance. If Scorecard results indicate multiple areas for improvement, systems should begin addressing foundational issues. It is recommended that all systems strive to meet the minimum expectations for asset management plans and address all significant compliance issues. Next, addressing water loss, inflow and infiltration, and replacing aging and failing infrastructure could be a priority. As a system works to resolve and mitigation critical needs, the financial integrity and sustainability of the utility should improve.

WATER INFRASTRUCTURE SUMMARY					
Name of Entity:	Metropolitan Government of Nashville and Davidson County				
Office Address:	1600 Second Ave N				
City:	Nashville	State:	TN	Zip Code:	37208
County:	Davidson				
Primary Community Served:	Nashville-Davidson		Population:	722,043	
ATPI:	60				
Utility Type:	Other				
Number of Water Connections:	299,603			Total Connections:	519,540
Number of Wastewater Connections:	219,937				
Number of Employees:	1000 Full-time		5 Part-Time		
Does your utility run more than one water and/or wastewater system?					

PWSID
000494

NPDES
TN0020575
TN0020648
TN0024970

UTILITY CONTACT LIST

Name	Title	Phone	Email
Amanda Deaton-Moyer	Assistant Director	615-751-7137	amanda.deaton-moyer@nashville.gov

REPORTING REQUIREMENTS

Entity Fiscal Year:	June
Date of Last Audit:	June 30, 2021
Adverse Audit Findings:	No
Notes:	

REGIONALIZATION

Has the system considered any regional cooperative efforts?	Yes

ASSET MANAGEMENT

Asset Mangement Plan	Yes
GIS Mapping	>75%
Inventory and Condition Assessment	<50%
Planned O&M and Work Order System	Yes
Meter Testing & Changeouts	Yes
Captital Improvement Plan & Budget	Yes
IT Infrastructure	Yes

WATER LOSS

PWSID	Unaccounted Water Loss	Millions of Gallons/year	Production Cost/year
000494	32%	10704.00	$19,053,120.00

INFLOW/INFILTRATION

NPDES/SOP	Inflow and Infiltration	Millions of Gallons/year	Treatment Cost/year
TN0020575	35%	14,950.40	$16,146,432.00
TN0020648	42%	2,770.35	$2,991,978.00
TN0024970	41%	5,026.05	$5,428,134.00

MODERNIZATION

PWSID	Drinking Water Plant >80% Capacity	Age of Drinking Water Plant	Percentage of lines older than 50 years
000494	No	50+ years	>50%

NPDES/SOP	Wastewater Plant >80% Capacity	Age of Wastewater Treatment Plant	Percentage of lines older than 50 years
TN0020575	Yes	50+ years	25-50%
TN0020648	No	50+ years	25-50%
TN0024970	No	30-50 years	0-25%

COMPLIANCE

PWSID	Drinking Water Violations	State Mandated Compliance Order (Water)	Meeting Order Requirements (Water)

NPDES/SOP	Meeting Wastewater Permit Requirements	State Mandated Compliance Order (WW)	Meeting Order Requirements (WW)
TN0020575	Yes	Yes	Yes

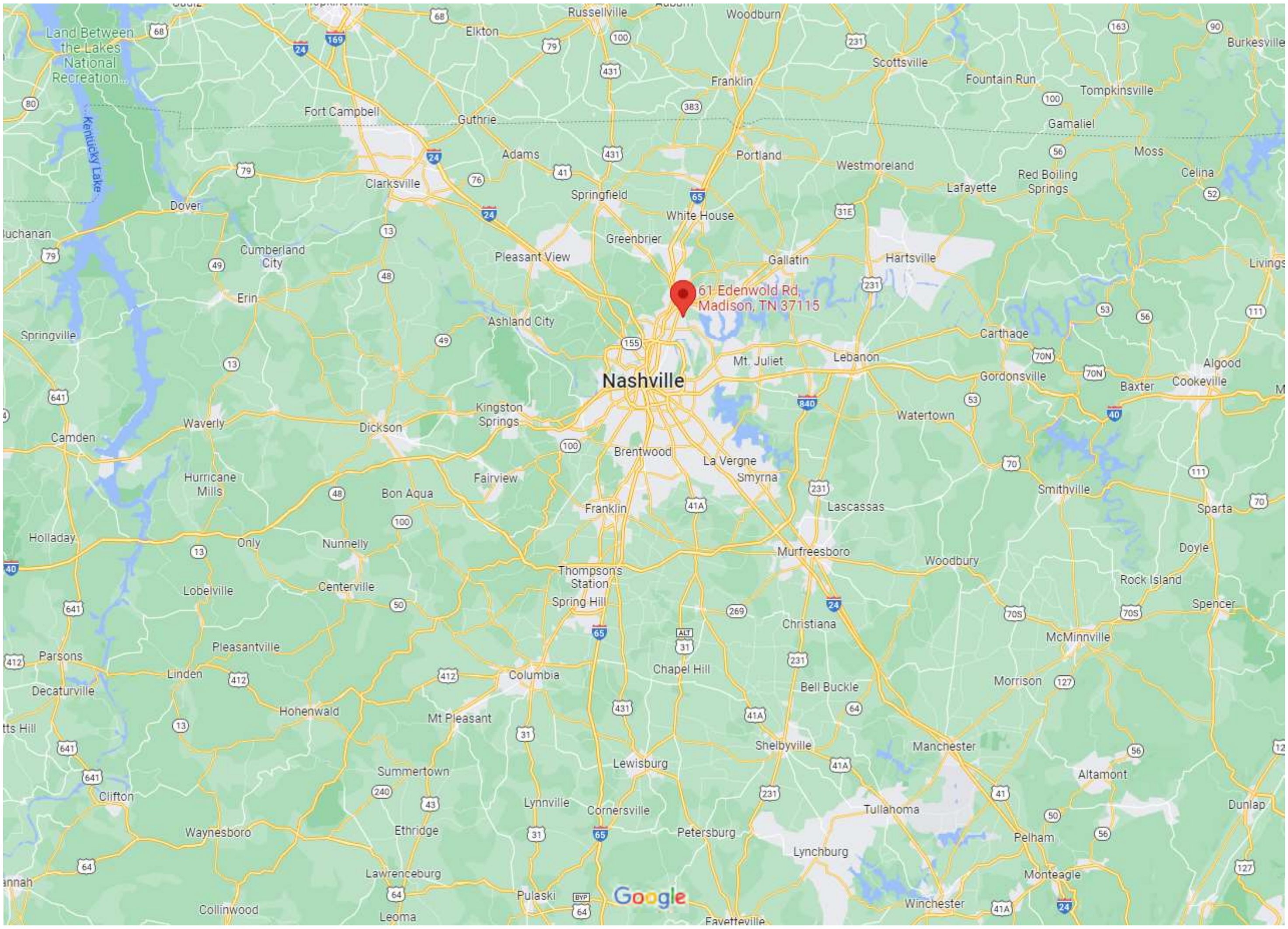
000494	No	No	NA

TN0020648	Yes	Yes	Yes
TN0024970	Yes	Yes	Yes

STORMWATER

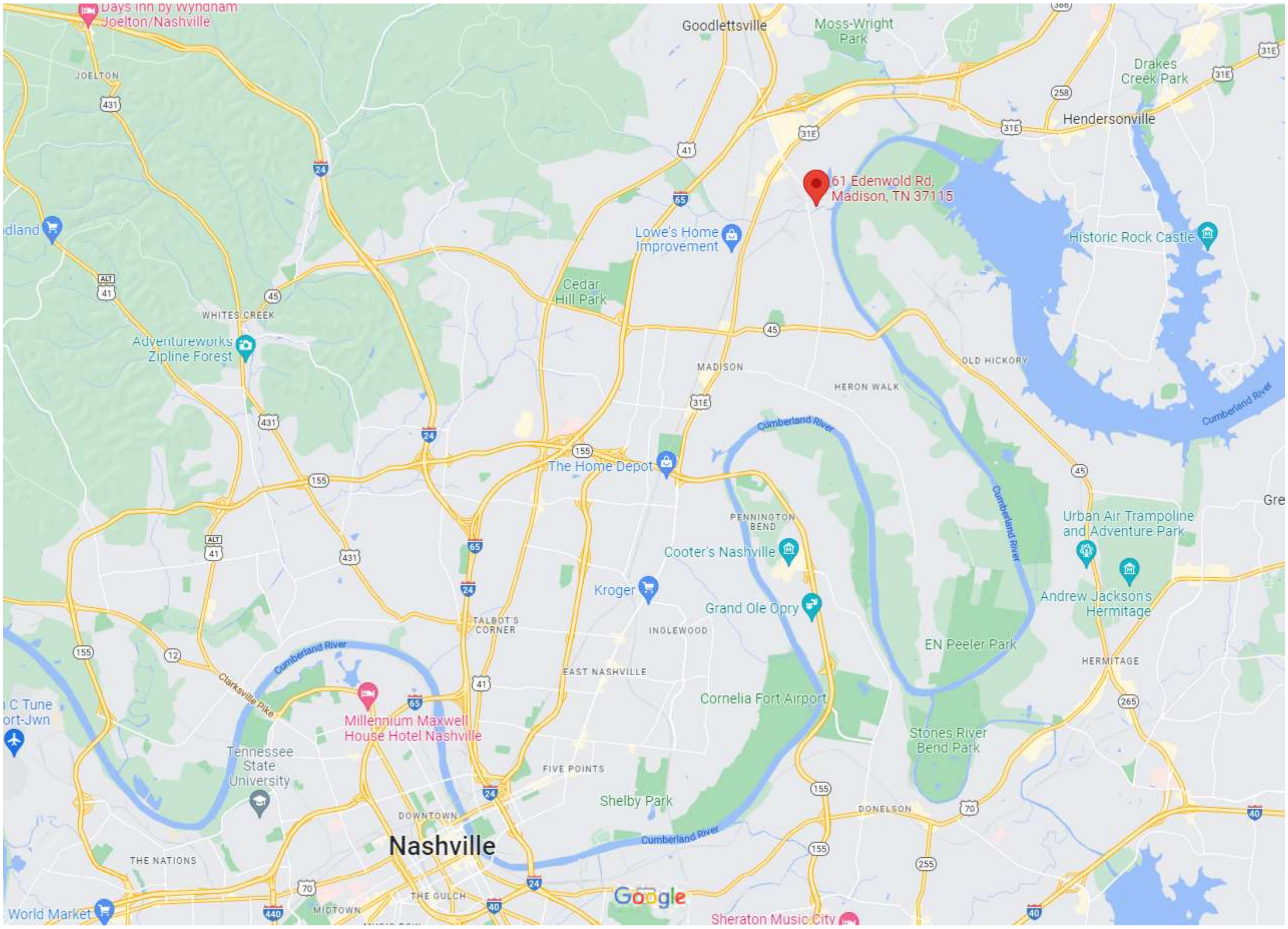
Stormwater Management Plan	Yes
System-Wide Map	Yes

Google Maps 61 Edenwold Rd



Map data ©2022 Google 10 mi

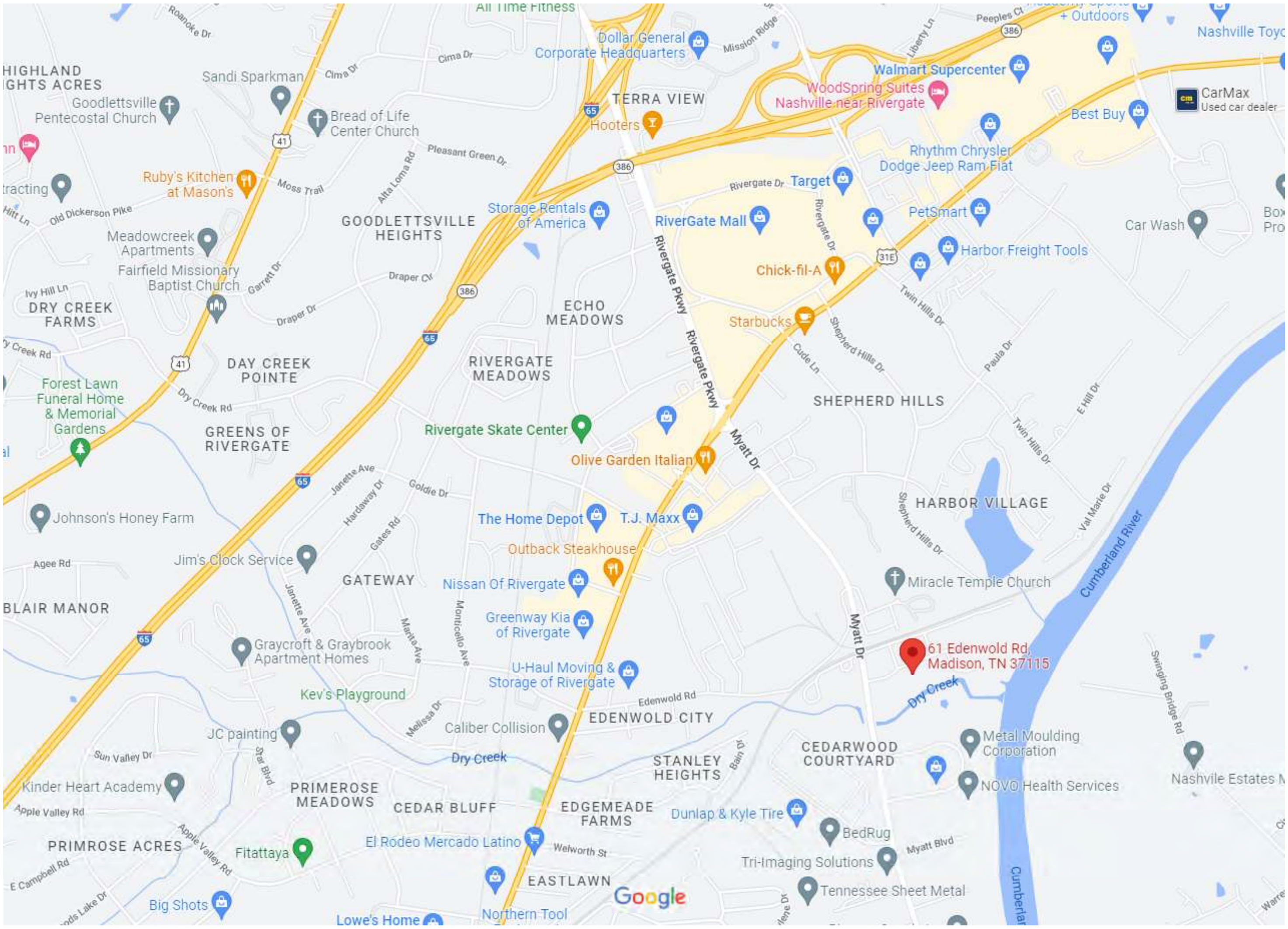
Google Maps 61 Edenwold Rd



Map data ©2022 Google 1 mi

DocuSign Envelope ID: 83DC6356-BE4F-4082-A915-609CEE012602

Google Maps 61 Edenwold Rd



Map data ©2022 1000 ft

Dry Creek WRF

Headworks and Class A Biosolids Improvements

Preliminary Engineering Report

Prepared for

Metro Water Services

Nashville, TN

September 2, 2022

Dry Creek WRF
Headworks and Class A Biosolids Improvements

Preliminary Engineering Report

Prepared for
Metro Water Services
Nashville, TN
September 2, 2022

Brown AND Caldwell

List of Figures

List of Tables

List of Abbreviations

AACE	Association for the Advancement of Cost Engineering
AASHTO	American Association of State Highway and Transportation Officials
ACH	Air Changes per Hour
ANSI	American National Standards Institute
BC	Brown and Caldwell
BG	Biogas (from Anaerobic Digesters)
BMP	Best Managements Practices
BDF	Biosolids Drying Facility
cf	Cubic Feet
cfm	cubic feet per minute
CMU	Concrete Masonry Unit
DAFT	Dissolved Air Flotation Thickener
DCS	Distributed Control System
DSST	Digested Sludge Storage Tank
DCWRF	Dry Creek Water Reclamation Facility
EAF	Exhaust Air Fan
EL	Elevation
EQ	Equalization
EPSC	Erosion Prevention and Sediment Control
FFE	Finish Floor Elevation
FIT	Flow Indicator Transmitter
FM	Force main
ft	Feet
FRP	Fiberglass Reinforced Plastic
GBT	Gravity Belt Thickener
GFI	Ground Fault Interrupting
GPD	Gallons per Day
GPH	Gallons per Hour
GPM	Gallons per Minute
H_2S	hydrogen sulfide
HDPE	high-density polyethylene
HPE	High Pressure Effluent
hp	horsepower
I&C	Instrumentation and Controls
MCC	Motor Control Center
MWS	Metro Water Services
MG	Million Gallons
MGD	Million Gallons per Day
M-T-M	Main-Tie-Main
MOPO	Maintenance of Plant Operations
NFPA	Nation Fire Protection Association
O&M	Operation and Maintenance
PER	Preliminary Engineering Report
PFD	Process Flow Diagrams
P&IDs	Process and Instrumentation Diagrams
PLC	Programmable Logic Controller
POR	Preferred Operating Region (as for a pump per ANSI/HI 9.6.3)
PPM	parts per million
PS	Pump Station
PVC	Polyvinyl Chloride
PW	Potable Water
RDT	Rotary Drum Thickener
SAF	Supply Air Fan
SDL	Superimposed Dead Loads
SW	Spray Water
TM	Technical Memorandum
TDEC	Tennessee Department of Environment & Conservation
UV	Ultraviolet
VFD	Variable Frequency Drive
WRF	Water Reclamation Facility
WSE	Water Surface Elevation

Section 1

Project Overview

Metro Water Services (MWS) contracted with Brown and Caldwell (BC) to perform the design for improvements to the existing headworks and solids handling facilities at the Dry Creek Water Reclamation Facility (DCWRF). The overall intent of these improvements is two-fold: (1) improve plant operations by providing influent screening and new grit removal system to remove solids more effectively from the incoming wastewater and (2) upgrade the solids processing systems to produce a marketable Class A biosolids product, similar to that currently produced at the Central WRF. This project will not increase the rated flow capacity of the facility. This report presents the preliminary engineering performed by BC for the above improvements and will serve as the basis of design for all subsequent design activities.

1.1 Project Background

The DCWRF is one of three treatment facilities owned and operated by MWS. Located in the Madison area, the facility treats wastewater from northeastern Davidson County and portions of southern Sumner County. The DCWRF currently has a rated average daily flow capacity of 24 million gallons per day (MGD), a peak wet weather capacity of 63 MGD, and a residuals treatment capacity of approximately 25 dry tons per day. The DCWRF was originally constructed in the early 1960s and has undergone three major expansions with the most recent major upgrade occurring in 2009. Figure 1-1 provides and aerial view of the existing facility.

Figure 1-1. Aerial View of DCWRF Area from Google Earth

Currently, preliminary treatment at the facility consists only of grit removal, utilizing an antiquated aerated grit system that has been problematic for operations staff and is not as effective as other newer technologies. Combined with a lack of influent screening, the heavy load of solids that is delivered to the downstream processes results in increased wear to equipment and piping and accumulation of grit and debris in tanks and channels. These conditions pose significant challenges to plant maintenance and operations staff and the potential for reduced reliability and loss of treatment capacity. To address these conditions, a new preliminary treatment system is needed that combines both effective screening and grit removal.

Managing biosolids disposal at the facility has also become a concern in recent years. The DCWRF currently stabilizes residuals to USEPA 40CFR503 Class B standards, utilizing thickening and digestion processes along with belt filter presses for final dewatering. The processed and stabilized residuals are transported to a landfill for disposal. Landfill disposal, however, has come under increased scrutiny in recent years with significant increases in costs, making reliance on this method a liability for MWS. Further, MWS has moved to sludge drying at its largest facility (Central WRF) which produces a highly marketable, Class A product. To relieve the reliance upon landfill disposal, provide for more beneficial reuse of biosolids, and provide consistency of operations between treatment facilities, MWS elected to modify the solids treatment train at the DCWRF to include a new sludge drying facility.

1.2 Previous Work

The major improvements to be implemented under this project are based upon previous work performed by the BC Team, documented in two separate technical memoranda:

- The proposed headworks improvements generally follow the recommendations and design criteria included in Technical Memorandum (TM) No. 1 – DCWWTP Headworks Improvements, dated November 2017 (revised December 2019).
- The proposed biosolids improvements generally follow the recommendations and design criteria included in TM No. 22 – DCWWTP Class A Technology Evaluation, dated June 10, 2020.

Where referenced in this report, the TMs are referred to as the ‘Headworks TM’ and “Biosolids TM,” respectively. The concepts presented in these TMs were subsequently updated and refined based on workshops conducted during the preliminary engineering phase of this project.

1.3 Design Workshops

A series of design workshops were held throughout the preliminary engineering phase of the project, and prior to the issuance of this report, to refine the recommendations from the TMs, evaluate design alternatives and further develop the design of the proposed improvements. These workshops are listed below:

- Biosolids Design Improvements (Dryer System Focus) Workshop No. 1 – January 10, 2022
- Odor Control and Preliminary High Pressure Effluent Improvements Workshop – February 24, 2022
- Headworks, Plant Utilities (HPE and Tank Drain Systems), and Plant Electrical Improvements Workshop – June 14, 2022
- Biosolids Design Improvements (Sludge Thickening, Storage and Digester Gas Focus) Workshop No. 2 – June 16, 2022

The presentation materials are provided in Appendix A for reference. This PER presents the recommendations resulting from these workshop discussions. Refer to the workshop materials for discussions of the alternatives considered for each major process area affected by the proposed improvements presented in this report.

1.4 Summary of Improvements

The following is a summary of the major improvements to be constructed under this project and presented in this report. The general locations for each component are highlighted on Figure 1-2.

1.4.1 Headworks Improvements

Headworks improvements will consist of the following elements:

- Replacement of the existing 3' Hendersonville Parshall flume with a 4' Parshall flume to increase flow measurement capacity. The proposed flume will be installed in the existing flume channel.
- A new fine screening system utilizing perforated-plate screen technology with 6-millimeter (mm) perforations. The new screening system will be retrofitted into two of the existing aerated grit tanks and covered by a lightweight enclosure sitting atop the existing tank structure.
- A new stacked tray grit removal system. The grit system tankage will be constructed adjacent to the existing aerated grit system with flow routed from the existing primary influent channel and then back into the channel downstream of the proposed grit removal system.
- Associated grit pumps, grit washing and dewatering units, screenings washer/compactors, material handling equipment, and load-out systems for screening and grit removal. The screenings and grit solids processing systems will be enclosed in a new building directly adjacent to the new grit structure.
- Demolition of portions of the existing aerated grit tanks, including piping and equipment in the below-grade tunnel/gallery areas to facilitate integration of the new systems into the existing plant systems.

1.4.2 Edenwold Connector Road Relocation

Due to limited space available on the existing site for the proposed Sludge Dewatering Facility, the existing Edenwold Connector Road will be relocated to the west (closer to Myatt Drive). It is expected that this work will be bid as a separate construction contract ahead of the rest of the WRF improvements to facilitate public access during construction and provide additional contractor laydown areas. This effort will include expansion of the existing plant fence line, relocation of the existing guard shed to a new gate relocation and preparatory grading of the area for the proposed Biosolids Dewatering Facility.

1.4.3 New Biosolids Drying Facility

Sludge dewatering and drying improvements will consist of the following elements:

- A new thermal drying system (drum dryer technology similar to that employed at the Central WRF) and supporting equipment to achieve a marketable Class A biosolids product. The drying system will be designed with the intent of running on digester or natural gas and produce an Exceptional Quality Biosolid pellet as defined in USEPA 40 CFR 503 Regulations.
- New dewatering centrifuges to be located adjacent to the new drying system. The dewatering and drying systems will be housed in a new stand-alone building.
- Gas conditioning equipment to treat digester gas for use in the thermal drying process.
- Supporting equipment that includes product storage and loadout, combustible dust handling equipment, and treatment of air emissions.

- Demolition of portions of the existing plant dewatering systems located in the existing Filter Press Building.

1.4.4 Sludge Thickening Improvements

The existing gravity belt thickeners (GBTs) used to thicken a combination of primary and secondary sludges and scum will be replaced with new rotary drum thickeners. The new equipment will be installed in the existing GBT room within the existing Filter Press Building. New support systems including replacement of the existing polymer feed and conveyance equipment will be provided along with other building mechanical and odor control modifications.

1.4.5 Digested Sludge Storage Improvements

Portions of an existing RotaMix® jet mixing system within the two digested sludge storage tanks (DSSTs) will be removed, such as the jet nozzles and pumps. The existing mixing system will be replaced with a new mixing system consisting of multiple submersible propeller-type mixers installed within each tank. Provisions for access, maintenance, and equipment removal will be provided.

1.4.6 Waste Gas Burner Improvements

A new waste gas burner (WGB) will be installed in parallel with the existing candlestick flare, which will include more modernized features for improved efficiency and performance. The existing candlestick flare will be retrofitted with a new pilot and ignition system to serve as a back-up to the new WGB.

1.4.7 Odor Control Improvements

The existing biofilter odor control system will be reused to support the new and upgraded facilities. New and modified ductwork will be provided to support each of the modified process areas described above along with necessary modifications to the existing odor control fans. In general, the new total air flow to the odor control system will be slightly reduced from that of the current facility.

1.4.8 Plant Water System Improvements

The existing high-pressure effluent (HPE) system at the plant will be expanded to accommodate the account for the new and future process demands and provide a minimum service pressure of 90 psig at all facilities. The new system will consist of the following elements:

- A new pumping system will utilize vertical turbine pumps housed inside a new structure constructed atop the existing chlorine contact tanks.
- New flow measurement, automatic basket strainers, and a chemical disinfection system using sodium hypochlorite.
- No changes to existing low-pressure spray water pumping equipment are included in this project; however, a new flow meter will be added along with provisions for disinfection via the HPE sodium hypochlorite system will be provided.

1.4.9 Plant Drain System Improvements

Process and tank drain system improvements will consist of the following elements:

- Process, floor and tank drains for the new Headworks facilities will be routed to the existing plant tank drain system or directly into adjacent process tanks/channels.
- Process, floor and tank drains for the new Sludge Dewatering Facility will be routed to a new sump pump system in that area and pumped back to the Headworks.

- Process, floor and tank drains associated with sludge thickening and DSST improvements in the existing Filter Building area will be routed to the existing plant tank drain system.
- Process, floor and tank drains associated with the new HPE Building will be routed to the existing plant tank drain system.

1.4.10 Other Site Improvements and Modifications

In addition to the process improvements above, the following site improvements are also included:

- The existing primary electrical systems housed in the existing Blower Building will be modified and/or replaced as part of improvements to the overall plant electrical distribution system.
- The existing Chlorination/Dechlorination Building will be demolished (down to the existing process area floor slab) to facilitate use of the area for future plant needs.

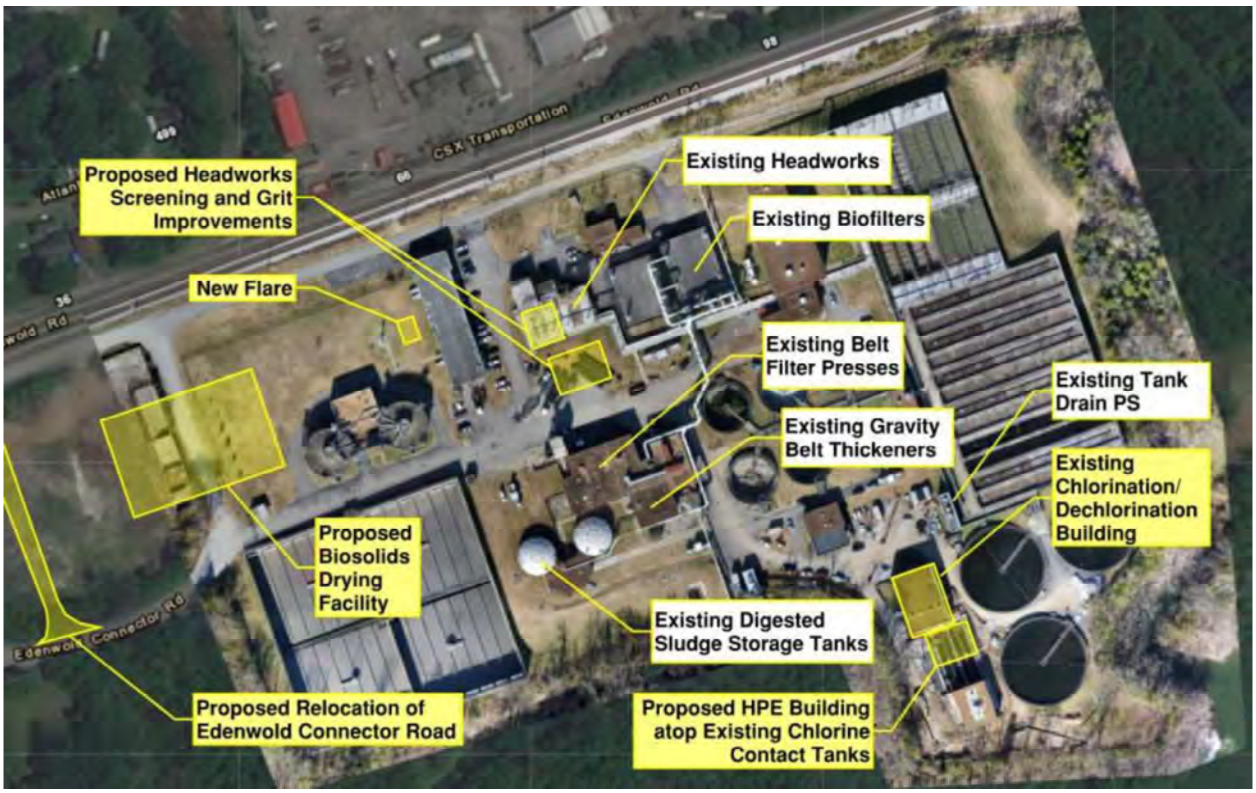


Figure 1-2. General Location Key for Proposed Improvements

1.5 Coordination with Other DCWRF Improvements

Concurrent with this project, MWS is undertaking two other construction projects at the site. These projects are in various stages of completion. A summary of each is provided below including potential impacts to this project which will be coordinated as this project progresses.

1.5.1 Ultraviolet Disinfection Project (16-SC-0087)

Currently nearing the end of construction, the existing chlorine-based disinfection system will be replaced with a new ultraviolet (UV) disinfection system. The project, designed by CH2M (now Jacobs) includes the following major components:

- Modifications to the existing chlorine contact channels to accommodate new UV equipment and associated changes to the path of flow through the structure.
- Construction of a new building to enclose the new UV equipment and associated electrical equipment
- Demolition of the abandoned gaseous chlorination and dechlorination systems in the existing Chlorination/Dechlorination Building
- Construction of a new diesel-engine driven standby generator system to serve the UV disinfection facilities.

Construction activities commenced in 2021 and are expected to be completed in 2022. In general, the improvements will be isolated to a limited area around the existing chlorine contact tanks and thus will have little impact on the design or construction of this project. Figure 1-3 provides the general location of the proposed improvements and major components.

Figure 1-3. December 2021 Aerial Photograph with New Facilities Highlighted

1.5.2 Flood Mitigation Improvements (21-SC-0226)

Currently in design, a new floodwall will be constructed around the existing site to protect the facility from flooding. This flood mitigation project is part of ongoing, system-wide flood mitigation efforts that stemmed from the historic flooding and subsequent facility damage in 2009. The design, led by Barge Design Solutions, includes the following major components:

- Construction of a new floodwall/berm extending around the south, east and north sides of the existing site. The wall will include removable flood gates at existing site access points along Edenwold Road.
- Modifications to the existing stormwater pump station and outfall to Dry Creek.
- Relocation of Dry Creek and associated site regrading along the south side of the facility.

Design activities commenced in 2021 and are expected to be completed in the summer of 2022. Construction is scheduled to begin in fall/winter 2022 with completion ahead of this project; thus, no consideration for further floodplain mitigation or permitting is required for the improvements under this project. Coordination will be required, however, with the proposed floodwall/berm design on the north side of the site in the vicinity of the proposed sludge dewatering and dryer facilities. Figure 1-4 provides the general extents of the proposed flood wall and associated improvements.

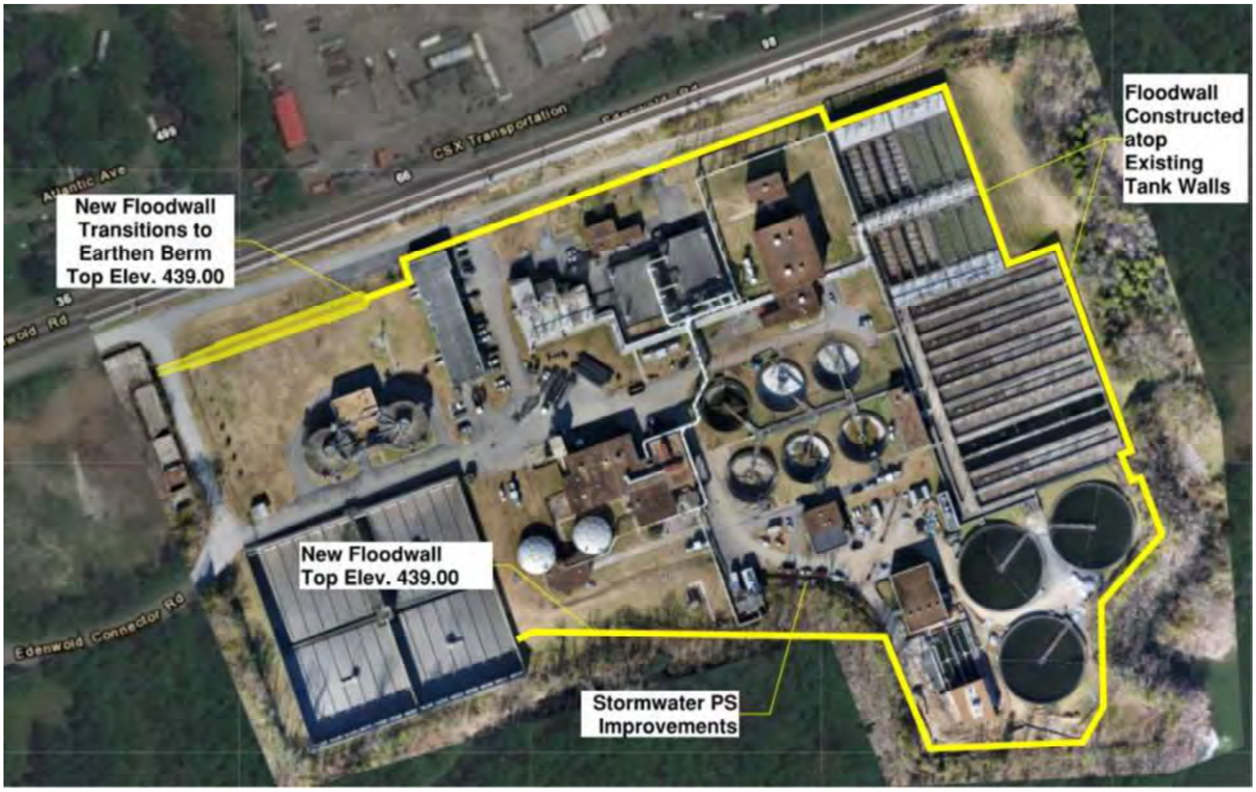


Figure 1-4. Extents of Proposed Floodwall Construction

1.6 Report Content and Organization

Table 1-1 below provides an overview of the content and chapter organization for this report.

Table 1-1. PER Organizational Outline

Grouping	Section	Title
Design Flow Criteria This section provides a summary of influent flow analyses and related design flow criteria used for this project.	2	Design Flow Criteria
Treatment Process Improvements (Organized by Process Area) These sections provide the basis of design for each process area improvement with emphasis on site location, process and mechanical components, operations and constructability.	3	Headwork Improvements
	4	Biosolids Handling Improvements
	5	Odor Control Improvements
	6	High Pressure Effluent Improvements
Design Disciplines These sections provide the basis of design and standards to be used by each of the design disciplines development of the project, including specific assumptions and design concepts for each process area.	7	Site Development and Civil Design
	8	Structural Design
	9	Architectural Design

Table 1-1. PER Organizational Outline

Grouping	Section	Title
	10	Building Mechanical Design
	11	Electrical Design
	12	Instrumentation Design
Additional Design Considerations These sections provide pertinent design criteria and considerations that impact multiple design disciplines as well as maintainability and plant resiliency.	13	Equipment Access
	14	Site Demolition
	15	Flood Protection
Permitting This section provides a preliminary permitting plan for the project including a summary of the permits required including general requirement and schedule for each	16	Permitting
Opinion of Probable Construction Cost (OPCCs) This section provides a composite Class 5 estimate for the overall project including updates to the OPCCs provided in the Headworks and Biosolids TMs and new items not included in them. This estimate is intended to provide a new baseline for the project for capital planning purposes.	17	Opinion of Probable Construction Cost
Appendices Relevant supporting documents and preliminary engineering drawings	A	Preliminary Engineering Workshop Presentation Materials
	B	Preliminary Drawings: Dwg Index, Hydraulic Profile, PFDs, and P&IDs
	C	Preliminary Technical Specifications List
	D	Preliminary Cost Estimate

Section 2

Design Flow Criteria

2.1 Plant Design Flows

The current projected design flow conditions for the plant were determined during an analysis of existing and proposed influent wastewater flows documented in a report entitled "Dry Creek WWTP Capacity Analysis" dated August 2003 prepared by Jacobs Civil Inc. and Brown and Caldwell. The analysis resulted in an average daily influent wastewater flow of 24 MGD and a peak hour design flow projected for 2020 of 84.5 MGD.

No additional future wastewater flows are projected to be directed to the DCWRF. However, it was noted by plant operations staff during the preliminary design that wet weather flows have been exceeding the capacity of the existing Hendersonville influent flume so additional analyses were performed to determine if the design flows provided in the 2003 report were still appropriate.

This evaluation of influent plant data indicated the Hendersonville flume exceeded its measurement capacity on at least 30 occasions between April 1, 2021, and March 31, 2022. Existing influent flow flume capacities and corresponding hourly peak and 95 percentile flows reported between April 1, 2019, and March 31, 2022 at the DCWRF are summarized as follows:

Table 2-1. DCWRF Hourly Influent Flow Analysis (4/1/19 thru 3/31/22)

Flume	Analysis Period	Average Hourly Measured Flow (MGD)	Maximum Hourly Measured Flow (MGD)	95th Percentile Measured Flow (MGD)	Flume Measurement Capacity (MGD)	No. of Hourly Flume Measurement Exceedances
Dry Creek	2019-2020	8.82	42.94	20.94	66.88	0
	2020-2021	7.17	46.90	16.69		0
	2021-2022	7.98	72.07	28.37		1[1]
Hendersonville	2019-2020	9.28	28.08	19.73	32.57	0
	2020-2021	8.12	28.11	16.16		0
	2021-2022	10.14	32.90	30.53		30[2]
Old Hickory	2019-2020	1.19	4.50	2.23	10.43	0
	2020-2021	0.94	4.92	1.73		0
	2021-2022	0.79	4.76	2.46		0
Total	2019-2020	19.28	74.72	42.77	--	--
	2020-2021	16.23	78.67	34.74		
	2021-2022	18.91	82.86	57.58		

Notes:

1. *This appears to be issue with instrument reading since reading dropped back to 52 MGD per hour after the unusually high hourly flow recorded.*
2. *Elevated numbers for 95 percentile as well as number of flume capacity exceedances indicates there may have been system changes such as pump replacements in stations or extensive pipeline rehabilitation around this time. MWS is to investigate if there were any associated system change sand report back to project team. Approximately 11 MGD additional flume capacity can be*

obtained by replacing the existing 3' flume with a 4' flume to provide a more accurate flow measurement from the Hendersonville system.

Although the peak hourly flows shown in Table 2-2 are below 84.5 MGD, peak hourly flows reported in the plant DCU data are estimated slightly above 90 MGD. It was agreed a peak hourly design flow of 95 MGD provided a practical safety margin for the purposes of the new Headworks facility design. Note that each of the contributing municipalities are currently planning collection system improvements to reduce inflow and infiltration during wet weather; thus, peak hourly flows are expected to reduce over time. There is no definitive timeline, however, for these improvements. Additionally, MWS is to investigate if there have been any system changes within the Hendersonville system during the last few years which would affect peak hourly flows and report back to the project team.

The peak flow rate of 95 MGD will be used for the design of the new Headworks facility; however, the capacity of the downstream primary and secondary treatment processes are limited to 63 MGD. No change to the design capacity for these process areas is contemplated under this project.

Section 3

Headworks Improvements

The proposed Headworks improvements for the DCWRF will generally include the addition of a new influent screening system and replacement of the existing aerated grit system with a stacked tray grit removal system. A new building will also be constructed to house equipment for processing and disposal of the associated solids. Each of these new systems and related improvements in the vicinity are described in this section. Figure 3-1 depicts the basic system layout.

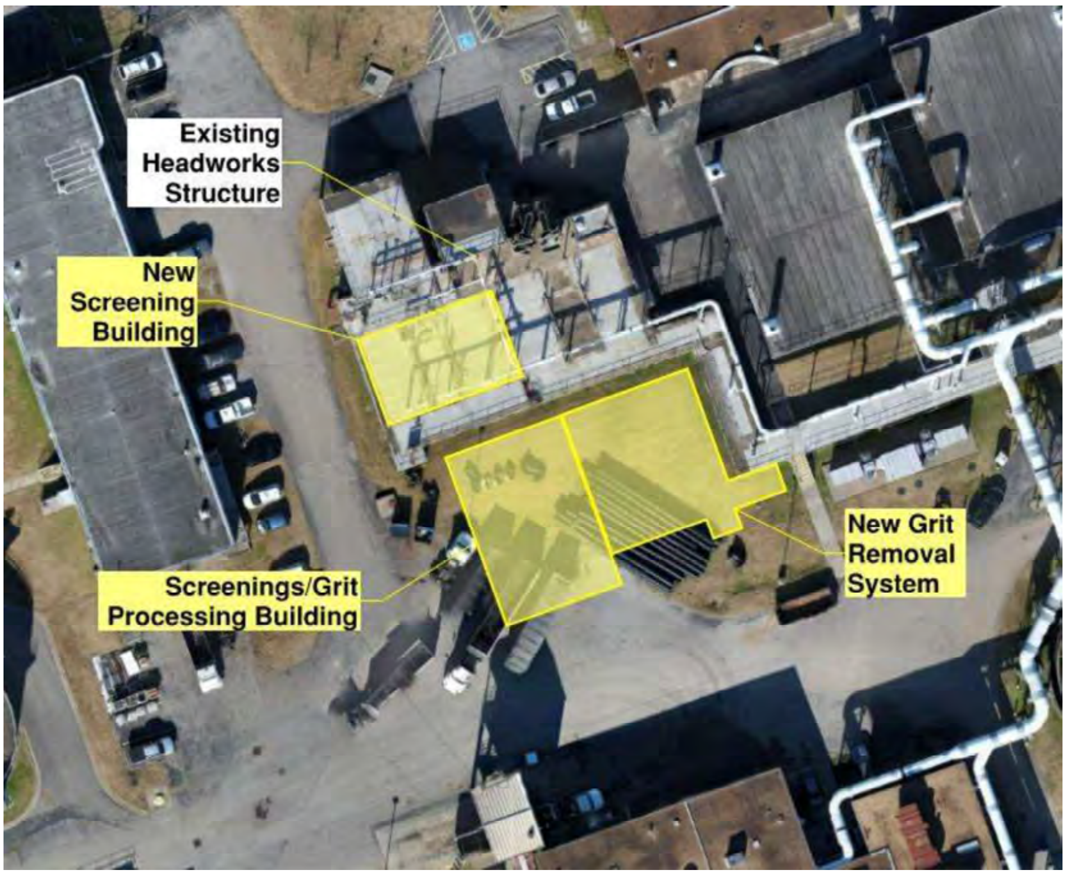


Figure 3-1. Proposed Headworks Layout

3.1 Preliminary Design Criteria and Major Equipment

Table 3-1 summarizes the preliminary process design criteria and major equipment associated with the headworks improvements. Refer to Appendix B for a preliminary Process Flow Diagram (PFD) and Process and Instrumentation Diagrams for the major Headworks improvements components.

Table 3-1. Headworks Improvements Preliminary Design Criteria

Area	Units	Value
FINE SCREENS		
Number of Units	4	3 duty, 1 standby
Screen Type		Front Loading, Perforated Plate
Channel/Screen Width	FT	5
Channel Depth	FT	9.8’
Screen Height	FT	20
Screen Incline Angle	Deg	70
Design Peak Hourly Flow @ 40% Blinded (per screen)	MGD	32
Opening Size	mm	6 mm circular
Screen Headloss @ Peak Hourly Flow, w/ 40% Blinding	IN	11
Screen Drive Inverter Duty Motor	HP	1.5 (VFD)
Screen Cleaning Brush Geared Motor	HP	2
Wash Water Requirement Per Screen (min)	GPM	36 @ 75 PSI
SCREENINGS SLUICE		
No. of Sluiceways	2	
Plant Water Requirement Per Sluice (intermittent)	GPM	300
Approximate Length (each)	FT	175
Approximate Width	IN	12
Approximate Depth	IN	16
Knife Gate Valves		4
Slope	%	1
SCREENINGS WASHER/COMPACTORS		
No. of Compactors/Presses	4	2 duty, 2 standby
Avg. Screenings Load [1]	CF/HR	37.5
Max. Screenings Load [2]	CF/HR	150
Maximum Hydraulic Capacity (Each)	GPM	270
Maximum Solids Capacity (Each)	CF/HR	283
Plant Water Requirement Per Washer/Compactor	GPM	24 @ 20-40 PSI
Motor Horsepower	HP	7.5
TIPPING TROUGHS		
No. of Tipping Troughs	4	2 duty, 2 standby (operate when associated Washer/Compactor operates)
Disposal Bin Size	CY	20
Nominal Length	FT	18
Inside Trough Width	IN	18
Inside Trough Depth	IN	24
Trough Cross Section Shape		U-shaped

Table 3-1. Headworks Improvements Preliminary Design Criteria		
Area	Units	Value
Motor Horsepower	HP	3/4
STACKED TRAY GRIT REMOVAL UNITS		
No. of Grit Removal Units	3	2 duty, 1 standby
Unit Diameter	FT	12
No. of Trays per Unit		12
Hydraulic Capacity, each	MGD	47.5
GRIT PUMPS		
No. of Pumps	3	2 duty, 1 standby (spare pump and parts on shelf for redundancy)
Capacity	GPM	400
Motor Horsepower	HP	20
GRIT WASHING/DEWATERING UNITS		
No. of Units	3	2 duty, 1 standby
Hydraulic Capacity	GPM	400
Grit Capacity	CY/HR	1.5
Motor Horsepower		
Agitator	HP	1
Auger	HP	2
SUMP PUMPS FOR GRIT PUMP ROOM		
No. of Units	2	1 duty, 1 standby
Estimated Capacity	GPM	150
Estimated Motor Horsepower	HP	5

Notes:

1. *This is the uncompacted screenings load, per duty washer/compactor, based upon 24 MGD Annual Average Daily Flow (AADF).*
2. *This is the uncompacted screenings load, per duty washer/compactor, based upon 95 MGD Peak Hourly Flow (PHF).*

3.2 Preliminary Process Flow Diagram and P&IDs

Refer to Appendix B for a preliminary PFD and Process and Instrumentation Diagrams for the major Headwork improvements components.

3.3 Headworks Design Flow Considerations

As discussed in Section 2, the proposed Headworks improvements including the new influent screening and grit removal systems will be designed for a peak flow of 95 MGD. Additional design flow considerations are summarized below.

3.3.1 Diversions to Flow Equalization

While the Headworks will be designed for a peak flow of 95 MGD, the capacity of the downstream primary and secondary treatment processes are limited to 63 MGD. Currently, flows in excess of 63 MGD are diverted to the existing 14-million-gallon flow EQ basin from a location upstream or downstream of the existing aerated grit tanks. These diversion provisions will be maintained and a third location added to provide additional operational flexibility as listed below:

- Upstream of Proposed Influent Screens (existing location at common influent channel)
- Between Proposed Influent Screens and Proposed Grit Removal System (existing location at existing Headworks effluent channel)
- Downstream from Proposed Grit Removal System (new grit effluent channel)

An analysis of the diversion system piping confirms that flows up to 32 MGD can be passively diverted from the first two (existing) locations. Due to the elevation difference between the existing and proposed diversion locations, the passive flow diversion capacity for the post-grit diversion is limited. The full, excess design flow of 32 MGD can be delivered passively to the EQ basin when the level in the EQ basin is below approximately 9 feet. As the EQ Basin level rises, the passive flow capacity falls quickly, eventually going to zero as EQ Basin reaches full condition Modifications to the existing manual and modulated diversion gates will be evaluated during detailed design to improve operational flexibility.

3.3.2 Recycle Flows

Plant recycle flows from both the existing Tank Drainage Pump Station and the new Biosolids Drying Facility sump pump station will be introduced into the influent screen common channels. Refer to Table 3-2 below for anticipated maximum flow. These projected recycle flowrates are considered in the design of the respective Headworks system components.

Table 3-2. Plant Recycle Flow Summary

Source	Maximum Flow	Discharge Location(s)	Characteristics
Existing Tank Drain PS	2.9 MGD	Influent screen common influent or effluent channel	Tank drainage from primary and secondary treatment processes, RDT underflows, process area washdown
New Biosolids Dryer Facility Sump PS	3.0 MGD	Influent screen common effluent channel	Tank drainage from Biosolids Dryer Facility process area washdown, dust collectors, conveyor flushing water

3.4 Design Component Descriptions

3.4.1 Existing Headworks

Figure 3-2 provides an overview of the existing Headworks facility highlighting the major features discussed in this section. The primary components and flow paths are highlighted below:

- All influent flow is pumped into a common influent structure with Parshall flumes for flow measurement.
- A common influent channel that distributes flow to the existing aerated grit tanks.
- Four aerated grit tanks with associated air delivery, grit pumping systems and cyclone/classifiers. A majority of this equipment is located within the tank or in the tunnel (piping/pump gallery) in the basement of the structure. The grit cyclone/classifiers are located on the grit tank deck.
- A common effluent channel that routes flow to the primary clarifiers. Two flow diversion chambers that can bypass plant influent flow to the Equalization (EQ) Basin.

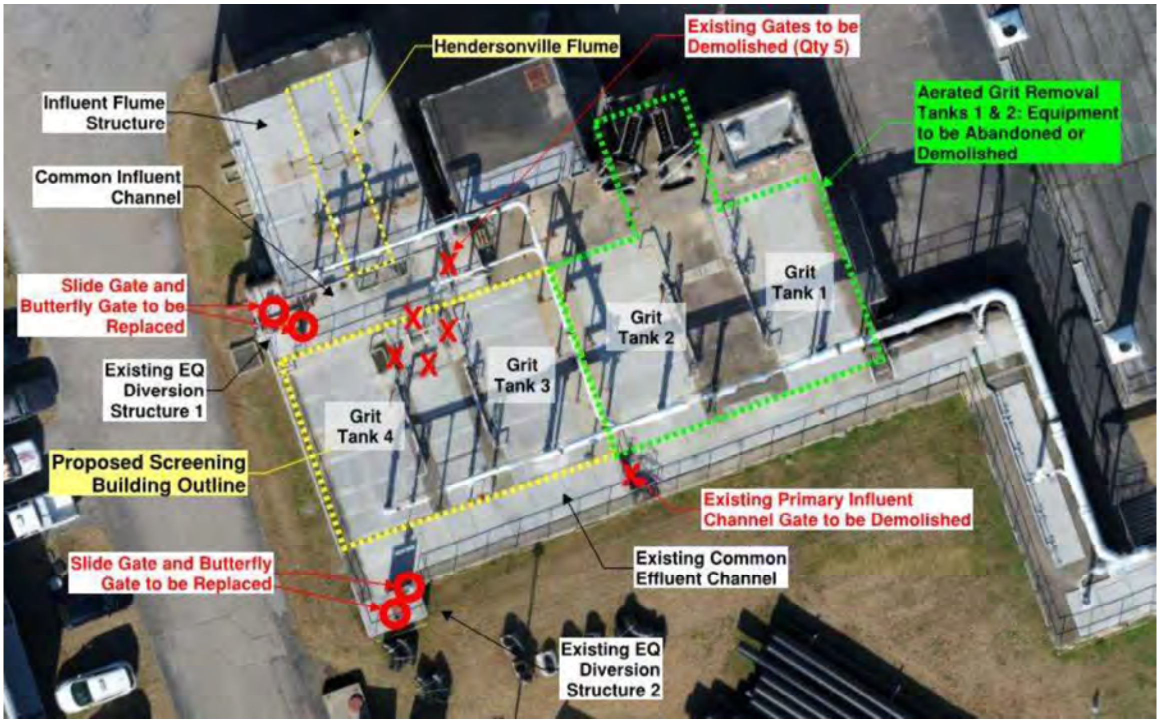


Figure 3-2. Primary Features of Existing Headworks Structure

3.4.2 Influent Flow Measurement Improvements

All influent flow to the plant is pumped to an influent structure ahead of the Headworks where it is measured in one of three existing Parshall flumes before combining in a common influent channel. The flow from the three flumes is totalized to provide the total plant influent flow. Table 3-3 below provides a summary of the existing flume capacities and associated flow data from the analysis mentioned previously.

Table 3-3. Influent Flume Evaluation Summary

Parshall Flume Location	Throat Width (ft)	Rated Flume Capacity (MGD)	Current Max Hourly Flow (MGD)
Dry Creek	6	66.88	47
Hendersonville	3	32.57	32.9 (peak recorded; but, exceeded flume measurement capacity)
Old Hickory	1	10.43	5

As previously noted, the capacity of the Hendersonville flume was exceeded resulting in inaccurate flow measurement. To remedy this, the existing flume will be replaced with a larger 4-ft throat flume in the current flume channel. This will increase the capacity of the flume to ~43 MGD. The two remaining flumes have sufficient capacity..

3.4.3 Fine Screening System

A new influent screening system will be constructed by converting Existing Grit Tanks 3 and 4 to a series of new influent channels equipped with mechanical screens as described below. A building will be constructed atop the existing tankage to enclose the new screening system along with a new adjacent building for processing of screenings. The remaining grit tanks (Tanks 1 and 2) will be abandoned.

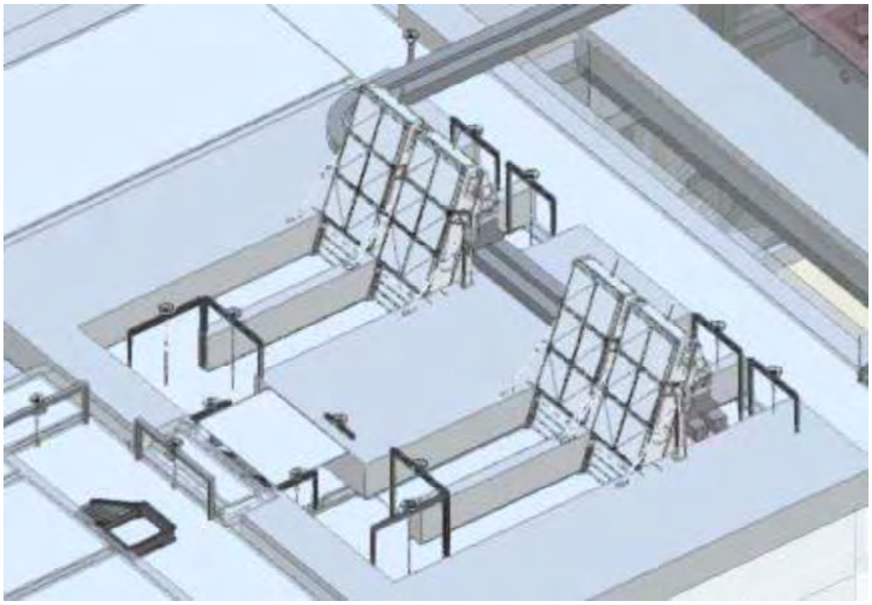


Figure 3-3. Proposed Headworks Screening Layout

3.4.3.1 Mechanical Screens

Four, mechanical, perforated plate, front-loaded fine screens with 6 mm circular openings are proposed for installation at the Dry Creek WRF. The screens will be sized using a three duty and one standby configuration. Therefore, each screen is designed to handle one-third of the peak hourly flow, ~32 MGD, each. Each screen channel will have motorized influent and effluent isolation gates to allow for screen maintenance and channel cleaning.

To help minimize odors in the screenings area, the screens will be provided with a cover system to enclose and contain the full height of the screen above the influent channel. A foul air duct connection will be provided at the top of each screen in order to provide a continuous flow of air through the enclosure and route it to the odor control system. Influent and effluent channels for the screens will have odor control covers which will also have duct connections to provide flow of air to the odor control system.

3.4.3.2 Screen Bypass Provisions and Plant Recycle Flows

The fourth channel and screen are redundant in the proposed screening system layout and will be used if one screen is out of service. Additionally, flow can be diverted away from the entire screening system influent channel by utilizing the existing gravity drain lines connected to the influent force mains and sending flow to the EQ Basin. Flow from the EQ Basin is brought back to the head of the plant through the Dry Creek force main. Plant recycle flows are reintroduced into the plant in this common influent channel. Additional means of bypass such as through existing aerated grit tank 1 and from EQ to the EQ diversion box downstream of the screens will be further investigated during detailed design.

3.4.3.3 Screening Conveyance

Debris captured on the screens will be deposited into one of two screenings sluices for transport to washer/compactors. Unlike a motorized conveyor system, a sluice uses a flow of water to flush the screenings down a gradually sloping trough to the washing presses. This passive design eliminates the maintenance concerns with typical conveyors, offering ease of operation and higher reliability. Sluice water (non-potable plant water (NPW)) is introduced into the upstream end of the trough using a motorized ball valve to add water only when the screens are operating. The timing of sluice water addition will be adjustable, offering the ability to optimize the flow rate to minimize demands on the plant water system. Similar to the screens, the sluice troughs will be provided with covers for odor control purposes. The sluice covers will be hinged to provide ease of inspection and maintenance.

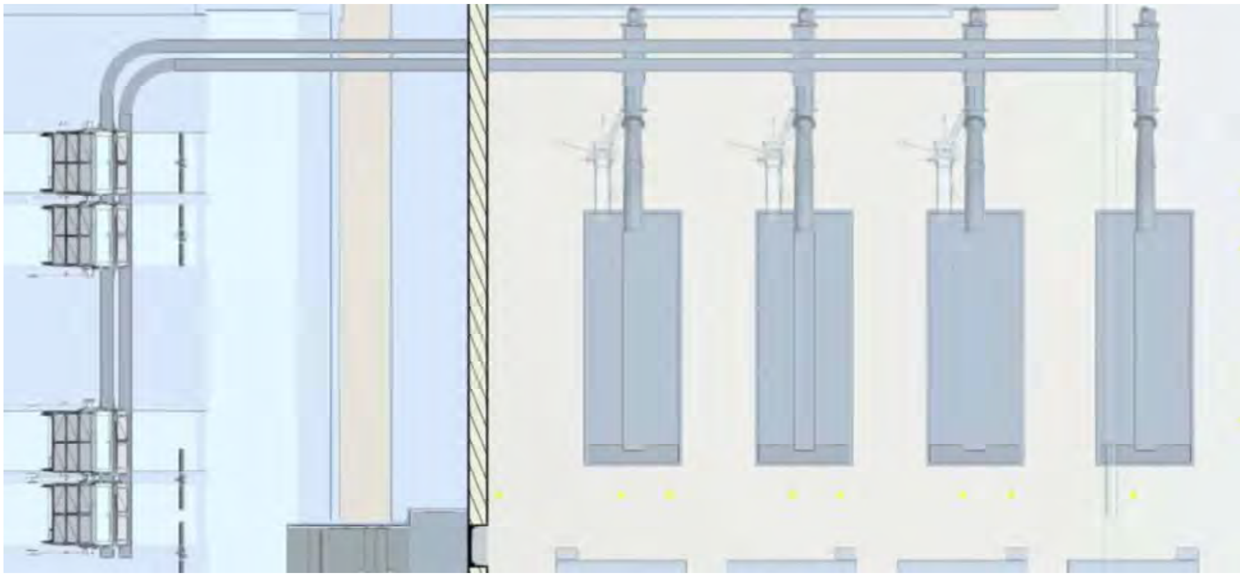


Figure 3-4. Proposed Headworks Screening Conveyance Layout

3.4.3.4 Screenings Handling

The screenings sluices will route fluidized screenings to the first floor of the proposed Screenings/Grit Processing Building containing four screenings washer/compactor units. At the end of each sluice, screenings will be diverted with a tee and two knife gate valves (or small slide gates) into either of two units, similar to system shown on Figure 3-5. Each of the four washer/compactors is sized to handle one-half of the peak solids loading under peak hourly flow conditions providing full redundancy (two duty and two standby).

These washer/compactors are designed to accomplish the following:

- Separate organic material and water from the raw screenings.
- Return the organics and wastewater back to the sewage flow stream.
- Compact the residual washed screenings and discharge them to the screenings dumpster for offsite disposal.

Figure 3-5. Example of a sluice channel (uncovered) discharging to a pair of screenings compactors

Each washer/compactor includes a wash zone where screenings are exposed to directed turbulence created by automatic introduction of wash water. The wash zone includes a screw conveyor that pushes the wet screenings through the pressure zone (rising pipe) where they are compressed, dewatered and compacted before they are discharged through the discharge pipe into a tipping trough above each dumpster.

Screenings will be deposited into the tipping troughs to evenly distribute solids over dumpsters; thus, preventing the need for bumping dumpsters or raking solids as the dumpsters are filling. The washer/compactors will be completely covered with ducts running to the odor control system while the room itself will be ventilated and routed to the odor control system. The screenings handling room layout will provide adequate clearance at the drive-end of the washing presses to remove the unit internals for maintenance.

3.4.3.5 Screenings Area Features and Support Systems

The major design features of this area are summarized below:

- All influent wastewater channels, screening equipment, sluiceways, and washer/compactor equipment will be covered and connected to the odor control system.
- Channels will be aerated to keep solids in suspension. Existing channel aeration will be reused where possible and new channel aeration systems will be installed where existing is unavailable such as in the new screening channels. It is assumed that the existing channel aeration systems can be extended from the existing channel aeration system in these proposed areas.
- The screenings system will be located in the old, aerated grit removal tanks 3 and 4. The system will be covered with a light-weight manufactured building for protection from the elements. Hatches will be provided above the screens for removal and a rollup door will be provided on the west end of the Screening Building for removal of small equipment and materials.
- The screenings washer/compactors are located on the first floor of the proposed Screenings/Grit Processing Building. The sluiceways will slope continuously downward from the screens to the discharge into the washer/compactor inlet hoppers. Staircases are provided to access the Screenings Building and the Screenings/Grit Processing Building from multiple locations.
- Air pulled from the covered screens and channels within the Screening Building will be routed to the odor control system. A continuous ventilation system will be provided for the remaining area within the Screening Building which will not be routed to the odor control system.

- The Screenings Processing Room will also house proposed dumpsters for collection of dewatered screenings and grit. Four roll-up doors will be provided for removal and replacement of the dumpsters as they fill. This room will be vented to the odor control system. Man-doors will be provided for access to the room for operations and maintenance.

3.5 Grit Removal System

3.5.1 General

The proposed grit removal system will include stacked tray, vortex-type grit removal units, grit pumps, and associated grit washing and dewatering equipment.

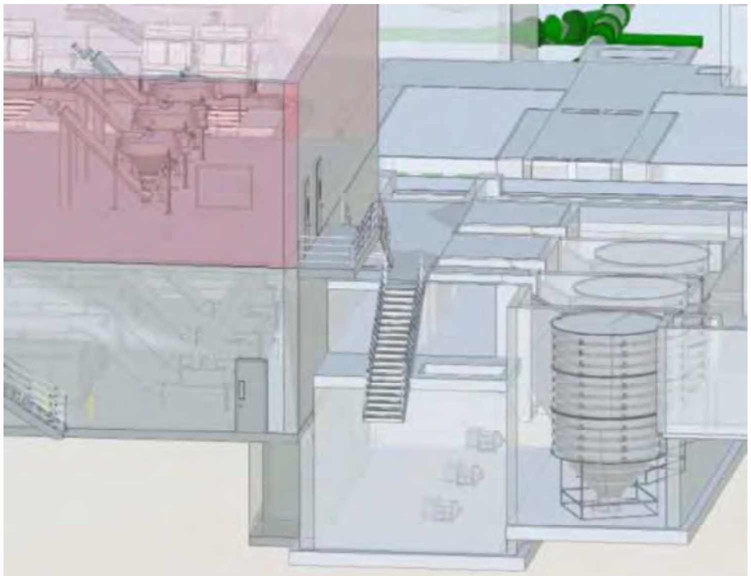


Figure 3-6. Proposed Headworks Grit Removal System Layout

3.5.2 Stacked Tray, Vortex-Type Grit Removal Units

Three, stacked tray, vortex-type grit removal systems capable of processing 95 MGD with a 95 percent removal at a 150-micron cut point with three units in operation will be installed. The peak hydraulic flow through a 12 ft, 12 tray system is 46.2 MGD with a 212-micron nozzle design (largest stacked tray system available). Therefore, with only two units in service the peak design capacity would be 92.4 MGD. It is possible to process 95 MGD through two of the proposed grit removal units; however, if the 92.4 MGD peak design capacity for two units in operation is exceeded there is a potential for short circuiting over the influent nozzles. In this case, the portions of the flow which short circuits the nozzles (theoretical maximum of 2.6 MGD) could escape over the grit removal system effluent weir untreated. Since there are no moving parts in the grit removal units they should rarely be out of service. Given the minimal chance of the units being out of service during a peak flow event and the limited effect it would have on treatment, it is recommended that three, 12 ft diameter units be installed with 212-micron nozzles in order to process peak flows of 95 MGD.

3.5.3 Grit Pumps

The proposed grit removal system will include three horizontal recessed impeller grit pumps for use in transporting the grit slurry collected from the bottom of the stacked tray, vortex-type grit removal units to the three grit washing and dewatering units to be located on the second floor of the proposed Screenings/Grit Processing Building. Each pump will be dedicated to a given grit removal unit and grit washing/dewatering unit and will run continuously when the associated grit removal system is online. The dedicated pump layout allows for fewer valves and fittings which are prone to clogging in grit systems. The grit pumps will be located in the proposed Grit Pump Room. A spare pump will be provided in the scope of work to allow for quick replacement and maintenance of system operation. An equipment removal hatch will be installed in the southeast corner of the grit pump room for removal of pumps and equipment for maintenance.

3.5.4 Grit Washing and Dewatering

The proposed fluidized bed/screw auger grit washing and dewatering system for the improvements project is capable of processing the proposed peak grit load with two of the three units in operation. It is recommended that the same vendor supply the stacked tray, vortex-type grit removal units as well as the washing and dewatering units in order to obtain a performance guarantee. The grit washing and dewatering units will be located on the second floor of the new Screenings/Grit Processing Building with skylights above each unit for installation and removal. The units will be totally enclosed with odor control duct connections. Floor mounted davit cranes will be installed adjacent to the units to allow for removal of small equipment such as motors, valves and instruments. A floor hatch will be provided with monorail for lowering these small pieces of equipment to the first floor when maintenance is required. Washed and dewatered grit will be discharged from the units on the second floor of the new Screenings/Grit Processing Building through chutes leading to dumpsters on the first floor.

3.5.5 Grit Removal System Bypass Provisions

The grit removal system will consist of three units with individual influent isolation gates so any combination of units can be in operation at a given time depending upon influent flow. The proposed grit removal system will have a common influent and effluent channel. In the event that the influent or effluent channel needs to be taken out of service for maintenance the entire grit removal system can be bypassed by utilizing the section of the existing primary influent channel that becomes a grit removal system bypass channel upon installation of proposed isolation gates. Additionally, flow can be diverted away from the grit removal system by utilizing the existing EQ diversion boxes and diverting flow through existing gravity pipelines to the EQ Basin.

3.5.6 Grit Removal System Features and Support Systems

The major design features of this system are summarized below:

- The proposed grit removal system will be located in a proposed structure and building to the south of the existing aerated grit removal system as depicted in Figure 3-2. The grit removal units will have removable panels for odor control and protection from the elements.
- The grit washing/dewatering units are to be located on the second floor of the new Screenings/Grit Processing Building. The grit pumps will be located in the Grit Pump Room which will have staircases for access from the north or south end of the new Screenings/Grit Processing Building.
- All influent wastewater channels, grit removal equipment, and washing/dewatering equipment will be covered and connected to the odor control system.
- A continuous ventilation system will be provided for the grit dewatering room. Ventilation from the grit dewatering room will not be routed to the odor control system since the equipment will be totally enclosed and routed to the odor control system as mentioned above.
- Roof hatches are to be provided above the grit washing/dewatering equipment for removal and a floor hatch is provided for removal of small equipment and materials.

3.6 Screenings/Grit Processing Building

3.6.1 Layout

The new Screenings/Grit Processing Building will consist of two floors. The first floor will house the. screenings sluiceways, screenings washer/compactors, and dumpsters for the dewatered screenings and grit. The second floor will house the grit washing/dewatering units and a separate electrical room.

3.6.2 Electrical Room

A common electrical room will be provided for the entire Headworks system on the second floor of the new Screenings/Grit Processing Building, sized with sufficient space for the anticipated loads and located above the 500-year flood elevation.

- The electrical room will be physically separated from the screening and grit removal equipment areas of the building to avoid area classification concerns (NFPA 820). Vendor control panels will be located in this electrical room. Local control panels (Hand/Off/Auto) will be located near equipment for maintenance use.
- Double man-door access will be provided with access to an exterior platform for removal of electrical equipment using a crane.
- HVAC for the space will include air conditioning and pressurization to provide an optimum environment for the electrical and control equipment.

Refer to Sections 8, 9 and 10 for additional information.

3.7 Gate Replacement and Addition

All existing gates withing the footprint of the proposed headworks improvements project, including EQ diversion box gates, will be demolished or replaced with actuated 316SS gates. In addition to the gates to be replaced there will be 8, (10'H x 5'W) screening channel isolation slide gates, 4, (8'H x 9'W) grit removal system bypass slide gates, and 3 (8'H x 4'W) grit removal system influent isolation slide gates added to the proposed Headworks system.

3.8 Preliminary Process Control Strategies

3.8.1 Fine Screening System

The control system for the influent screening system will provide the following general features:

- General:
  - Each screen, sluice water supply motorized ball valve, sluice discharge gate, and screenings washer/compactor units will be equipped with Hand/Off/Auto hand switches to allow for manual and automatic control for the system.
  - The EQ diversion gates prior to screening will be automated based upon channel levels in the common influent channel.
- Influent Screens:
  - The number of screens in operation will be determined based on plant influent flow using an operator adjustable set point to determine when an additional screen is needed.
  - Operation of the respective influent and effluent screening channel gates will be interlocked with the screen such that the gates will open when the screen is placed in service and vice versa. This will regulate the approach and orifice velocities for optimal screen capture rates.

Channel air will also be interlocked with this signal so it is only running when the respective channel/screen is active.

- Alternation of screen operation will be provided via LEAD/LAG1/LAG2 switch with automatic alternation of the lead screen designation based on an adjustable timer.
- Vendor control panels will be provided for the screens to allow for proprietary control functions as necessary. In general, however, the cleaning mechanism will be activated based upon a combination of differential water level (headloss) across the screen and timers. Vendor control panels will be located in the electrical room with local control panels located in the screening building to allow for minimal screen control during maintenance.

- Screening Sluice:
  - Redundant sluice water ball valves will be provided with a duty/standby switch and (if desired) provisions for automatic alternation of duty designation.
  - The sluicing trough water feed ball valve(s) will be controlled by a run signal from each screen and a preset/adjustable cycle count.
  - Once a preset cycle count is reached the ball valves will energize to open and remain energized for a preset/adjustable time after each screen stops to allow the collected screenings to be conveyed to the washing press.
- Screenings Washing/Dewatering Units:
  - Operation of the screenings washing/dewatering units will be controlled via an interlock with the sluice water ball valves such that whenever the sluice is activated the associated washing/dewatering units will operate also,
  - Alternation washing/dewatering units will be provided via a duty/standby switch with automatic alternation of the lead unit designation based on an adjustable timer.
  - Operation of the respective sluice discharge gate will be interlocked with its respective washing/dewatering unit such that the gate for the designated unit opens when the unit is called to run.
  - Vendor control panels will be provided for the compactors to allow for proprietary control functions as necessary, including potential networking with the screen control panel (depending on supplier). Vendor control panels will be located in the electrical room with local control panels (Hand/Off/Auto) located in the screenings processing room to allow for minimal unit control during maintenance.

3.8.2 Grit Removal System

The control system for the grit removal system will provide the following general features:

- General:
  - Each grit pump, grit washing/dewatering unit, and isolation gate will be equipped with Hand/Off/Auto hand switches to allow for manual and automatic control for the system.
  - The EQ diversion gates prior to and after grit removal will be automated based upon total plant influent flow rates recorded versus flow rates recorded by the associated existing influent EQ flow meter. The existing diversion gates prior to the proposed grit removal system will be utilized to shed flow to the EQ Basin in the event one of the units is down during a peak flow event. The proposed EQ diversion system after the grit removal system will be used to maintain a 63 MGD maximum flow to secondary treatment.
- Grit Removal Units:

- The number of Grit Removal Units in operation will be determined based on plant influent flow using an operator adjustable set point to determine when an additional Grit Removal Unit is needed. When an additional Grit Removal Unit is needed the associated influent isolation gate will be automatically opened.

- Grit Pump:
  - Operation of grit pumps dedicated to Grit Removal Units and Grit Washing/Dewatering Units will be controlled via an interlock with the Grit Removal isolation gates such that whenever the gates are in the open position the associated Grit Pump is activated. When in operation the grit pumps will run continuously.
- Grit Washing/Dewatering Units:
  - Operation of the grit washing/dewatering units will be controlled via an interlock with the grit removal isolation gates such that whenever the gates are in the open position the associated grit pumps and grit washing/dewatering units will also operate. Vendor control panels will be located in the electrical room with local control panels (Hand/Off/Auto) located in the grit dewatering room to allow for minimal unit control during maintenance.

3.9 Maintenance of Plant Operations (MOPO) and Construction Sequencing

The new Headworks will be constructed generally within the boundaries of existing aerated grit removal tanks 3 and 4 and within proposed structures southwest of the existing aerated grit removal system in a currently unused area of the site (see Figure 3-3). Existing plant operations must be maintained during construction of the proposed improvements.

The intent of the MOPO plan is to mitigate interruptions to plant operation and maintain permit compliance throughout construction and startup. Impacts to existing operations will primarily result from required channel connections between the new structure and existing facilities. The following connections to existing facilities will be required to fully commission the new headworks facilities.

- **Influent Flume Rehabilitation** – During the replacement of the Hendersonville influent flow measurement flume the associated influent flow can be routed to the Dry Creek influent force main by utilizing existing valves and bypass piping. Additional valves may be needed on existing piping just prior to the influent flume structure or bulkheads can be placed inside the flume measurement structure. This work should be completed during dry weather; however, if peak events were to occur while the flume is out of service excess flow can be diverted to the existing EQ Basin.
- **Gate Replacements at Existing Aerated Grit Removal Structure** – The existing common influent channel will need to be bypassed during construction for replacement or demolition of various isolation, control, and weir gates. Flow can be diverted to the existing EQ Basin for some amount of time dependent upon influent flow; however, it is anticipated that some bypass pumping will need to occur to provide sufficient time for completion of all the scope associated with gate replacement. Portable pumps and temporary piping will need to be installed for this bypass pumping from the influent to existing aerated grit removal tanks 1 and 2.
- **Screen Installation** -Operation of existing aerated grit removal tanks 1 and 2 must be maintained throughout construction. Existing aerated grit removal tanks 3 and 4 will both be out of service during construction. Currently, there is a 36” pipeline in the existing tunnel from the east end of the common influent channel to aerated grit removal tanks 1 and 2 influent. Preliminary hydraulics indicate the capacity of this pipeline is approximately 50 MGD. Any influent flow in excess of 50 MGD occurring while tanks 3 and 4 are out of service will need to

be diverted to the existing EQ Basin or pumped from the common influent channel to aerated grit tanks 1 and 2 utilizing portable pumps and temporary piping. This will have limited impact on existing operations. The proposed screens must be operational prior to diverting flow to the proposed grit removal system.

- **Grit Removal Facility and Solids Processing Building** – The proposed grit removal system and solids processing building can be fully constructed without affecting the existing treatment processes with the exception of connections to existing utilities including the influent and effluent channels. An existing knock-out wall will be utilized for the connection of the proposed Grit Removal System effluent channel to the existing primary influent channel. Thus, these portions of the proposed facility construction will have limited impact on existing operations.

Section 4

Biosolids Processing Improvements

4.1 Introduction

The proposed biosolids processing improvements at the DCWRF include new and modified treatment processes in three primary areas of the facility:

- **Existing Filter Building** – Improvements in this area will include replacement of the existing GBTs and associated polymer feed systems, improvements to the tank mixing system inside the DSSTs, and demolition of the existing Belt Filter Presses (BFPs).
- **Existing Digester Complex** – A new, modernized waste gas burner will be installed to provide waste gas flaring redundancy along with upgrades to the controls of the existing waste gas burner for improved performance.
- **New Biosolids Drying Facility (BDF)** – A new building will be constructed to house new sludge dewatering centrifuges (to replace the BFPs) and a new biosolids drying system capable of producing a Class A biosolids product, similar to that produced at the Central WRF. Related to the biosolids drying system, a new truck load-out area, odor control and other support systems will be provided. The building will include new electrical and control rooms and multiple personnel spaces (conference and locker room facilities) to serve the overall site.

The locations of the three primary areas at DCWRF undergoing biosolids processing improvements under this project are shown below in Figure 4-1 on the next page.

In general, the proposed facilities are modeled after the biosolids facilities at the Central WRF, building upon the operational experience and successful enhancements employed at this facility by MWS staff. This section provides a review of the existing facilities, design criteria for the overall biosolids train, followed by a detailed description of the specific improvements in each area.

Refer to Appendix B for a preliminary PFD and Process and Instrumentation Diagrams for the major biosolids processing improvements components.

4.1.1 Existing Facilities

Figure 4-2 on the next page presents the overall PFD for the existing solids process train at the DCWRF. The existing system produces a Class B biosolids product as described in Section 1.

4.2 Design Basis

This section of the report presents the fundamentals for the design and performance of the new biosolids processing system provided under this project. Topics presented include historical flows and loads, current and design-condition process mass balances, and underlying assumptions around which the process design was developed. Specific assumptions surrounding the mechanical, structural, and instrumentation designs of specific unit operations are presented in subsequent sections when and where relevant.

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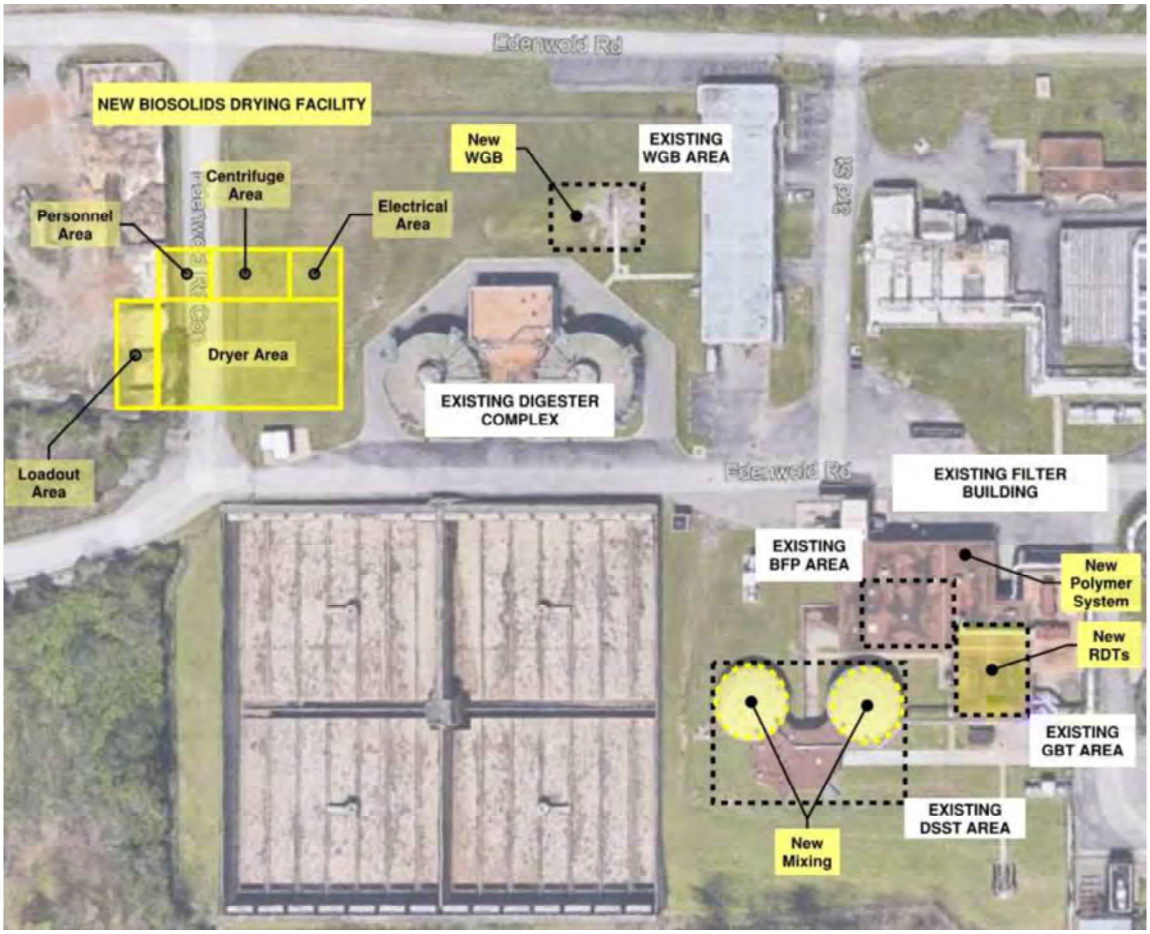

Figure 4-1. Summary of Biosolids Improvements at the DCWRF

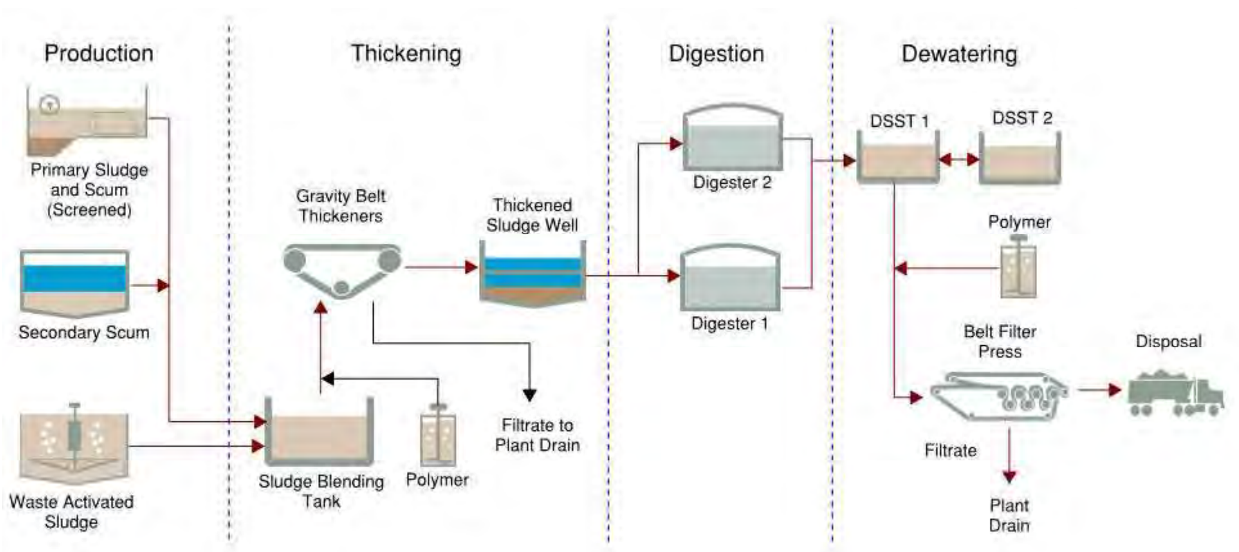

Figure 4-2. Existing DCWRF Solids Process Train

4.2.1 Historical Raw Sludge Flows and Loads

The project team worked with Dry Creek staff to collect and evaluate daily operating data from the DCWRF. A total of 3 years of data were used (2019-2021) to develop the following flow and load conditions:

- Average annual
- Maximum 14-day average
- Maximum 7-day average
- Maximum day

These varying conditions are used to develop the design criteria for biosolids processing unit operations and equipment at design conditions. Table 4-1 lists the max day, 7-day, and 14-day peaking factors from annual average for the total blended sludge (primary sludge and WAS) loading to the thickening process.

Table 4-1. Raw Sludge Peaking Factors

Peaking Factors for Solids	Max day	Maximum 7-day average	Maximum 14-day average
Total Blended Sludge Flow to Thickening	2.7	1.6	1.4

It should be noted that these peaking factors are applied to projected flows and loads to determine design year conditions. Therefore, there is an underlying assumption that WRF operations will not change appreciably over the course of the project lifecycle. If sludge production increases significantly beyond the estimates, additional biosolids processing capacity will be required as discussed further in this report.

4.2.2 Current Mass Balance

To develop the mass and flow balance for this analysis, baseline plant data from 2019 to 2021 were evaluated for consistency, logic, and alignment with typical industry values. The plant data, along with a series of assumptions based on designer experience and/or expected equipment performance, were used to create a mass balance for the current biosolids processing train. The current mass balance model is used to project the future mass balances at design conditions, while relying on additional assumptions associated with the design, operating sensitivities and/or performance metrics for new biosolids processing unit operations, which are presented in the subsequent section. Table 4-2 presents the steady state mass balance for the existing operation at average annual conditions.

Key Assumptions:

- The blended, thickened sludge flow and loading to digestion was assumed to be the most reliable source of data because it is a compliance point and frequently monitored. It was used to calibrate sludge flow and loading upstream at thickening and downstream at dewatering.
- The WAS data was also assumed to be reliable as it is typically more consistent and more frequently monitored compared to PS. PS data can often be unreliable due to FM fouling and fluctuating %TS conditions. Consequently, PS loading was back-calculated to match historical loading to digestion at an assumed GBT solids capture efficiency..
- Historical PS and WAS data indicate the capture rate for the existing GBTs is low (approx. 80% compared to an expected efficiency of 95%) and results in a recycle of solids that artificially

increases primary sludge production. For startup and future scenarios, the solids recycle flow from GBTs was removed from influent PS to assess future solids projections more accurately .

- BFP feed data were not relied upon since the flow meters installed at the BFP feed do not follow best practices (vertical with no diameter restriction) and were not reported to have been calibrated recently. The flow to dewatering was assumed to be the same as the flow to digestion.
- Dewatered solids from the BFP were analyzed in December 2021 and found to 13-14% total solids (TS), which is less than the 16-17%TS the BFP were designed to produce and achieved at commissioning, MWS staff reported that the filtrate from the BFP show visible signs of solids carryover, indicating poor capture efficiency at current operation. Consequently, various capture efficiency scenarios were modelled to evaluate the impact of varying capture efficiencies on solids production. The model showed that the current dewatered solids production (38 wet tons per day) correlated to a 13-14%TS content at a poor recovery efficiency (approx. 70%) and 16%TS at a well-performing solids capture rate (approx. 93%). To reflect operation of the BFP's target performance, the model was calibrated at 17%TS and the dry solids production calculated accordingly.

Table 4-2. Current Solids Mass Balance – Annual Average Conditions

	Comb. Sludge	GBT Filtrate	Digester Feed	BFP Feed	Cake	BFP Filtrate
Dry Tons per Day	14.0	3.1	10.9	6.6	6.1	0.5
% Solids	1.2%	0.3%	5.2%	3.2%	16%	0.3%
Wet Tons per Day	-	-	-	-	38	-
Gallons per Day	283,307	233,522	49,784	49,784	-	40,619

4.2.3 Projected Average Loads-Start Up (2025)

This section establishes the projected design conditions in the anticipated start-up year of 2025. Solids production was projected using the growth rate of 1.7% per year. The growth rate for the population served by the DCWRF was estimated to be 1.7% per year based on 2004-2018 population growth data evaluated in the 2020 Dry Creek Wastewater Treatment Plant Food Waste Feasibility Assessment report. The annual increase in sludge production for this project's 20-year planning horizon was assumed to be proportional to the increase in service area population and thus set at 1.7% per year based on the 2020 report.

The future DCWRF solids process train is depicted in Figure 4-3 and the solids flow and loading values at startup are provided in Table 4-3. The rotary drum thickeners (RDTs) installed under this project are anticipated to have a capture efficiency of approximately 95%, which will reduce recycled solids through the system. The improved dewatered solids %TS assumed with centrifuge dewatering is anticipated to lower the wet solids and evaporative loading to the dryer.

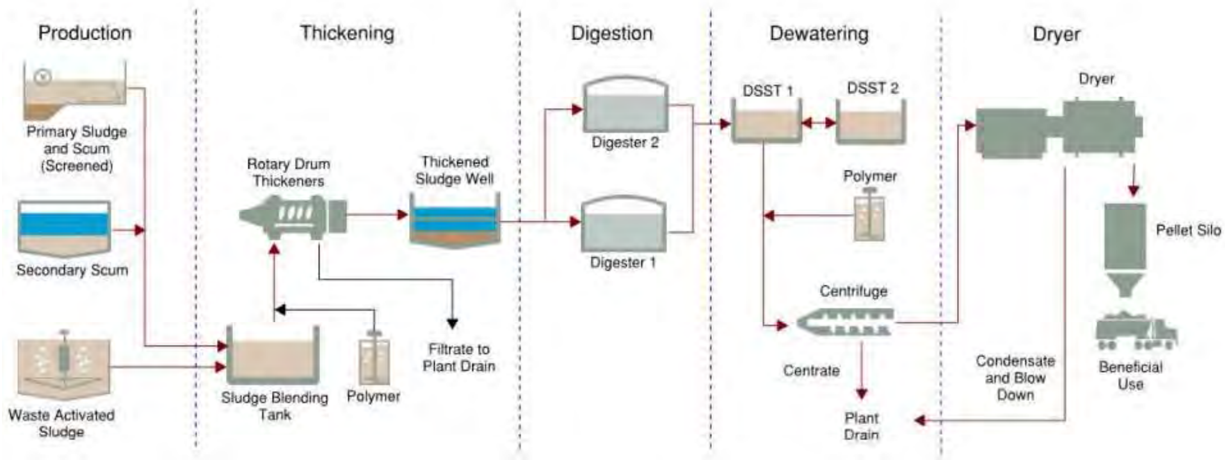

Figure 4-3. Design DCWRF Solids Process Train

Table 4-3. Start-Up Mass (2025) Mass Balance – Annual Average Conditions						
	Comb. Sludge	RDT Filtrate	Digester Feed	Centrifuge Feed	Cake	Centrate
Dry Tons per Day	12.3	0.6	11.6	7.0	6.7	0.4
% Solids	1.2%	0.1%	5.2%	3.2%	21%	0.2%
Wet Tons per Day	-	-	-	-	32	-
Gallons per Day	248,835	195,578	53,257	53,257	-	45,635

4.2.4 Process Design Loads-Future (2045)

This project assumes a 20-year planning horizon to establish a 2045 design condition. The overall process is identical to startup conditions, but the quantities are increased at the 1.7% per year assumption. As discussed in the following subsections, the biosolids processing upgrades will include space for additional processing capacity addition past the design condition, or sooner if more growth occurs than projected. Table 4-4 shows the full buildout mass balance

Table 4-4. Design Mass Balance (2045) – Annual Average Conditions						
	Comb. Sludge	RDT Filtrate	Digester Feed	Centrifuge Feed	Cake	Centrate
Dry Tons per Day	17.2	0.9	16.3	9.8	9.2	0.6
% Solids	1.2%	0.1%	5.2%	3.2%	21%	0.2%
Wet Tons per Day	-	-	-	-	44	-
Gallons per Day	348,603	273,993	74,610	74,610	-	64,063

4.3 Existing Filter Building

The existing Filter Building houses the GBTs for PS and WAS thickening, BFPs for dewatering, and a polymer area to condition sludge before processing in the GBTs and BFPs. The DSST area, adjacent to the Filter Building, holds and mixes digested sludge for pumping to the BFPs. Successful operation of the new biosolids drying system requires that upstream solids handling operations such as thickening and dewatering be reliable and consistent to continuously generate feed material within the dryer's operating targets. Per MWS staff input during project workshops, the following improvements were recommended for inclusion in this project to provide reliable solids handling through the 20-year planning horizon.

- **Thickening:** This project will demolish the existing GBT equipment from the GBT area and install new RDTs in the same area. The RDTs will be provided at the same quantity and capacity with room for installation of a future unit to allow for future growth. The existing sludge feed and thickened sludge transfer systems in the basement will continue to be used with the new RDTs.
- **Dewatering:** This project will demolish the existing BFP equipment from the BFP area. New dewatering centrifuges will be installed at the new BDF as described later in the section.
- **Polymer Storage and Feed System:** This project will demolish all polymer tanks and equipment in the Existing Filter Building. New polymer tanks and equipment for conditioning sludge feed to the RDTs will be installed in the polymer area in the Existing Filter Building. New polymer tanks and equipment will be installed in the BDF for use with the new dewatering centrifuges as further described later in this section.
- **DSST Mixing:** This project will demolish the existing jet mixing system at each of the DSSTs and install new propeller type submersible mixers in each tank. Access hatches will be modified or provided new with tank platforms and davit cranes for access to the new submersible mixers.

The locations of the process areas at the Existing Filter Building undergoing biosolids handling improvements are highlighted below in Figure 4-4.

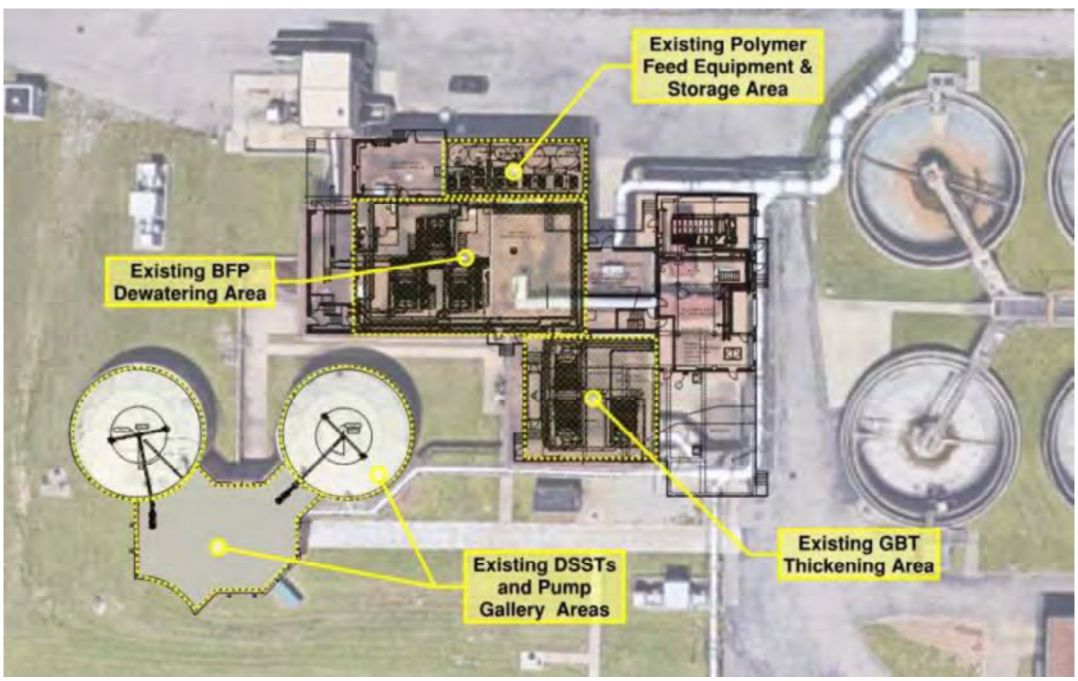

Figure 4-4. Existing process areas at the Filter Building

4.3.1 Preliminary Design Criteria and Major Equipment

Table 4-5 summarizes the preliminary process design criteria and equipment associated with the Existing Filter Building improvements. The thickening process will continue to run continuously (24/7) and the design criteria is represented accordingly.

Table 4-5. Existing Filter Building Preliminary Design Criteria

Area	Units	Value
SLUDGE THICKENING (BLENDED)		
Number of Units		2 duty, 1 standby
Type		Rotary Drum
Manufacturers		Andritz, Parkson, Alfa Laval
Annual Average Hydraulic Loading (2045)	gpm	242
Max Day Hydraulic Loading (2045)	gpm	654
Capacity, Each	gpm	400
Capacity, Firm	gpm	800
Operating Schedule		24/7
Influent Sludge Content	% TS	1
Unit Solids Capture	%	95
Minimum Target Solids Content	%	5
BOOSTER PUMPS		
Number of Units		2 duty, 1 standby
Capacity, each	gpm	60
Pressure Output	psi	120
POLYMER PROPERTIES, THICKENING		
Type		Emulsion
Polymer Active Fraction	%	40
POLYMER FEED, THICKENING		
Number of Blending Units		2 Duty, 1 Standby
Polymer Dose[1]	Active lb/dry ton	15
Polymer Feed Rate[2]	Active lb/hr	12.554
Polymer Feed Rate (Neat)[2]	gph	1.477
Final Polymer Solution Concentration	%	0.25
Polymer Solution Feed Rate	gal/hr	3.692
POLYMER STORAGE, THICKENING		
Required Volume[3]	gal	2,659
Tank Quantity	No.	1
Type		Vertical, HDPE
Storage Quantity, Each	gal	5,000[4]
DSST SUBMERSIBLE MIXERS		
Number of Units per Tank		2 (1 duty/1 standby)

Table 4-5. Existing Filter Building Preliminary Design Criteria

Area	Units	Value
Thrust, each	N	1553 - 1919
Speed	rpm	47 - 575
Power	hp	7.5

Notes:

1. *Per January 24, 2022, Andritz laboratory analysis thickening performance analysis*
2. *Polymer usage based on maximum RDT loading of 400 gpm and optimum dosage of 15 active lb/ton TSS*
3. *Required volume provides 30-days of storage at max RDT capacity (400 gpm)*
4. *Larger size provided to allow for full offloading of transfer truck*

4.3.2 Design Component Descriptions

4.3.2.1 RDT Area (Thickening)

The proposed sludge thickening system will consist of new RDTs, flocculation tanks, wash water booster pumps, and a new emulsion polymer feed system. Sludge is currently thickened with GBTs in the filter building that are nearing the end of their useful life. Thickened sludge from the GBTs is transported to the thickened sludge well on the level below via a conveyor. Rotary drum thickeners are recommended as they are totally enclosed, have a smaller footprint, and require less maintenance. Some WRFs have found RDTs require more polymer however, and the new polymer system will be designed accordingly. Figure 4-5 shows the components of a typical RDT unit.

Primary sludge and WAS are combined upstream of the thickeners in the sludge blending tank, where combined sludge is then pumped to the sludge thickeners for co-thickening. The existing GBT feed pumps will be reused, and the piping re-routed to pump directly to the new RDTs from the feed pump isolation valves. Each RDT is provided with a flocculation tank upstream of the unit where sludge is mixed with polymer. Wash water is constantly fed to the top of the drum, and filtrate falls by gravity to the process drain system where it is recycled to the head of the plant. Modifications will be made to the process drain piping to connect the filtrate piping into the existing process drain system. Thickened sludge will be discharged directly from each RDT to the thickened sludge wet well directly below through an opening in the slab where it will be pumped to the digesters utilizing the existing digester feed pumps. Wash water booster pumps will be supplied to provide adequate spray water pressure from the HPE system. The RDTs are totally enclosed, and a flanged connection will convey foul air to the odor control system. Figure 4-6 on the next page shows the proposed RDT room layout. Space is provided for a fourth RDT to be installed in the future if demand increases. This arrangement will leave the area in front of the roll up door minimally obstructed.

4.3.2.2 Existing BFP Area (Dewatering)

The existing BFPs will be demolished after commissioning of the BDF, described in subsequent sections of this report. The existing dewatering feed pumps in the DSST area will be repurposed as sludge transfer pumps to pump digested sludge to the new dewatering feed well in the BDF. Two new buried pipelines (one duty and one standby) will be installed to transfer the digested sludge to the BDF feed well to allow for periodic cleaning. The existing pump capacity to transfer digested sludge through the new pipelines will be verified during detailed design.

4.3.2.3 Existing Polymer Area

The sludge thickening polymer system will be in the existing polymer room. All the existing polymer storage and feed equipment in this room will be demolished as it has reached the end of its useful life. This room will house a new bulk storage tanks and polymer blending units needed to activate and convey polymer solution to the RDT feed piping where it is introduced upstream of the flocculation tanks. Dosing locations will be evaluated during detailed design to provide optimal polymer dosage, contact time, and operational flexibility. Additional evaluation will be required to make accommodation for removal of the existing chemical tanks and installation of new tanks inside the existing room.

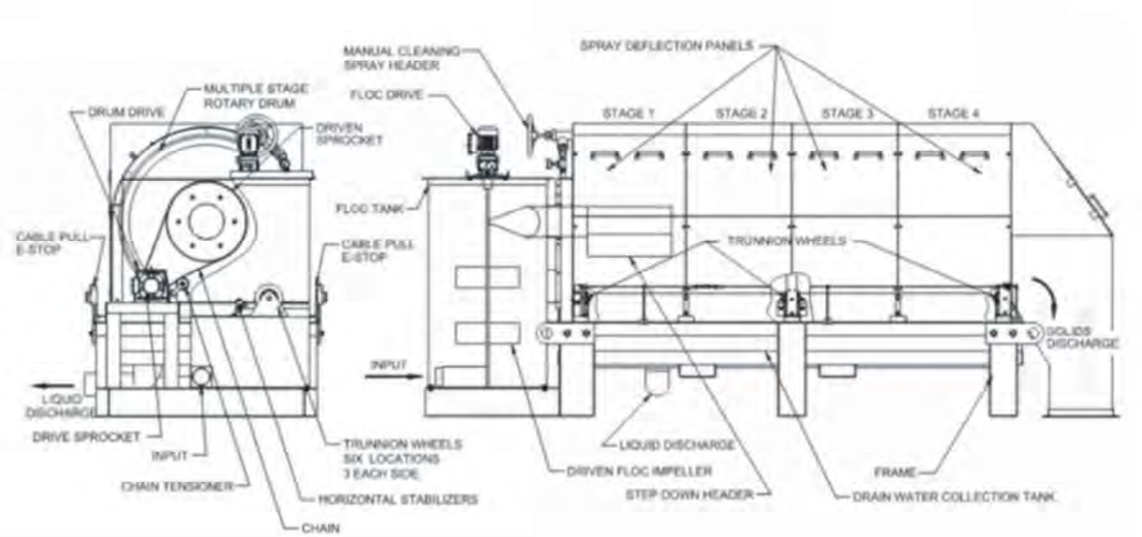

Figure 4-5. Typical Rotary Drum Thickener Components (Parkson Thicktech unit shown)

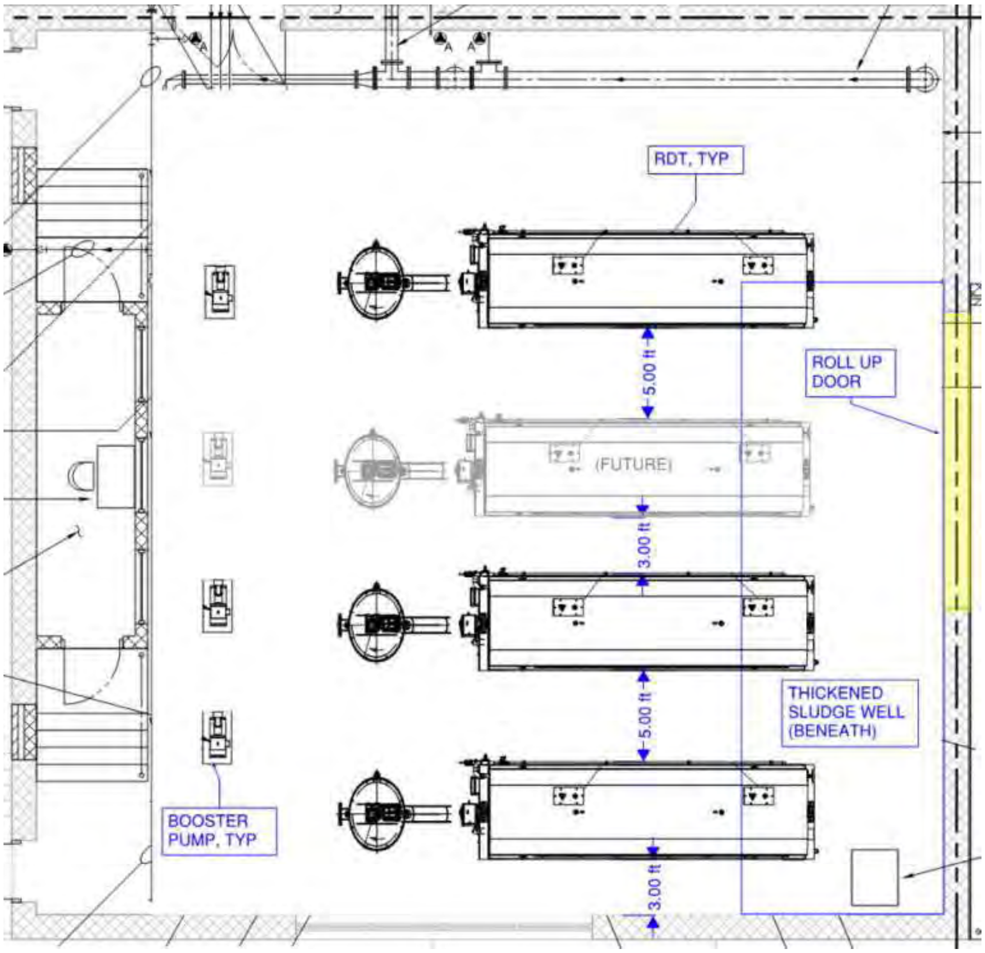

Figure 4-6. Proposed Thickening Room Facility Layout (Layout based on Andritz PDR1200 unit)

4.3.2.4 DSST Mixing

The existing DSSTs are used to store digested sludge from the anaerobic digestion system. The DSSTs currently uses a pump mixing system to keep solids in suspension and prevent debris from settling on the tank floor. Table 4-6 presents the existing parameters for the DSSTs.

Table 4-6. Existing DSSTs Parameters		
Area	**Units**	**Value**
Existing DSSTs		
Number of Units		2 (existing)
Diameter	ft	50
Side Water Depth	ft	22.8
Volume, Each	gal	330,000

The existing pump mixing system consists of a RotaMix® jet mixing system that draws the tank fluid contents through a pump and distributes the fluid through a series of jet mixing nozzles that are mounted onto a fixed manifold located on the tank floor. This pump mixing system will be decommissioned due to operational issues such as historical ragging and plugging and a new mixing system consisting of multiple propeller-type submersible mixers will be installed within each tank. The new submersible mixers will be provided with a rail system such that each mixer can be raised and lowered to provide optimum mixing and can be angled so the flow can be pushed to the floor to keep solids in suspension.

Additional major improvements for this area will include the following:

- Modifications to each existing DSST geodesic dome cover to allow access provisions atop each tank for removal and maintenance of the mixers. During detailed design it will be confirmed that the existing geodesic dome covers are capable of being modified to accommodate the proposed access hatch improvements for equipment removal.
- A davit crane/hoist will be provided at each mixer location to accommodate removal and servicing of equipment.
- New stairs and platform will be required at each DSST to allow access to the top of the tanks as well as the proposed submersible mixers and associated equipment. A catwalk will be provided around the outside perimeter of the tanks to connect the maintenance platforms to the existing Headhouse roof for ease of access.
- HPE will be supplied to the DSSTs for wash down and cleaning of the interior of the tanks utilizing the existing jet mix system piping and nozzles.

Figures 4-7 and 4-8 present a conceptual depiction of the DSST mixing access and maintenance provisions. Modifications shown in Figure 4-8 for DSST No. 1 are to be similar for DSST No. 2.

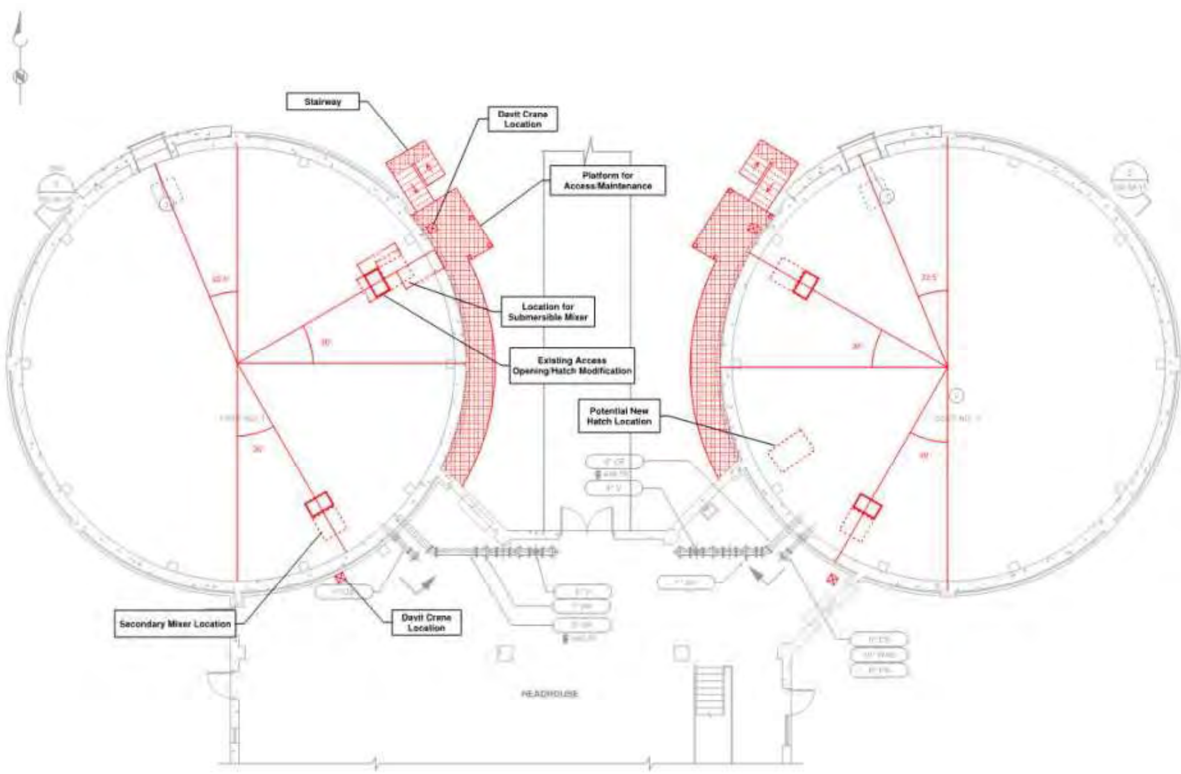

Figure 4-7. Conceptual Layout of DSST Mixing Access and Maintenance Provisions

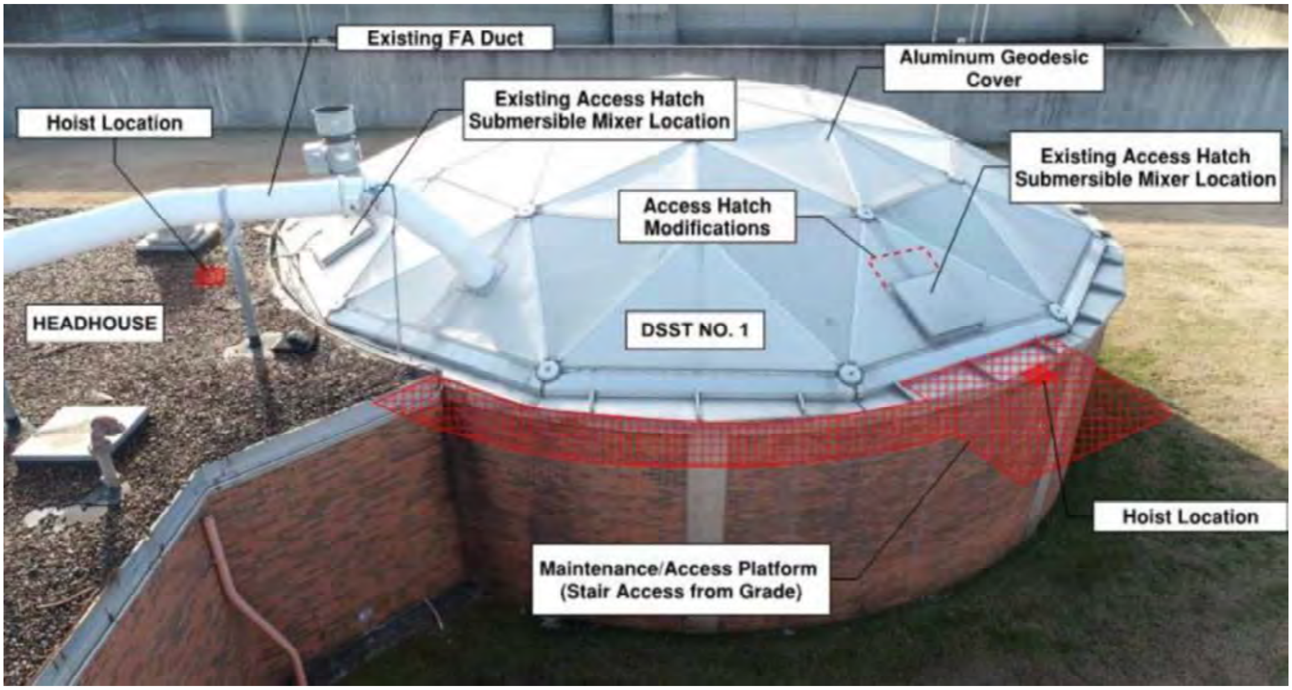

Figure 4-8. Photograph of DSST No. 1 for Conceptual Modifications and Improvements

The proposed mixing system for the DSSTs will consist of:

- Two 7.5 to 15 horsepower (hp) submersible mixers located along the perimeter of the interior wall of each tank. Mixers will be provided in a duty/standby arrangement and supplied with external variable frequency drives.
- The mixers will be mounted on vertical rails supported by the tank wall and floor that allow direction and depth of the mixers to be adjusted as required to properly mix the tank. A mast will be provided with the rail system to accommodate the unidirectional adjustment given specific degree rotational increments.
- Based on tank mixing manufacturer input, a minimum submergence of up to 4-feet may be required to run the mixers. A minimum liquid depth will be required to avoid creating a vortex in the flow and damaging the mixers. This will be further developed in detailed design.

Figure 4-9 presents an example isometric of the proposed propeller-type submersible mixer and rail system.

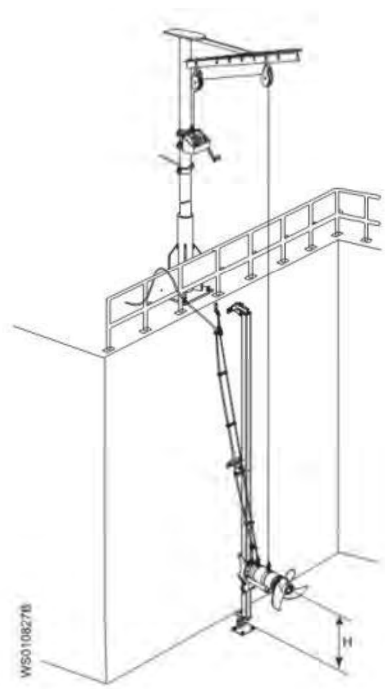

Figure 4-9. Proposed Propeller-Type Submersible

4.3.2.4.1 Computational Fluid Dynamics (CFD) Modeling

CFD modeling of the proposed mixers within the existing DSSTs was requested by Metro. CFD modeling will be performed by the submersible mixer manufacturer, Xylem-Flygt, in order to properly select the quantity and location of the submersible mixers to provide adequate mixing. Results will be shared with MWS during the detailed design phase.

4.3.3 Preliminary Process Control Strategies

4.3.3.1 RDT Area (Thickening)

The general control system for the RDTs will be as follows:

- The RDTs will be operated 24-hours per day, 7 days per week.
- Screened PS and primary scum will be blended with WAS and secondary scum in the existing sludge blend tank and pumped continuously to the RDTs based on operator-selected flow set-point on the RDT feed pumps.
- The RDT drum and flocculation tank drives will be capable of being adjusted manually at the units and from the plant's DCS system to achieve optimal thickening.
- Flow meters will be located on the influent pipes of the RDTs.
- Polymer feed rate will be flow-paced based on the influent sludge flow rate and operator-selected polymer dose.
- Polymer dose and dilution rate will be adjustable by the operator.
- Polymer will be introduced at multiple injection locations along the conveyance pipe to provide optimal polymer dosage, contact time, and operational flexibility.
- Blending unit dilution water and pump speeds will be automatically controlled via programmable logic controller (PLC) on the blend unit skid to provide polymer solution at the selected concentration and dose based for each application point.
- Thickened sludge will be discharged directly into the existing thickened sludge well and pumped via the existing thickened sludge pump station to the anaerobic digesters.
- Tank level in the existing sludge blend tank and thickened sludge well is monitored by level sensors. Pumps are operate to maintain liquid level in a set band and operators are notified of low level and overflow conditions by alarms set for each condition.

4.3.3.2 DSST Mixing

The general control system for the DSSTs will be as follows:

- Mixing will be provided in each of the DSSTs and controlled via liquid level sensors. The mixers will run continuously once the liquid level reaches a submergence depth of 4 feet or higher in the tanks. The mixers will be connected to external variable frequency drives (VFDs), and the output will be automatically adjusted based on liquid level in the tank. The operators will have the option to place the mixers in manual and adjust the mixer output based on operator experience. When the tank liquid level falls below a calibrated setpoint the mixers will shut off to avoid creating vortex flows within the tanks.
- Filling and draining of both tanks will continue to follow the existing control strategy. However, the existing controls will likely need to be modified in coordination with the new controls affecting the DSST mixers.

4.4 Existing Digester Complex

Blended, thickened sludge is anaerobically digested at the existing digester complex. Biogas generated from the process fuels hot water boilers within the complex, or when produced in excess, is flared at a WGB. MWS staff identified several operational issues at the existing WGB that will be addressed with modifications made under this project. Additionally, this project installs a new WGB to provide redundancy for biogas flaring. The new WGB will be installed next to the existing to connect to the existing biogas management and utility systems. The location of the existing and proposed WGB is shown below in Figure 4-10. Space will be set aside near the new BDF to accommodate siting both WGBs if new digesters are installed in their footprint in the future.

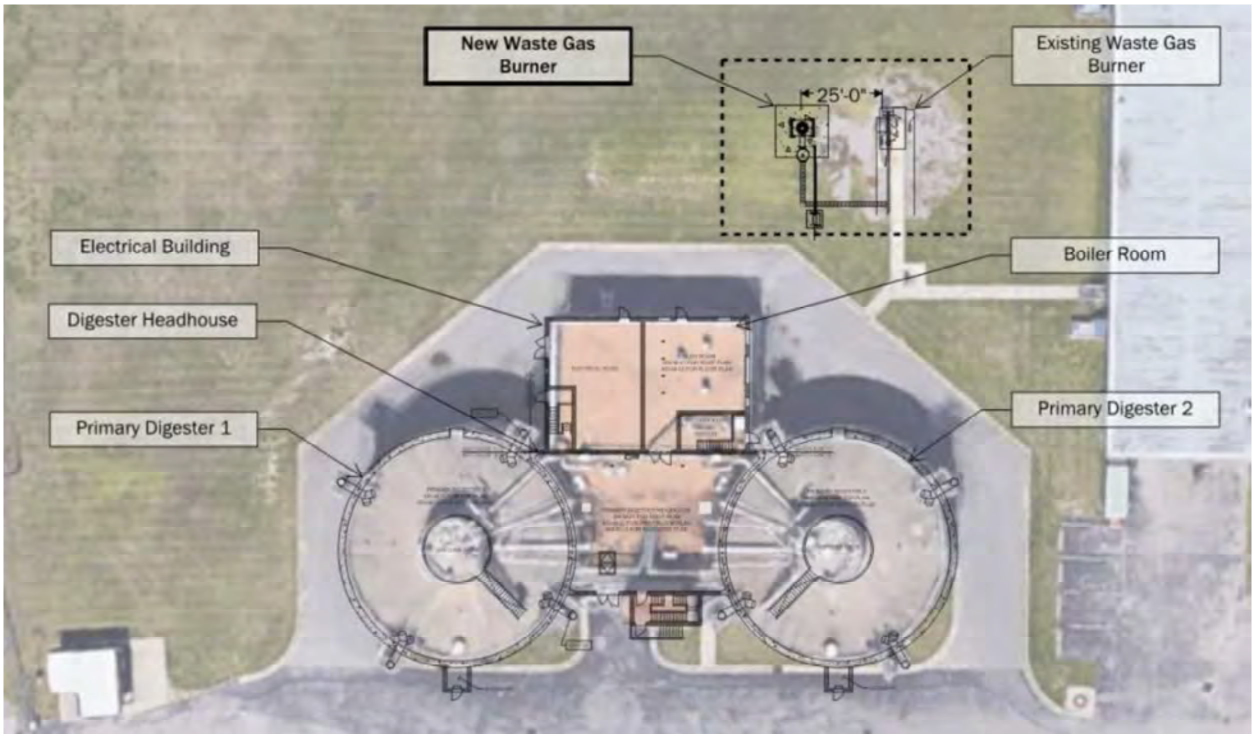

Figure 4-10. Aerial view of Existing Digester Complex with New WGB

4.4.1 Preliminary Design Criteria and Major Equipment

Table 4-7 summarizes the preliminary design criteria and equipment parameters for the new WGB.

Table 4-7. New Waste Gas Burner Preliminary Design Criteria

Area	Units	Value
Number of Burners		1
Burner Type		Candlestick
Burner Size	in	10
Peak Hour (2045) Flow[1]	SCFM	730
Capacity	SCFM	1500[2]

Notes:

1. *Assumed to be peak day times a peaking factor of 2.*
2. *Matches existing capacity*

4.4.2 Design Component Descriptions

4.4.2.1 Existing WGB Modifications

The pilot ignition system and control panel at the existing WGB will be replaced under this project to provide more reliable operation. Additionally, a new backpressure control valve will be installed at the existing valve train to provide greater working access. The backpressure control valve will be insulated and heat traced to guard against condensate freezing. During detailed design, alternative butterfly control valves will also be considered as an opportunity to guard against methane leaks.

4.4.2.2 Proposed WGB Improvements

A new WGB will be installed 25 feet away from the existing in conformance with CSA/ANSI B149.6:20 Code for digester gas, landfill gas, and biogas generation and utilization. The new WGB will be close coupled with a flame trap and arrestor assembly oriented in the vertical to prevent condensate pooling. The backpressure control valve will also be installed outside, and piping sloped toward the buried section supplying the digester gas to drain the condensate towards the existing collection system in the digester headhouse. A sketch of the new WGB is provided in Figure 4-11.

4.4.3 Preliminary Process Control Strategies

The control strategy for digester gas flaring will remain the same. The backpressure control valve at the WGB will be set to feed digester gas to the WGB when pressure builds up in the header beyond an operator adjusted setpoint. When the system is placed in manual, the ignition electrode will spark and the pilot light will be maintained continuously. When run in automatic, the pilot gas solenoid valve and ignition electrode will activate only when a pressure switch in the feed branch detects a digester gas pressure nearing the backpressure control valve setpoint. Manual isolation valves will be installed upstream of the two WGB supply branches and will be manually activated to select which WGB is active.

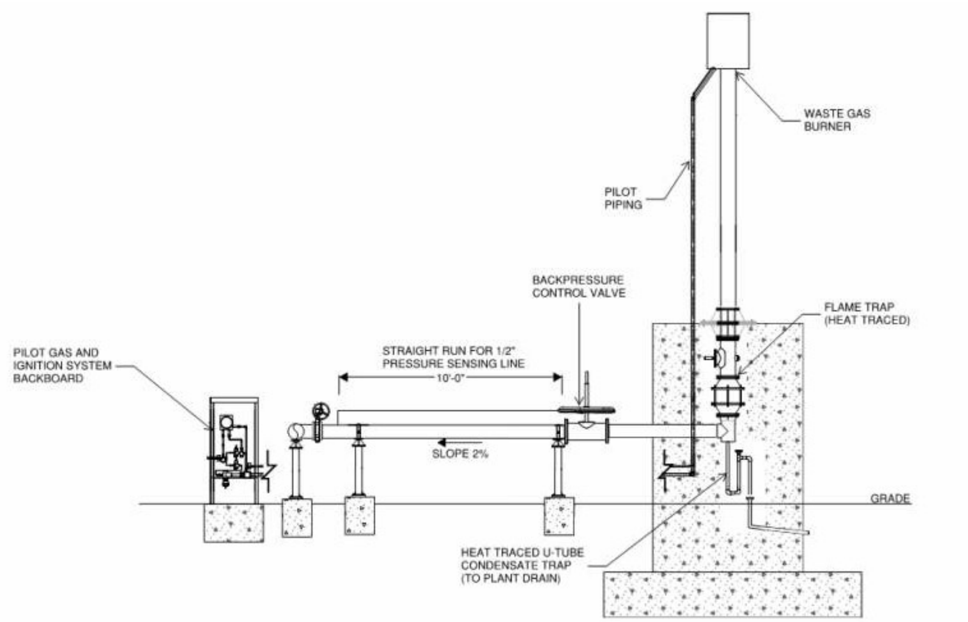

Figure 4-11. Representative sketch of new WGB

4.5 Biosolids Drying Facility

This project proposes to install a new BDF to process digested sludge at DCWRF into a marketable, dried pellet conforming to USEPA 40 CFR Part 503 Class A requirements. The BDF will consist of two integrated, dewatering and drying processing trains with one fully redundant dewatering centrifuge. The dewatering and dryer trains are sized so that one train will operate continuously with the second train available for operation in parallel as needed. Solids loading projections estimate only on train will be required for operation at startup and population growth will likely require operation of the second unit up to half the year at the end of the 20-year planning horizon. Space will be provided to install a third dryer train to provide full redundancy if regional growth accelerates more than projected and more downtime is required for planned maintenance activities on the dryer systems. Additionally, space for a fourth dewatering centrifuge will be provided if growth warrants its installation in the future.

The BDF building will be configured into two primary process area groupings; the first being a large, single-story area to house the dryer systems and equipment platforms, and the second being a three-story section that houses the dewatering and solids handling equipment that feed the dryer system, as well as personnel and electrical rooms. An overview of the process areas in the BDF building and those adjacent to the building is provided here, and the process areas are described in more detail further in this section.

- **Dewatering:** Digested sludge will be collected and mixed in a dewatering feed well, pumped and mixed with polymer via a new polymer feed system, and dewatered with new dewatering centrifuges. Dewatered solids will be transferred with screw conveyors to the dryer area or to a bypass truck loadout station. Solids handling equipment and tanks will be tied into the plant odor control system.
- **Drying:** Rotary drum dryers will process the dewatered sludge with post-dryer screening to sort product between cooling or internal recycle steps. Finished, cooled product will be sent to the loadout area and process safety and dust control devices will be provided throughout the system to meet life safety codes and standards.
- **Truck Dried Pellet Offloading:** A drive-through loadout facility will be provided on the ground floor to store and offload dried product in silos. Nitrogen and pellet oiling systems will be located adjacent to the loadout building for deflagration mitigation and product dedusting, respectively.
- **Biogas Conditioning:** A biogas conditioning system, consisting of hydrogen sulfide, moisture, and siloxane removal processes, will be installed adjacent to the BDF building to condition digester gas and boost its pressure for use as the primary fuel source for the drying process.
- **Flex Space:** Personnel areas will be provided for staff locker rooms, meeting spaces, and mechanical building systems.
- **Electrical**: Electrical equipment such as motor control centers (MCCs), VFDs, DCS enclosures and controls for powered equipment in the BDF will be housed in separate electrical rooms. The DCS Workstation and vendor panels with operator interface terminals will be located in the Control Room.

Figure 4-12 on the next page provides a conceptual layout sketch of the BDF with the corresponding process areas.

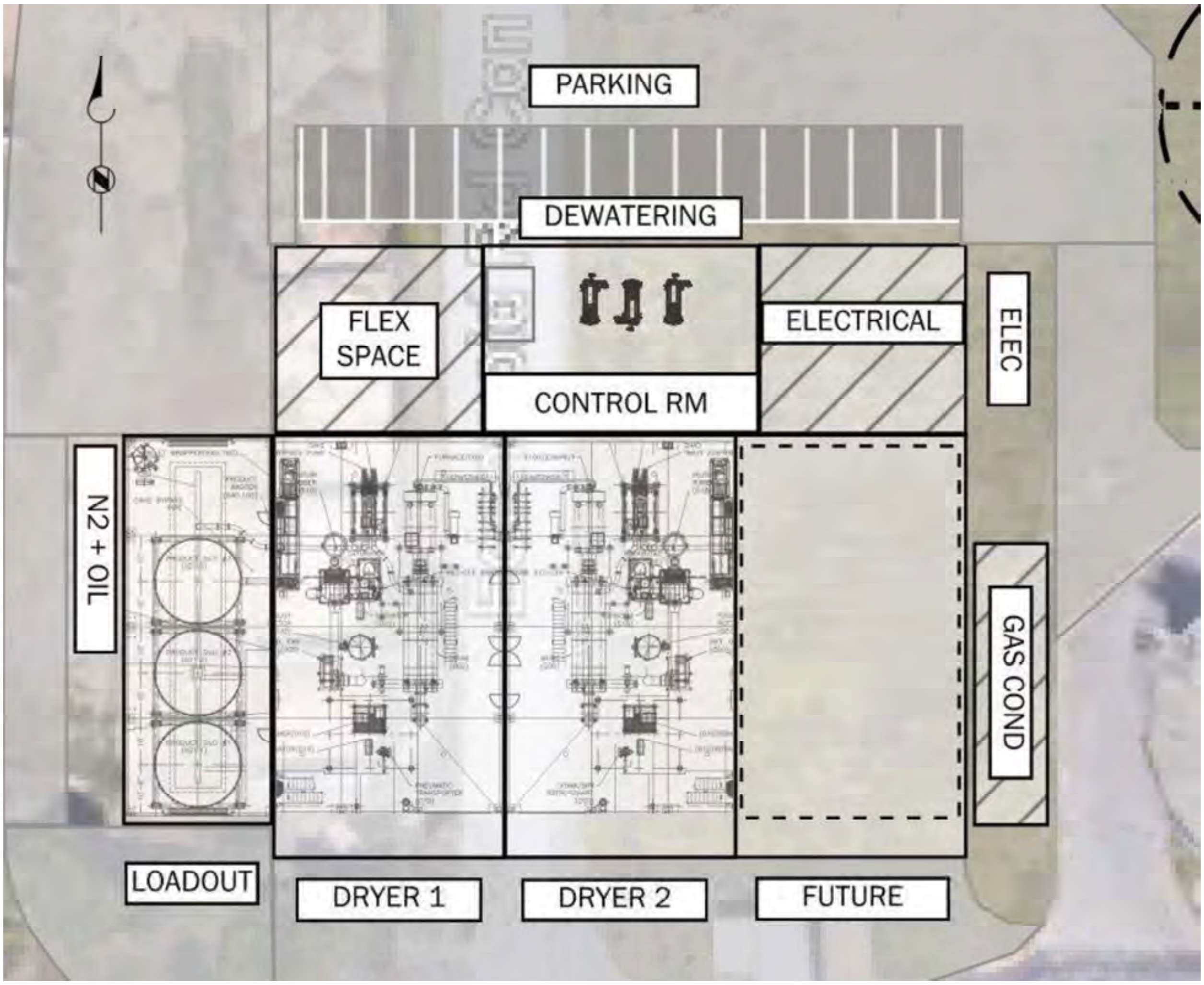

Figure 4-12. Overview Concept Sketch of the BDF

4.5.1 Preliminary Design Criteria and Major Equipment

Table 4-8 summarizes the preliminary process design and equipment associated with the BDF. The BDF unit processes are designed to run continuously (24/7) and the design criteria is represented accordingly

Table 4-8. Biosolids Drying Facility Preliminary Design Criteria		
	Value	Units
FEED WELL		
Tank Type	Rectangular Concrete	
Retention Time at Average Design Loads (2025)	20	hours
Retention Time at Max Two Week Loads (2045)	10	hours
Tank Volume	43,000	gal
Inner Tank Dimensions	32 (L) x 13 (W) x 18 (H)	feet
Max Side Water Depth (Overflow to Drain)	14	feet

Table 4-8. Biosolids Drying Facility Preliminary Design Criteria

	Value	Units
FEED WELL MIXERS		
Number of Mixers	1	
Min Submergence	1	feet
Max Solids Content	5%	TS
Motor	7.5	hp
Mixer Type	Stainless steel propeller	
DEWATERING FEED PUMPS		
Pump Type	Rotary Lobe	
Number of Pumps	3	
Pump Capacity	70	gpm
Drive	Variable Speed	
DEWATERING CENTRIFUGES		
Number of Centrifuges	3 (Lead/Lag/Standby)	
Target Feed Solids Content	3.3%	TS
Average Hydraulic Loading (2025)	35	gpm
Average Solids Loading (2025)	575	lb-TS/hr
Max Two Week Hydraulic Loading (2045)	70	gpm
Max Two Week Solids Loading (2045)	1,150	lb-TS/hr
Centrifuge Solids Capacity, Each	1,200	lb-TS/hr
Dewatered Solids Content[1]	21% - 25%	TS
BIOSOLIDS DRYER		
Dryer Type	Rotary drum dryer	
Number of Dryer Systems	2	
Design Solids Feed	21%	TS
Target Solids Content	93%	TS
Average Evaporative Load (2025)	2,025	lb-H2O/hr
Max Two Week Evaporative Loading (2045)	4,050	lb-H2O/hr
Dryer Evaporative Capacity[2]	4,400	lb-H2O/hr
Hydrogen Sulfide Removal		
Media Type	Granular Ferric Hydroxide	
Number of Vessels	2	
Diameter of Vessels	10	ft
Height of Media	8	ft
Vessel Configuration	Series or parallel	
Pressure Rating	5	psig
Vacuum Rating	1	psig
Removal Efficiency	99	%

Table 4-8. Biosolids Drying Facility Preliminary Design Criteria		
	Value	Units
Gas Blower		
Type	Rotary Lobe with VFD	
Number	2 (duty/standby)	
Capacity (each)	225	scfm
Minimum Discharge Pressure	6	psig
Motor Size	15	hp
Number of Particulate Filters	2 (duty/standby)	
Particulate Filters Removal Efficiency (3 microns)	99	%
Gas Cooling and Reheating HEX		
Type	Gas to Gas/Gas to Glycol	
Number	1	
Dew Point	40	°F
Discharge Gas Temperature	75 - 80	°F
Flow Rate	225	scfm
Pressure Rating	15	psig
Siloxane Removal		
Media Type	Activated Carbon	
Number of Vessels	2	
Diameter of Vessels	4.5	ft
Height of Media	10	ft
Vessel Configuration	Series or parallel	
Pressure Rating	15	
Removal Efficiency	99	
Number of Final Particulate Filter	1	
Removal Efficiency of Final Particulate Filter	99	
POLYMER PROPERTIES, DEWATERING		
Type	Emulsion	
Polymer Active Fraction	40	%
POLYMER FEED, DEWATERING		
Number of Blending Units	2 (duty/standby)	
Number of Metering Units	3 + 1	
Polymer Dose[1]	66	Active lb/dry ton
Polymer Feed Rate	37.95	Active lb/hr
Polymer Feed Rate (Neat)	4.46	gph
Final Polymer Solution Concentration	0.5	%
Polymer Solution Feed Rate	10.147	gal/hr
POLYMER STORAGE, DEWATERING		

Table 4-8. Biosolids Drying Facility Preliminary Design Criteria

	Value	Units
Storage Tank Required Volume	8036	Gal
Storage Tank Quantity	1	No.
Storage Tank Type	Vertical, HDPE	
Storage Tank Capacity, Each	8400	Gal
Day Tank Required Volume	245	Gal
Day Tank Quantity	1	No.
Day Tank Type	Vertical, HDPE	
Day Tank Capacity, Each	260	Gal

Notes:

1. *Per January 24, 2022, Andritz laboratory analysis dewatering performance analysis.*
3. *Per MWS staff experience, rotary drum dryers typically incur a 30% derate capacity over time due to normal wear and tear. Consequently, it is projected that increased loadings to the DCWRF BDF due to population growth over the 20-year project planning horizon, will exceed the capacity of a single dryer train and periodic, parallel operation of both trains will be required.*

4.5.2 Design Component Descriptions

This project installs new dewatering centrifuges in the new dewatering and dryer facility to dewater liquid digested sludge prior to thermal drying. Digested sludge is currently dewatered by three BFPs in the filter building and the BFPs are nearing the end of their useful life. Centrifuge technology is recommended for the new dewatering area as it is an enclosed process, produces drier cake solids, and has a smaller footprint. Both the dewatering and dryer equipment will be provided by the same system supplier to integrate controls and operation of both systems.

Solids loading projections show the full volume of both DSSTs provides 9 days of storage at annual average loading at design conditions (2045). It is assumed the working volume of both tanks will be maintained at a low level to buffer peak day and peak week events and that the maximum loading the BDF will encounter will be a maximum 14-day average load. Based on these solids loading projections, the BDF will require use of one dewatering and dryer train at start-up (2025). However, as growth over the 20-year planning horizon leads to increased loading, periodic operation of the second train in parallel will be required. Space for a fully redundant, third dryer train and a fourth dewatering centrifuge is provided in the BDF if future growth warrants their installation.

4.5.2.1 Dewatering

The dewatering and associated solids handling systems will be configured like the Central WRF Biosolids Facility to maintain a consistent operating philosophy between the two facilities. The dewatering centrifuges will be located on the third floor of the dewatering area of the BDF with a floor opening to move centrifuges to grade level. A bridge crane, sized to move the entire centrifuge assembly, will be provided to move the centrifuges across the floor and down the opening. The dewatering and drying building control room will be located on the third floor with viewing windows into the dewatering and drying areas on each side of the room. A conceptual sketch of the third floor of the dewatering area is provided as Figure 4-13, with the dryer area outside of the figure to the south.

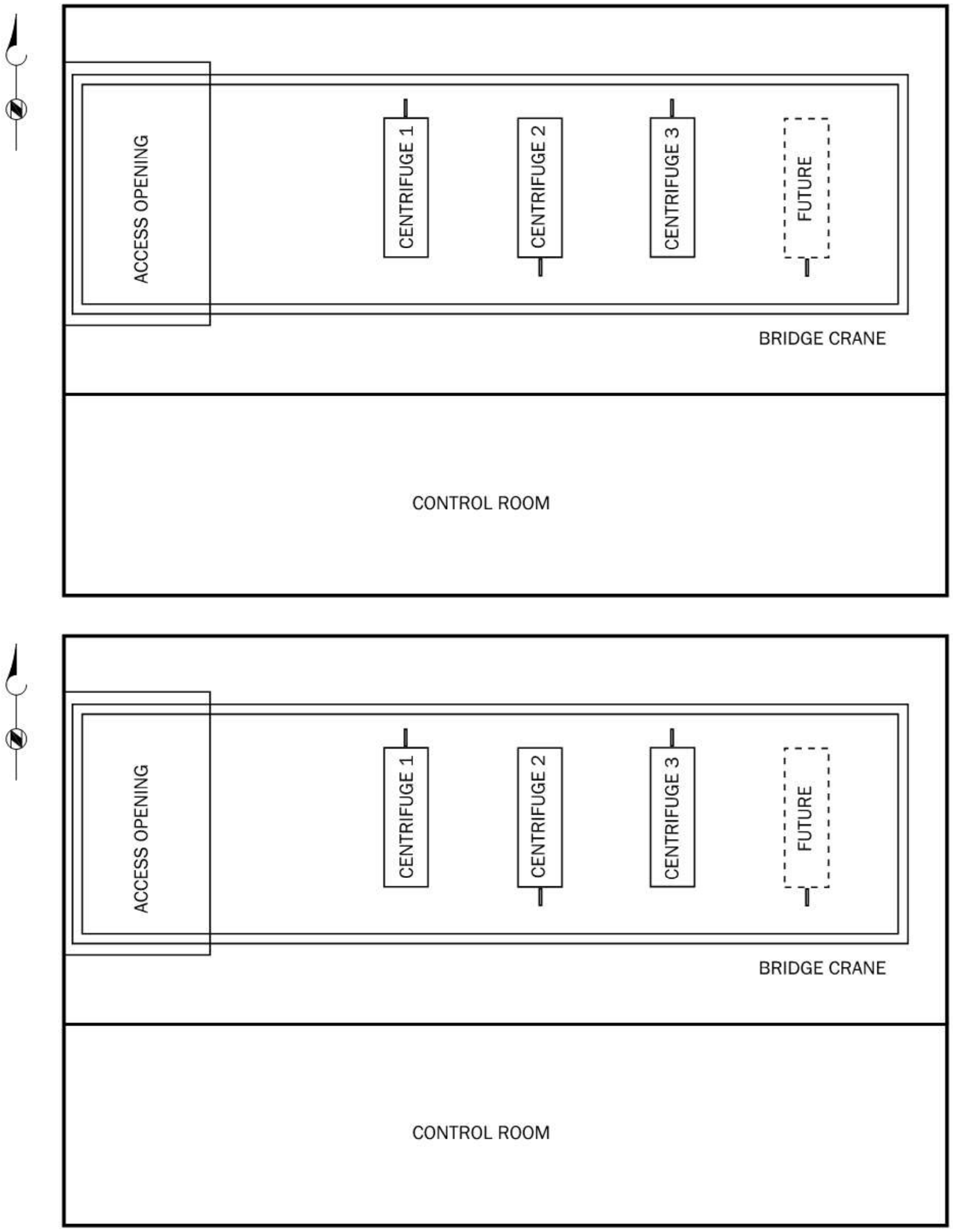

Figure 4-13. Conceptual Third Floor Layout of the Dewatering Area

Dewatered solids produced from the centrifuges will be dropped via chutes into a shaftless screw conveyor system on the second floor. The screw conveyors will transfer solids into wet material bins feeding the dryer system or to a bypass loadout bin in the truck loadout facility during dryer outages. The conveyors will be configured so that each centrifuge has a dedicated receiving incline screw that either feeds a transfer screw routed directly to a wet material bin or reversing collector system configured to transfer cake into any bin or the loadout facility. Slop generated at startup will be rinsed and drained from the incline conveyor and routed with centrate to a drain well in the basement. The second floor will be open to the dryer area with a walkway connection to the nearest dryer platform system. A conceptual sketch of the second floor of the dewatering area is provided as Figure 4-14, along with the outline of the centrifuges from the floor above.

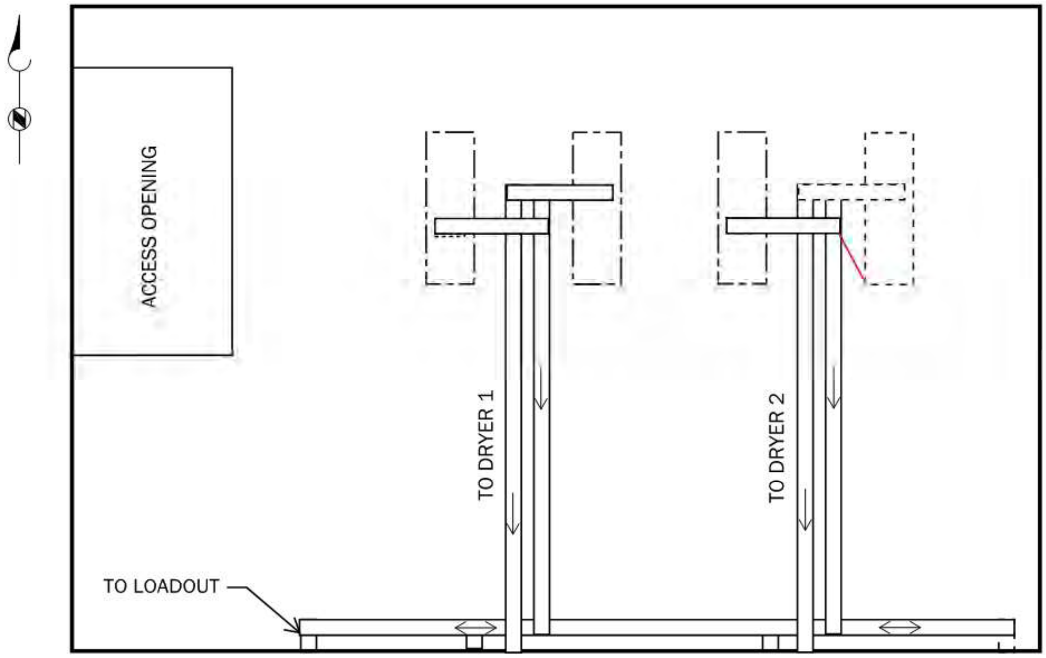

Figure 4-14. Conceptual Second Floor Layout of the Dewatering Area

The dewatering polymer system will be located on the ground floor of the dewatering area of the BDF. In addition, a packaged dissolved air flotation (DAF) unit will be located on the ground floor to process dewatering centrate and dryer system scrubber blowdown. These drain flows will be fed to the DAF if staff wish to recover and concentrate residual solids sent to a drain well in the basement. A large rollup door will be provided near the centrifuge drop-down area and equipment hatches will be provided for pumps and mixers in the basement. A conceptual sketch of the first floor of the dewatering area is provided as Figure 4-15.

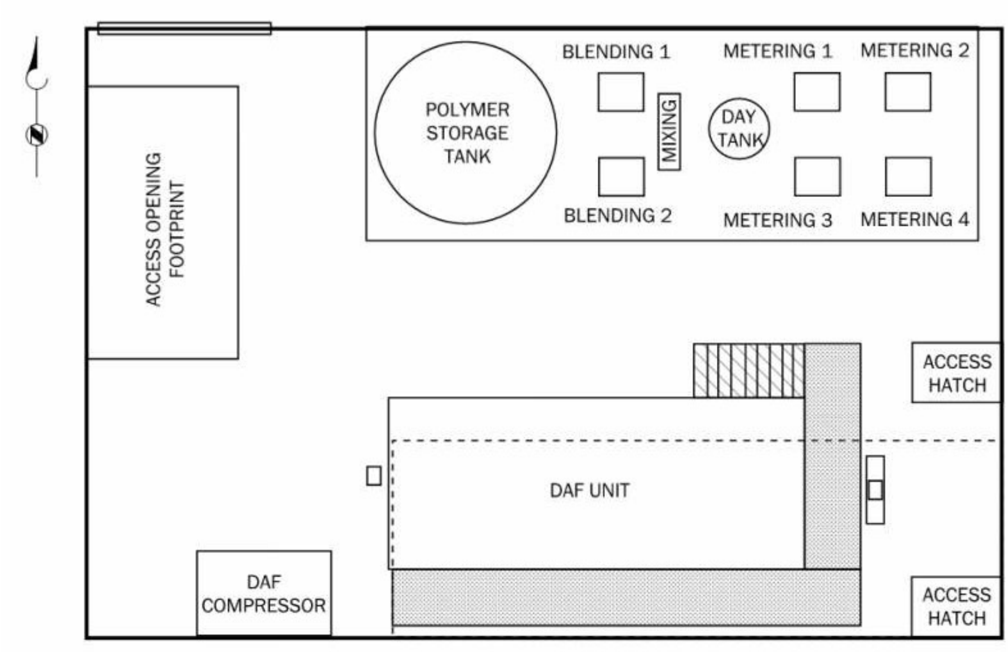

Figure 4-15. Conceptual First Floor Layout of the Dewatering Area

Liquid digested sludge pumped from the DSSTs to the BDF will be received and held in a feed well in the basement of the dewatering area. The feed well will be mixed with a submersible propeller mixer accessible from an access hatch on the first floor. Dedicated centrifuge feed pumps will be located on the basement floor and draw from the feed well to feed their respective centrifuges, with cross connections to provide redundancy. The BDF drain well and pumps will also be located in the basement. A conceptual sketch of the basement of the dewatering area is provided as Figure 4-16.

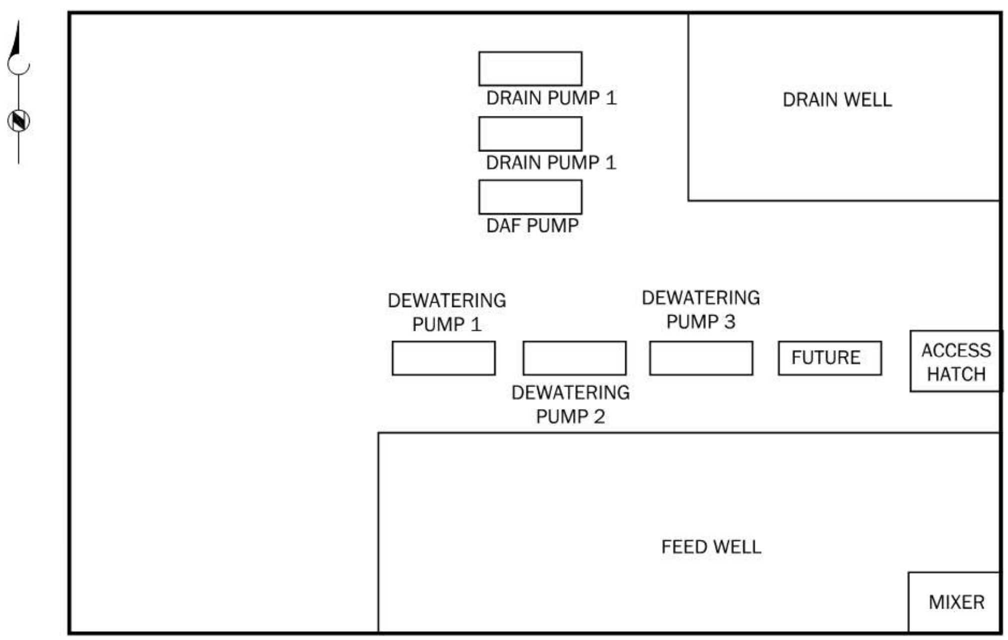

Figure 4-16. Conceptual Basement Layout of the Dewatering Area

Two polymer injection points will be installed on each dewatering feed line, to provide longer contact time and one point directly at the centrifuge inlet. The polymer feed system will be configured so that either injection point can be used, or all three in parallel.

4.5.2.2 Drying

This project provides two new rotary drum dryer systems to produce a Class A biosolids pellet at the DCWRF. As drum dryer systems are typically provided as a packaged design from a single system supplier, selecting the system supplier early in the project is a critical step for advancing the project design. To complete this task, a Request for Information was issued in April 2022 to three dryer vendors having experience in supplying rotary drum systems for biosolids drying in the United States, with responses received and reviewed in June 2022. Andritz was selected as the recommended system supplier due to their extensive operating experience, strong base of supporting staff in the United States, and competitive lifecycle cost projections.

The proposed Andritz rotary drum dryer system consists of the following process elements:

- Two (2) dryer process trains intended for 24/7, duty/standby or parallel operation. Process train equipment includes a wet cake bin with roughly 8 hours of storage, wet cake pumping system, rotary drum dryer, furnace with digester and natural gas blending, product screening, recycle and backmix system, and dried product pneumatic conveyance.
- Two (2) dried product silos, each with the capacity to store roughly one month of product, with a loadout system to load trucks in an enclosed drive through below. Alternative materials of construction to Andritz's standard bolted steel tanks, or installing the silos in a building, will be evaluated during detailed design to protect against moisture intrusion.
- A dust control system to capture and remove nuisance dust from the process compliant with current codes and standards, primarily NFPA 652 and 820. During detailed design, a dust safety subconsultant will conduct NFPA 652 desktop review of the design and evaluate Andritz's proposed ventilation design against best practices and design guidelines such as ACGIH Industrial Ventilation: A Manual of Recommended Practice for Design for items such as dust collection line velocity.
- Regenerative thermal oxidizers (RTO) for emissions and odor control from each dryer system exhaust stack.
- Ancillary support systems including dried and compressed air, nitrogen storage and ambient vaporizer, and product dedusting oil feed system.

A schematic of key unit processes included in the Andritz rotary drum dryer train is provided on Figure 4-17 on the next page.

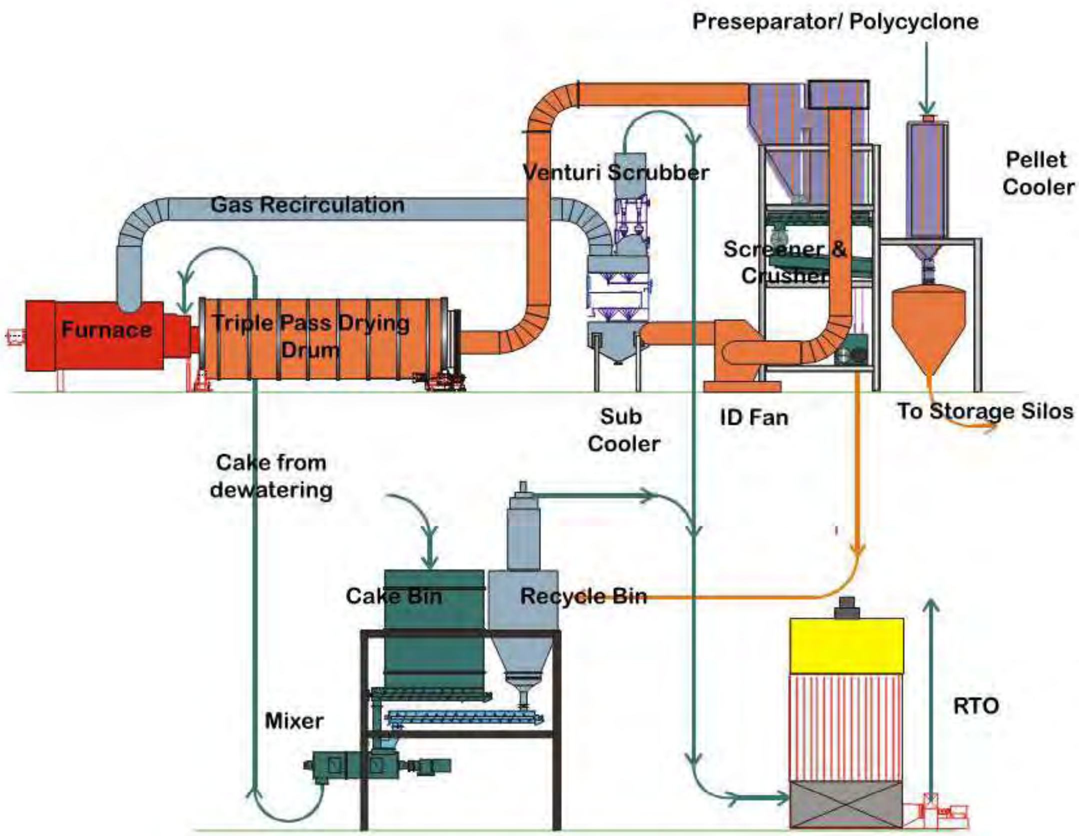

Figure 4-17. Schematic of rotary drum dryer unit processes (Courtesy of Andritz)

Detailed design of the dryer system will be based around general arrangement drawings and equipment data from historical Andritz drum dryer installations at the size proposed for the DCWRF BDF (2,000 kilograms of water per hour, or Andritz Model DDS20). After bidding of this project, the selected Contractor will contract with Andritz to supply final equipment design and shop drawings, along with the equipment itself, to deliver a “complete and operable dryer system.” Specific requirements for the DCWRF dryer system will be identified and communicated in the dryer system specification based on lessons learned from operations at the Central WRF Biosolids Facility and other sister facilities. Examples of unique requirements that may be included in the dryer system specification are as follows:

- Insulate dust control ducts to prevent condensation from forming on the interior of the lines due to any cooling in the line and guard against low-velocity induced settling.
- Provide individual access hatches on each of the RTO assemblies to provide greater working access to RTO internals and freeze protection for RTO valve train.
- Provide cooling for outdoor vendor control panels exposed to the sun.
- Increase pellet oil storage, heat trace lines, and install in secondary containment.
- Locate pellet loading control panel so staff can stand over chutes and control filling while viewing truck scale.
- Expand access walkways and platforms at dryer system to provide adequate working clearance at each unit process.

During detailed design, a three-dimensional model of the dryer system will be developed to facilitate design review with MWS staff and further define unique requirements for the dryer system specification. An example DDS20 model is provided below in Figure 4-18.

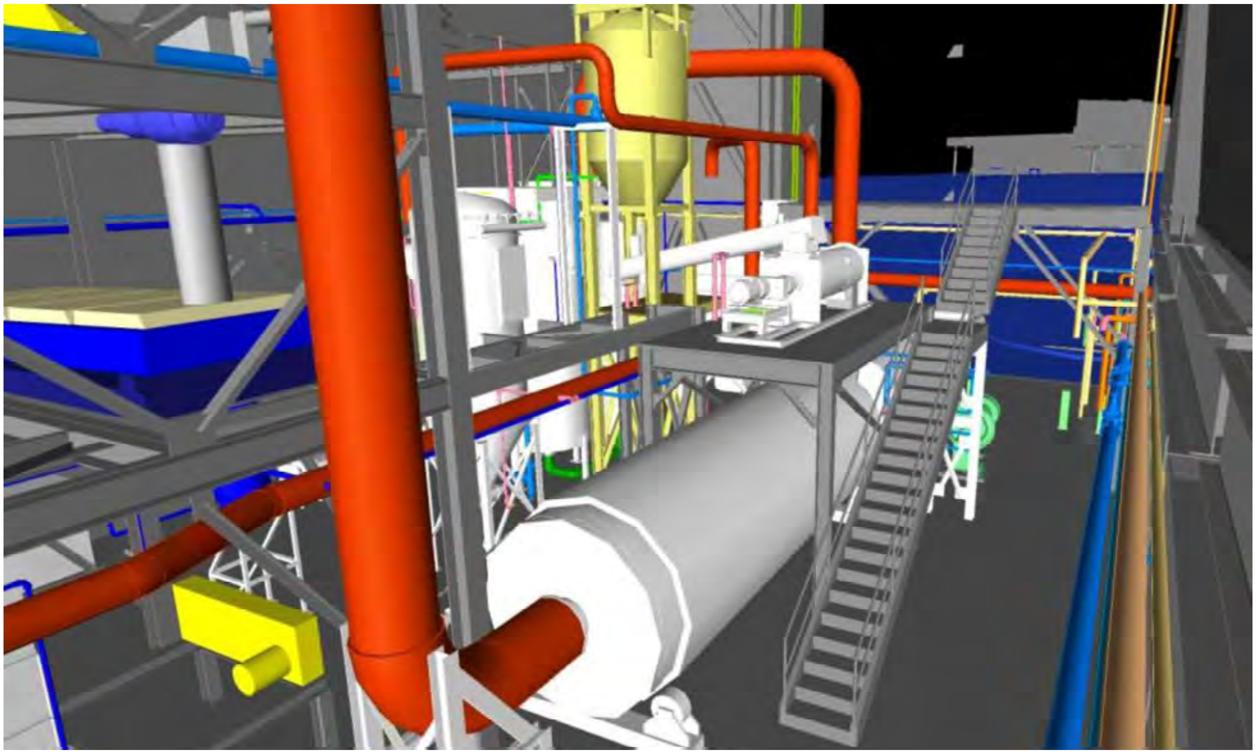

Figure 4-18. Drum dryer model developed for Pierce County, WA thermal dryer facility

4.5.2.3 Biogas Management and Utilization

Biogas (BG) from the digesters typically contains moisture, methane, carbon dioxide, hydrogen sulfide, ammonia, nitrogen, volatile organic carbons (VOCs), siloxanes, and trace amounts of other components. The BG generated at the DCWRF will be treated in a new biogas conditioning system to make it a suitable fuel to be used in the dryer. The BG conditioning system will include unit processes for hydrogen sulfide, moisture and siloxane removal and compression of the BG to the pressure required at the dryer furnace (5 psig). A simplified BG conditioning PFD is shown in Figure 4-19. The BG quality fed to the gas conditioning system (GCS) and dryer inlet fuel quality requirements will determine the level of treatment provided and the technologies to be used in the GCS.

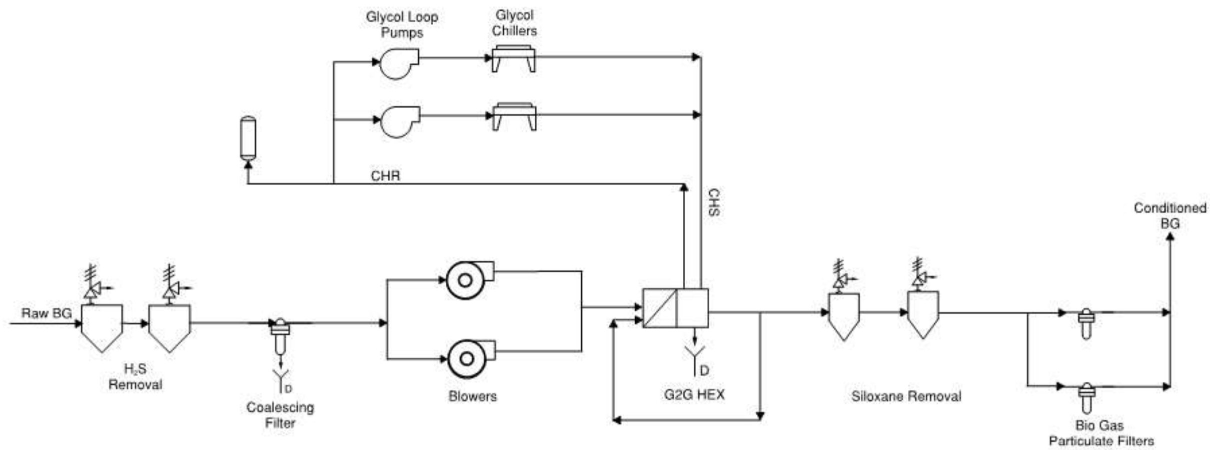

Figure 4-19. Digester Gas Conditioning System PFD

Table 4-9 summarizes the inlet gas conditions assumed for the project. Inlet gas conditions represent the BG quality characteristics established under the DCWRF cogeneration planning project (2016 Dry Creek Wastewater Treatment Plant Cogeneration Project 30% Design Report, Jacobs). Two additional BG quality grab samples will be collected and analyzed during detailed design of this project to provide additional reference points.

Table 4-9. Hydrogen Sulfide Removal Design Conditions and Preliminary Sizes

Parameter	Units	Value
Average Flow at startup (2025)	scfm	100
Minimum Flow assumed	scfm	70
Average Flow at design year (2045)	scfm	135
Maximum Design Flow (Max 7-Day, 2045)	scfm	225
Inlet Gas Pressure	Inches WC	2 to 16
Gas Temperature	°F	40 to 100
Relative Humidity	%	100
Water Dew Point	°F	40 to 95
Hydrogen Sulfide Concentration	ppmv	500
Total Siloxane Concentration	ppmv	0 to 5

4.5.2.4 Polymer System

A new dewatering polymer system will be provided in the first floor of the dewatering area in the BDF. This area will house the storage tank, activation skids, day tanks, and metering skids needed to convey polymer solution to the dewatering centrifuges. Polymer solution will be delivered to the site via chemical delivery truck and transferred to the bulk storage tank provided at the BDF. The storage tank will be equipped with level sensors and alarms to support delivery, prevent overfilling, and track usage. Both storage and day tanks will be equipped with mixers to prevent stratification. The proposed storage tanks and blending units will be located in a containment area to contain minor leaks and major spills from tank failure.

4.5.3 Preliminary Process Control Strategies

4.5.3.1 Dewatering

The general control system for the Dewatering system will be as follows:

- Flow rate and solids concentration on the dewatering feed pump discharge lines will be monitored with inline instrumentation to track solids loading to dewatering. These parameters, paired with regular solids content measurements of the dewatered solids, will be used to track dryer loading and capacity utilized.
- Dewatering feed pump speed will be adjusted by operators given current solids production data at primary and secondary treatment and liquid level in the DSSTs. If the DSST level rises to setpoints that will be established with operator experience, the operators will increase the dewatering feed pump speed. If the DSST level continues to rise, operating staff will plan to bring the second dewatering and dryer train online and adjust pump speed accordingly. The pump speed of the existing pumps at the DSST area used to pump sludge to the BDF will be automatically adjusted via the DCS to match the total flow rate to dewatering. The liquid level in the BDF feed well will be monitored with alarms to identify changes in feed well volume that would indicate issues with pumping equipment instrumentation or controls.
- During centrifuge startup, the incline conveyor will be run in reverse and the centrifuge slop drained to the centrate header. When no flow is detected due to cake forming and bridging in the conveyor, the auger will change rotation and direct cake into the respective bin set by staff from the PLC. During dryer maintenance, the operators may run multiple centrifuges for a shorter duration and route all cake to the cake loadout bin in the truck loadout facility.
- Inline solids concentration analyzers will also be installed on each centrate collection branch from each dewatering centrifuge. The solids content will be monitored, and if found to be excessive, the operating staff will redirect centrate and associated process drains to a wide standpipe in the basement that feed a DAF feed pump. The combined drain flow will be pumped to the DAF and the concentrated solids will dropped into the dewatering feed well and underflow routed to the drain well and pumping system. A fourth polymer metering skid will be provided with this project so that operating staff can choose to select whether to feed the DAF unit with polymer.

4.5.3.2 Drying

The general control system for the Drying system will be as follows:

- As part of the dryer system scope of supply, Andritz will provide a PLC-based control system and operator interface terminal and corresponding software packages for monitoring and operating the dryer process. The PLC-based controls will be tightly integrated into the DCS such that most operations can be performed from the DCS workstations, along with alarms and interlocks. The key parameter for operators to input and monitor during the dryer's operation is the wet/dry mix ratio, which is calibrated based on a visual confirmation that the mixed feed material is moist and crumbly. The controls system requires operators monitor the moisture content of the mix every half hour given potential fluctuations in the dewatered solids moisture content, and to ensure the associated conveyance and mixing systems are in good working order. The Dryer PLC controls will automatically modulate furnace output to match variations in solids loading by monitoring the drum outlet temperature. If the outlet temperature increases or decreases by more than 10°F, it is an indication the system is overloaded and an automatic sequence will reduce the wet feed rate by 5%.
- Both dryer startup and shutdown are automated, sequential processes that purge the equipment and heat or cool the system, respectively. The startup process requires several

equipment and controls readiness checks the operator must perform before initiating the startup sequence. During detailed design, the project team will work with Andritz to request a custom startup checklist control screen to require operators confirm they have completed the checks before startup can be initiated. Andritz has developed detailed operating checklists and normal operating ranges for all unit processes that will be used for operation and planned maintenance of the system and communicated in operator log entry sheets.

4.5.3.3 Biogas Management and Utilization

The general control system for the biogas management system will be as follows:

- BG from the GCS will be used to fuel the new dryer systems in the BDF and existing boilers in the digester complex. The DCS will monitor the available supply of BG to the GCS via pressure indicators on the low-pressure header. Compressor speed will be modulated so as not to draw down the low-pressure header past a minimum level. When the pressure in the discharge header from the GCS drops below a setpoint and the dryer PLC will automatically increase natural gas mixing to maintain the target dryer exhaust temperature. During periods of low BG production or high consumption, the BG feed to the digester complex boilers may be closed via actuated valves from the DCS system and BG routed only to the dryer.
- As the BG supply increases the pressure in the discharge header will rise and the dryer will reduce natural gas mixing. If supply outweighs demand, the GCS compressor will lower its speed to limit the discharge header pressure to its maximum setpoint. Pressure will build up in the low-pressure supply header and activate the backpressure control valve to flare the excess BG.

4.5.3.4 Polymer System

The general control system for the polymer system will be as follows:

- Polymer feed for thickening and dewatering will be automatically flow paced based on sludge flow. Polymer dose and dilution rate will be adjusted by the operator. Blending unit dilution water and pump speeds will be automatically controlled via PLC on the blend unit skid to provide polymer solution at the selected concentration and dose based for each application point.
- Tank level will be monitored by level sensors. Operators will be notified of low level and overflow conditions by alarms set for each condition.

4.6 Maintenance of Plant Operations (MOPO) and Construction Sequencing

The intent of the MOPO plan for the biosolids processing improvements is to mitigate interruptions to the existing solids processing areas and maintain a means for biosolids dewatering and disposal throughout construction and startup. MOPO in the following major work areas must be addressed as discussed:

4.6.1 Existing Filter Building

4.6.1.1 Existing GBT Area (Thickening)

The primary and secondary sludge and scum streams must be mixed, thickened, and pumped to the anaerobic digesters throughout construction. During demolition of the GBTs and installation of the RDTs, responsibility will be placed on the Contractor to rent and operate portable sludge thickening units in outdoor enclosures near the Existing Filter Building. The Contractor will route the thickening feed lines to the outdoor units, operate the existing thickening feed pumps, and install skid mounted centrate and thickened sludge pumps to transfer flows to the plant drain and anaerobic digester feed systems, respectively. The contractor will operate the existing polymer feed system in the

Existing Filter Building to supply polymer to the temporary thickening units. The contract documents will also allow for the Contractor to propose an alternative approach that phases demolition of the GBTs and installation of the new RDTs with responsibility for the thickening operation maintained by the Contractor during construction.

4.6.1.2 Existing BFP Area (Dewatering)

The existing BFP system will be used throughout construction to dewater and load out biosolids from the DCWRF. After the BDF and associated transfer pipelines are fully constructed the digested sludge flow can be routed to the new BDF for commissioning. After the BDF is fully commissioned, the existing BFP equipment will be demolished.

4.6.1.3 Existing Polymer Area

After the BFP equipment has been demolished, the Contractor will temporarily install and operate the polymer activation skids in the old BFP area to feed polymer from neat totes to the thickening system. The existing polymer equipment and tanks will then be demolished and new tanks and piping installed. Once the system has been fully installed minus the activation skids, the activation skids will be relocated to the new system in a phased sequence with one polymer feed system being installed at a time and assigned to the RDT unit in standby, until the entire polymer system has been installed. Provisions for removing and replacing the existing storage tanks will be further evaluated throughout detailed design.

4.6.1.4 DSST Mixing

During construction, only one of the DSSTs may be taken out of service at a time. During the time when modifications are being made, the solids production rate must be evaluated to ensure that a single DSST is not overloaded. Construction of the maintenance access platforms around both tanks may take place prior to any work related to installation of the new mixing system. Each tank must be drained and cleaned prior to installation of the new mixers. The intent is to use some of the existing hatches for the mixer and hoist placement to avoid extensive cover modifications. The HPE connection will be made to the existing Rotamix® nozzle system with manual isolation valves for each DSST when out of service.

4.6.2 Existing Digester Complex

The new WGB can be fully constructed next to the existing while it remains in service. The Contractor will ensure the existing pressure release valves on the digesters are in good working order and minimize the length of time to every extent possible when making piping tie-ins from the new WGB to the existing BG yard piping and NG pilot supply. Manual isolation valves will be installed at the inlet to the existing WGB valve train during the tie-in. Once the new WGB is fully commissioned the isolation valve can be closed on the existing WGB supply line and improvements made to the existing WGB as necessary. The BG piping in the digester complex will remain as is and once the new backpressure valve is installed on the WGB the existing backpressure valve in the digester complex basement will be permanently bypassed.

4.6.3 Biosolids Drying Facility

The new BDF and associated facilities will be constructed as the existing dewatering and loadout facility remains in operation. Once the BDF is constructed and ready to be online, the tie-in to the existing pumps in the DSST area will be performed when the BFPs are down. Once the connection is made the BDF will be brought online and used to process all the digested sludge. Once the BDF and all associated facilities are fully online, the demolition of the BFP equipment and related construction activities can commence.

Section 5

Odor Control Improvements

5.1 Introduction

Successful odor control first requires that the odorous foul air from the various odor sources be collected in a way that avoids fugitive odor emissions. This requires that air be exhausted from the controlled spaces so that negative pressure is maintained within the controlled space. By creating negative pressure, for example in covered tanks or channels, small leaks in the covers will draw fresh air under the covers rather than releasing odorous air to the environment, as shown in Figure 5-1.

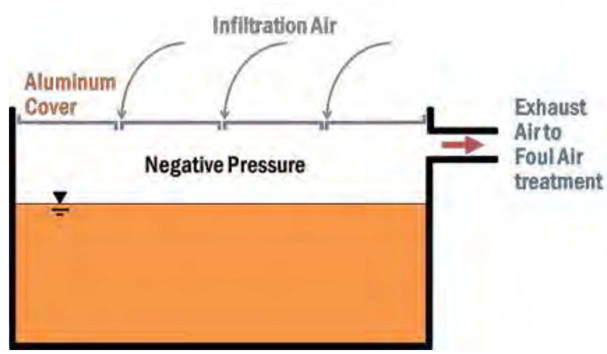

Figure 5-1. Foul Air Collection

Creation of negative pressure in the controlled spaces requires achieving a ventilation rate that will maintain negative pressure. In addition, the ventilation rate must consider the minimum air changes per hour required to prevent condensation and associated corrosion of concrete under the covers, as well as the air changes per hour (ach) requirement for the space classification under NFPA 820, as shown in Figure 5-2.

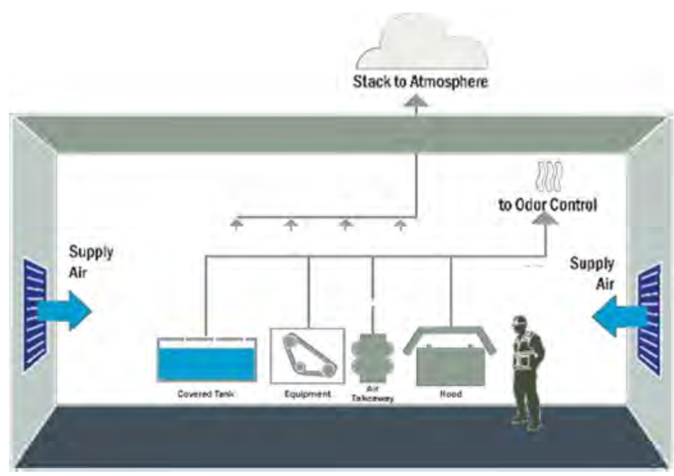

Figure 5-2. Creation of Negative Pressure in Odor System

It is important to note that NFPA 820 is a fire and explosion prevention standard and does not address adequacy of airflow to maintain safe atmospheres and low H_2S concentrations. NFPA 820 also does not prescribe practices for heating, ventilation, and air conditioning (HVAC) or well-designed ductwork that promotes good air turnover within a building or space.

Determination of the design ventilation rate requires calculation of ventilation rate based on cover leakage plus aeration as well as calculation of ventilation rate based on the required air changes per hour as described above. These two ventilation rates are compared and the higher rate controls.

5.2 Preliminary Design Criteria and Major Equipment

5.2.1 Design Criteria

5.2.1.1 Ventilation Rates

Design criteria for ventilation rate calculations are summarized below.

- Cover leakage for aluminum covers
  - 0.5 cfm/sf for most spaces
  - 1 cfm/sf for areas that are less tightly sealed, such as areas under existing older covers
- Aeration – maximum aeration rate
- Air changes per hour (ach) as a minimum to meet NFPA 820
  - 6 ach for most spaces under covers, including areas with low to moderate hydrogen sulfide (H_2S), areas classified as NFPA 820 Class 1 Division 1, and unoccupied spaces
  - 8 ach for spaces under covers that are located within buildings
  - 12 ach for areas classified as NFPA 820 Class 1 Division 2, such as building interior spaces
  - Higher air changes for spaces with high H_2S that require dilution either for life safety issues or to reduce H_2S concentrations for more efficient treatment
  - Rooms that are odor-controlled spaces, such as the Headworks Solids Processing Room – exhaust rate 10% higher than supply air flow to maintain negative pressure in the room and prevent fugitive odor emissions
  - Room exhaust for rooms that are not odor-controlled spaces but contain spaces under covers that are odor controlled, such as the Screening Building – supply 10% higher than room ventilation rate plus ventilation rate for areas under covers to maintain positive pressure in the room
- Openings
  - 1000 fpm face velocity for door openings to outside, such as rollup doors, when the expectation is that the door will remain open, to overcome wind effects
  - 100 fpm face velocity for cover openings, such as openings at screen chutes to maintain negative pressure under the covers
  - 3,000 fpm stack velocity to provide air dispersion

5.2.1.2 Duct

Duct design considers velocity and pressure drop. High velocities can cause excessive noise in the duct. High pressure loss in ducts wastes energy because higher fan pressures are required to overcome the pressure loss. Duct design criteria are as follows:

- Maximum velocity = 2,500 fpm

- Maximum pressure drop = 0.2 inches of water column (in wc) per 100 feet of duct

Ductwork will be designed with balancing dampers at each drop connection. Balancing dampers will also be provided on major new manifolds for ease in balancing the system. Isolation dampers will be provided where required to allow isolation of equipment.

5.2.2 Major Equipment

5.2.2.1 Covers

New covers will be aluminum designed for odor control. Covers will be designed for live and dead loads required for maintenance and equipment laydown, where applicable.

5.2.2.2 Ductwork

Ductwork located above ground will be fiberglass reinforced plastic (FRP) similar to the existing ductwork or fluoropolymer-lined thin-walled stainless-steel. Stainless steel is much less susceptible to environmental degradation than FRP and does not require regular painting, and the total installed cost of FRP and lined stainless-steel is generally comparable. Final duct material selection will be made during 30% design.

Buried ductwork, if required, will be HDPE or Fiberglass Reinforced Polymer Motor Pipe (FRPMP).

5.2.2.3 Duct Supports

Duct supports will be 316 stainless steel similar to the existing supports in corrosive areas. For areas where corrosive conditions are not expected, supports may be 304 stainless steel or galvanized steel.

5.2.2.4 Odor Treatment System

The existing biofilters will be used to treat both existing and new foul air sources. The biofilter control panel will be replaced with a panel that has more flexibility for operational control. In addition, minor improvements will be made to the biofilter system to address items included in the biofilter manufacturer's inspection report dated October 30, 2017.

While it is anticipated that the existing odor control fans will be adequate for the modified system, the suitability of the existing fans to provide adequate pressure will be evaluated during 30% design. The existing fan that is dedicated to the gravity belt filters will be adjusted or replaced to accommodate the foul air flow from one biosolids dryer system.

The dryer system will be provided with a RTOs for treatment of certain odors, including foul air from the dryers, poly-cyclones, and ancillary equipment. The RTOs will be furnished by the dryer manufacturer, and discussion of the foul air treated by the RTOs will not be included in the remainder of this Section of the PER. Please see Section 3.4.3 for further information regarding the RTO.

5.3 Design Component Descriptions

5.3.1 Existing Odor Control System

A 76,560-cfm capacity Biorem biofilter with synthetic media provides treatment of the existing foul air stream. The system was installed as part of the 2005 improvements project, and was designed with four bays, each with an empty bed residence time (EBRT) of 45 seconds during normal operation. This allows one bed to be taken out of service for maintenance or media replacement while maintaining the minimum recommended EBRT of 30 seconds. Figure 5-3 summarizes the existing odor control system.

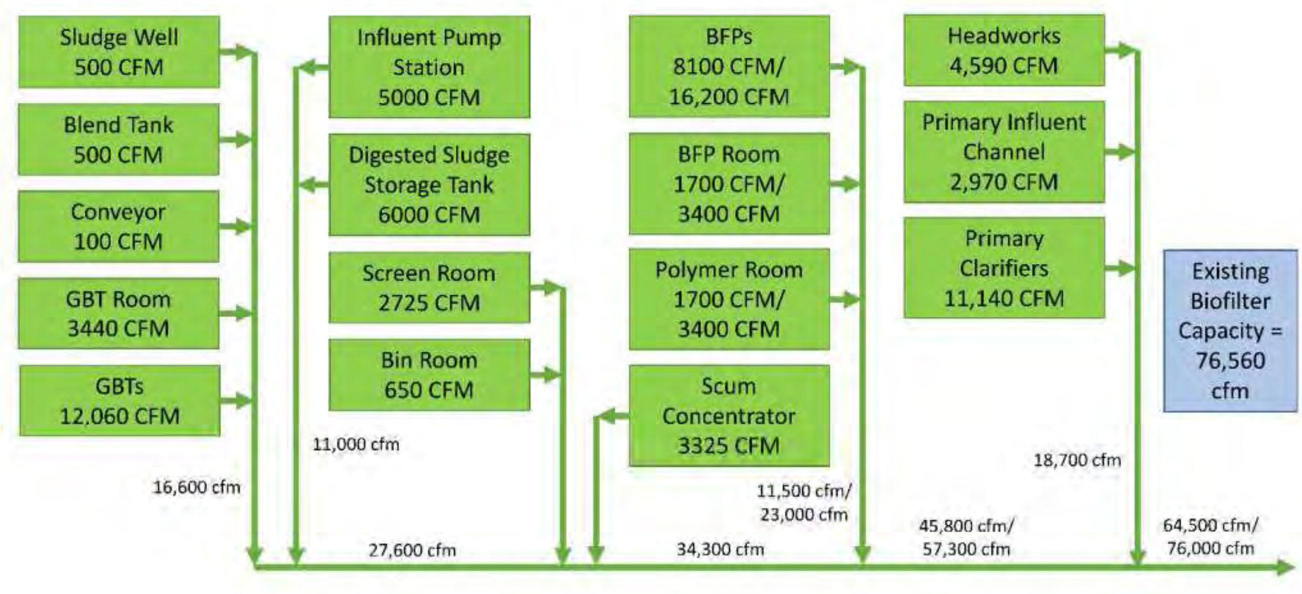

Figure 5-3. Overview of Existing Odor Control System

5.3.2 New Odor Sources

All of the existing areas that are currently odor controlled and will remain in service will continue to be provided with the same ventilation rate, and the foul air will continue to be treated by the existing biofilters. New odor sources will also be treated by the existing biofilters with the exception of a few sources of foul air related to the dryers, which will be treated by RTOs. Biofilters are currently used to treat foul air at Central WWTP and are also used at the Central Biosolids Facility, which is similar in design to the proposed facility at DCWWTP. The Odor Control Master Plan prepared as part of the COPT project confirmed that the existing biofilters were operating within design parameters and reducing H_2S to acceptable levels; therefore, the existing biofilters were determined to be an appropriate odor control technology.

The following new odor sources will be provided with odor control:

- Headworks:
  - Screening channels, screens, and screenings washer/compactors
  - Grit system channels, Headcells, and grit washer/compactors
  - Dumpster Room
- Solids Handling:
  - Sludge Blending Tank
  - Rotary drum thickeners
  - Thickened sludge well
  - Centrifuges (through screw conveyors)
  - Screw conveyors
  - Wet Cake Bin
  - Cake Mixers
  - Pellet Cooler
  - Pneumatic Conveyor
  - Recycle Bin
  - Fugitive Dust System
  - Centrate Dissolved Air Flotation Thickener
  - Truck Loading Bay

In addition, the foul air exhaust rate from the DSSTs will be increased to account for the lower liquid level required by this project. This will necessitate replacing the existing makeup air ventilators located on the roof of each DSST and will require upsizing of the existing duct. Figure 5-4 shows an overview of the proposed modifications to the odor control system, including existing sources that will be eliminated and proposed sources that will be treated.

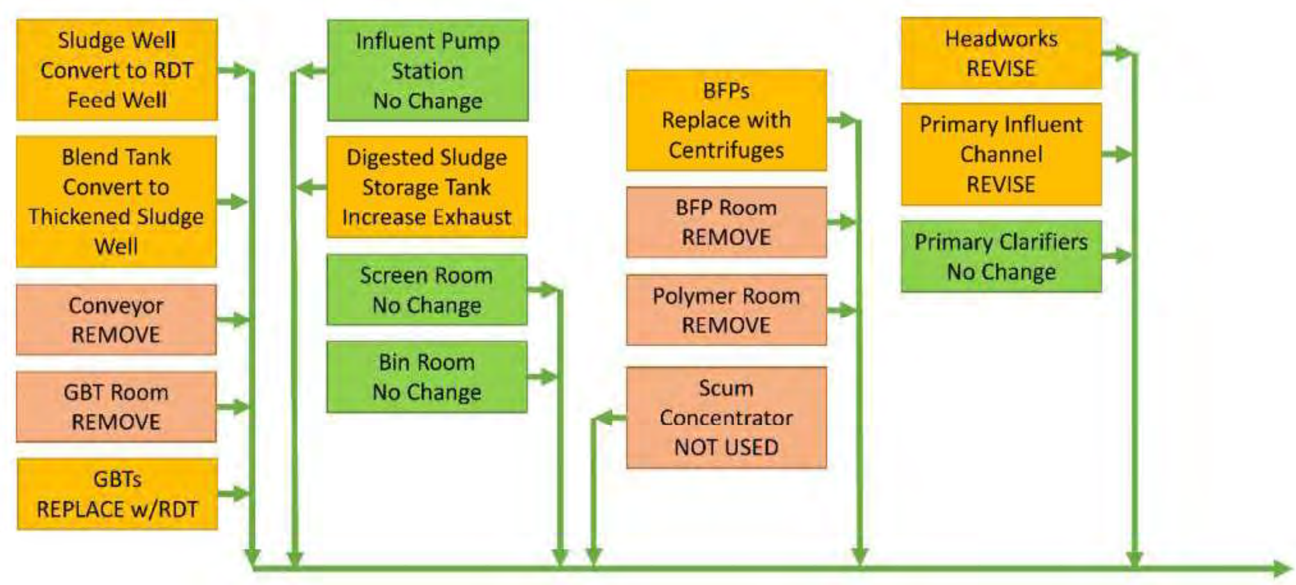

Figure 5-4. Overview of Modifications to Existing Odor Control System

Major new duct runs are shown in Figure 5-5. New duct from the BDF will be routed over the top of the existing Digester Headhouse and Maintenance Building.

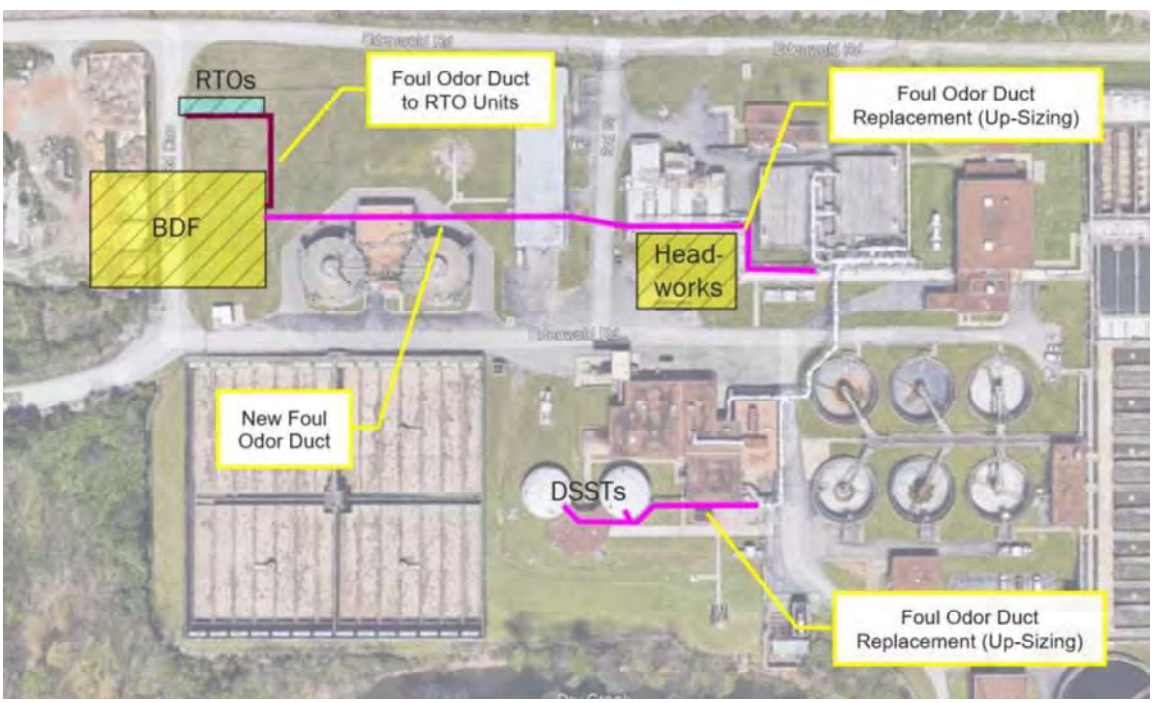

Figure 5-5. Proposed New Foul Air Duct

5.3.3 Foul Air Exhaust Rate Projections

Foul-airflow rates were established for the new sources listed above. Foul air flow rates for existing sources were taken from the 2005 odor control upgrades. Table 5-1 shows a summary of the foul air exhaust rates from the various odor sources and the NFPA 820 classifications for buildings and rooms. Note that the foul air exhaust rates for the dryer system will be furnished by the manufacturer. For the purposes of the preliminary evaluation, foul air exhaust rates from the Central Biosolids Facility were used to estimate the foul air exhaust in these calculations.

Table 5-1. Preliminary Foul Air Exhaust Rates

Area	Minimum Air Changes per Hour	Proposed Exhaust Rate cfm	Future Exhaust Rate cfm	Notes
Influent Pump Station		5,000		Existing – no change
Influent Flume Area		1,310		Existing – no change
Headworks				
Screening Channels	6	4,365		
Headcells and Channels	6	1,235		
Grit Classifiers		75		
Solids Processing Room	12	11,500		
Primary Clarifiers		13,780		Existing – no change
Solids Thickening				
Sludge Blending Tank		500		Existing – no change
Rotary Drum Thickeners	6	300	100	replace existing GBTs with RDTs, future 4th RDT
Thickened Sludge Well	6	500		Existing – no change
Sludge Screening Room		2,725		Existing – no change
Bin Room		650		Existing – no change
DSSTs	6	10,000		increased ventilation rate to account for proposed lower minimum liquid level
Biosolids Drying Facility				
Dewatering Room - centrifuges and conveyors	6	2,100	400	future 4th centrifuge
Dryer Room bins, conveyors, and tanks	6	5,500	2,700	future 3rd dryer
Loadout Facility		12,000		
TOTAL		71,540	3,200	total future exhaust rate = 74,740 cfm

5.3.4 Proposed Odor Treatment System

The total foul air flow from the facility, including a future additional dryer train, is less than the 76,560-cfm capacity of the existing biofilter system. All of the foul air will therefore be treated using the existing system. An evaluation of the suitability of the existing fans to provide adequate pressure will be conducted during 30% design.

5.4 Preliminary Process Control Strategies

Most areas requiring odor control, including spare equipment, will be continuously ventilated to simplify operation. The biosolids dryers are designed for one dryer train to operate continuously and the second dryer train to operate intermittently in parallel with the primary train. The foul air exhaust for the second dryer will operate only when the second dryer is in operation. This will be accomplished by adjusting or replacing the existing odor control fan that currently operates when the gravity belt thickeners are in service to accommodate foul air flow from the second dryer train. The fan controls and automatic dampers will interlock with the dryer controls to automatically open and close the appropriate dampers and start the odor control fan.

While the odor control system is adequately sized to treat foul air from planned future expansion of the solids handling system, the fans will be set to provide the correct exhaust rate for the equipment actually installed. Table 5-2 provides a summary of the control concept for the odor control system.

Table 5-2. Odor System Process Control Concept

Area	Primary Equipment Continuous Exhaust cfm	Spare Equipment Continuous Exhaust cfm	Primary Equipment Intermittent Exhaust cfm	Future Equipment No Exhaust cfm	Notes
Influent Pump Station	5,000	-	-	-	
Influent Flume Area	1,310	-	-	-	
Headworks					
Screening Channels	4,365	-			
Headcells and Channels	1,235	-			
Grit Classifiers	75	-			
Solids Processing Room	11,500	-			
Primary Clarifiers	13,780	-	-	-	
Solids Thickening					
Sludge Blending Tank	500	-		-	
Rotary Drum Thickeners	200	100		100	Two duty, one spare, one future
Thickened Sludge Well	500				
Sludge Screening Room	2,725				
Bin Room	650				
DSSTs	10,000	-	-	-	

Table 5-2. Odor System Process Control Concept

Area	Primary Equipment Continuous Exhaust cfm	Spare Equipment Continuous Exhaust cfm	Primary Equipment Intermittent Exhaust cfm	Future Equipment No Exhaust cfm	Notes
Biosolids Drying Facility					
Dewatering Room – centrifuges, conveyors, and DAFT	1,700	400	-	400	Two duty, one spare, one future
Dryer Room bins, conveyors, and tanks	2,800	-	2,700	2,700	One continuous duty, one intermittent duty, one future
Loadout Facility	12,000			-	
TOTAL	68,340	500	2,700	3,200	74,740

5.5 Maintenance of Plant Operations (MOPO) and Construction Sequencing

The existing odor control system must remain in service during construction. Much of the new work will allow the ductwork to be installed prior to connection to the existing duct system. It is likely that some of the existing duct will need to be replaced due to increased air flows. Temporary ducting may be required, particularly for the duct between the new headworks and the existing fans.

Replacement of the control panel for the existing biofilters may require a short period of reduced odor control capacity. Timing of the transition to the new control panel will minimize impacts to the surrounding area.

Section 6

Plant Utilities Improvements

6.1 Introduction

In support of the major plant process improvements described in the previous sections, improvements to several plant utility systems will also be required. These include the plant water system (consisting of the HPE system and spray water (SW) system) and plant drain system as described below.

- The HPE System delivers treated final plant effluent through strainers and then to a looped distribution network around the plant to serve numerous processes and maintenance functions.
- The SW system delivers treated final plant effluent through a low-pressure distribution network serving spray nozzles, primarily located at the Primary Settling Tanks and Aeration Tanks.
- The Plant Drain System (also referred to as the tank drainage system) consists of the drains for all process treatment units, both pumped and gravity lines.

The HPE system must be modified to accommodate the higher flow and pressure demands of the headworks improvements and biosolids handling improvements. Ancillary systems – specifically the associated strainers, flow measurement, and disinfection – will also be upgraded to improve operations & maintenance.

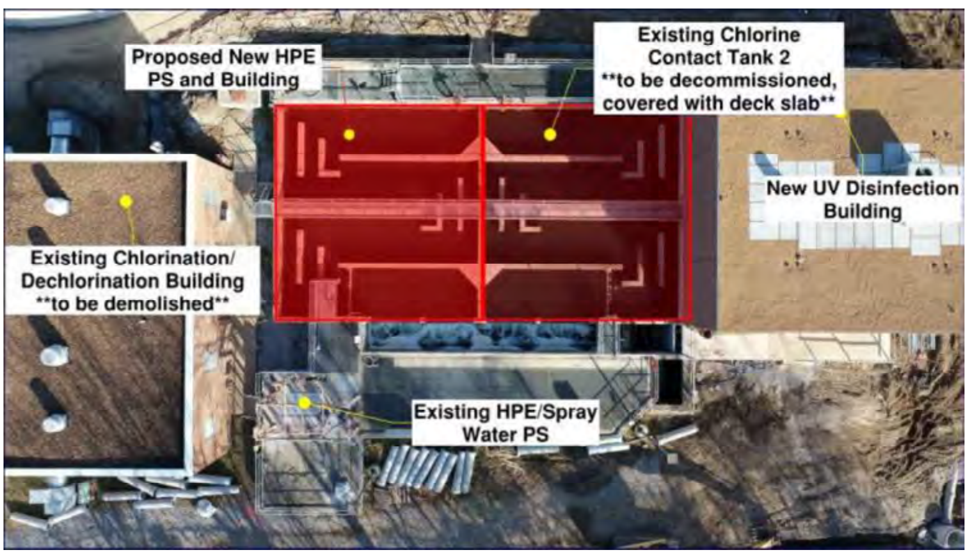

Figure 6-1. Aerial view of Disinfection and Plant Water Systems

6.2 Preliminary Design Criteria and Major Equipment

Table 6-1 summarizes the preliminary process design criteria and equipment associated with the HPE system and plant drain system modifications.

Table 6-1. Plant Water Improvements Preliminary Design Criteria		
Area	Units	Value
OVERALL DESIGN CRITERIA		
Minimum System Pressure	PSI	90
Current Design System Capacity	GPM	1,500
Future Design System Capacity	GPM	4,000
HPE PUMPING SYSTEM		
Number of Units (Duty + Standby)	Initial	3 (2 + 1)
	Future	4 (3 + 1)
Pump Type		Vertical Turbine
Rated Capacity, Each	GPM	1500
Pump TDH	FT	375
Motor / Drive Size	HP	150
Drive Type		Variable Speed
STRAINERS		
Number of Units (Duty + Standby)		2 (1 + 1)
Strainer Type		Basket-type, automatic backwashing
Perforation Size	inch	1/16
Rated Capacity (ea)	GPM	4000
Flange size	IN	16
Differential Pressure at Design Flow	PSID	0.6
DISINFECTION – serving both HPE and Spray Water		
Chemical		Sodium Hypochlorite
Number of Tanks		2
Storage Tank Capacity	GAL	550
Dosing Level	MG/L	0.5 to 3.0
Number of Pump Units (Duty + Standby)		4 (2 + 2)
Pump Type		Diaphragm (HPE), Peristaltic (Spray Water)
Rated Capacity, Each		1.4 gallons per hour (gph)
Pump TDH		To be determined
Motor / Drive Size	HP	<1
BIOSOLIDS DRYING FACILITY SUMP PUMPS		
Number of Units (Duty + Standby)		2 (1 + 1)
Pump Type		Dry Pit Centrifugal or Submersible
Rated Capacity	GPM	2100
Pump TDH	FT	55
Motor / Drive Size	HP	75

6.3 HPE Design Demand and Pressure Considerations

The design demand and pressure conditions used to size the new HPE system are based on the following considerations.

6.3.1 HPE System Demand

Existing HPE demands associated with the grit tanks, GBTs, and BFPs are being eliminated as part of this project, while new flow demands associated with the Headworks Facility and Biosolids Drying Facility are being added. Table 6-2 provides a summary of the projected demands on the HPE system.

Table 6-2. HPE System Flow Demand

WRF Area	Demand Sources	Approximate Average Demand	Approximate Maximum Demand
New Headworks Facility	Screens, compactors, grit pumps and washing, sluice channels, flushing connections	208 gpm	906 gpm
EQ	Flushing	0 gpm	320 gpm
Filter Building	Rotary drum thickeners	180 gpm	240 gpm
New Biosolids Drying Facility	Centrifuges, dryer system, dust control	900 gpm	2100 gpm
Biofilters	Irrigation, humidifiers	350 gpm	480 gpm
Digester Sludge Storage Tanks	DSST mixing	0 gpm	50 gpm
Hydrants and hose bibs	Throughout facility	0 gpm	500 gpm
TOTAL		Approximately 1600 gpm	Approximately 3800 gpm (not including EQ and hydrants)

6.3.2 HPE System Pressure

HPE services throughout the facility have various pressure demands ranging from a minimum of 20 psig to a maximum of 116 psig, with most pressure requirements falling between 50 psig and 75 psig. These pressure demands have no direct correlation to the corresponding flow demand to each specific HPE service.

After discussions with MWS, it was determined that a minimum pressure of 90 psig would be provided throughout the HPE distribution system. Pressure reducing valves will be provided at locations where 90 psig is greater than the discharge location's desired pressure, as determined during detailed design.

The service that requires a HPE pressure of 116 psig is a low-flow, intermittent service associated with the new rotary drum thickeners to be located in the Filter Building. Dedicated booster pumps will be provided for this application, as discussed in Section 3.3 of this PER.

6.4 HPE System Design Component Descriptions

The following subsections provide additional details on the components of the HPE system to be modified as part of this project. Figure 6-2 provides an overall PFD of the modifications to the HPE system.

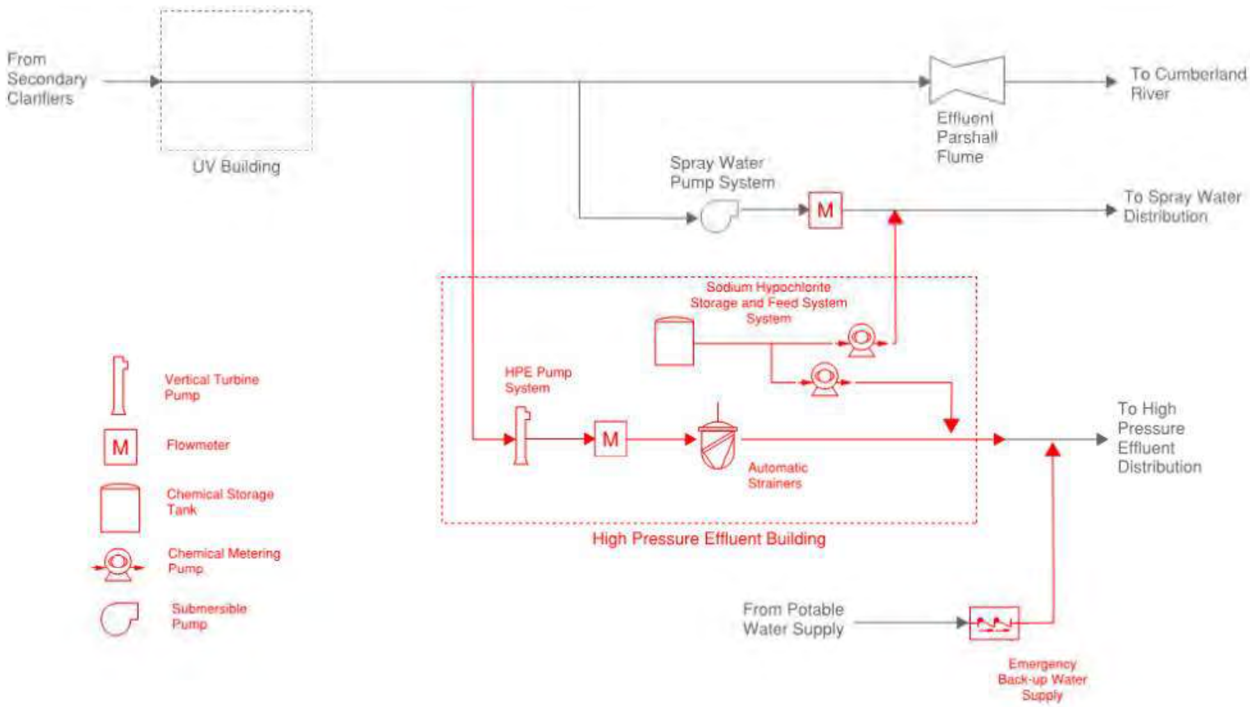

Figure 6-2. Overall Plant Effluent and Plant Water Systems Schematic

6.4.1 Existing HPE System and Demolition

Due to higher HPE demand throughout the facility as a result of the improvements discussed in earlier sections of this PER, the existing HPE vertical turbine pumps do not have the capacity to satisfy this demand. The two existing HPE pumps will be demolished at the conclusion of this project, along with the existing valves and ancillaries at the existing HPE pump station.

Additionally, the existing HPE strainers (one automatic, one manual) will not meet the new demand capacity of the system. These strainers, located in the site tunnels near the return sludge pump station, will be demolished.

6.4.2 New HPE Building

As previously mentioned, MWS intends to demolish the existing Chlorination Building (down to the operating floor slab), which will be decommissioned once the UV system is fully operational. Additionally, the existing Chlorine Contact Tanks (CCTs) will be decommissioned and repurposed. With these decisions in mind, a new HPE Building will be constructed over the existing CCT No. 1 and will house the new HPE pump station and the ancillary systems discussed in the following section. Refer to Figure 6-3 below for a conceptual sketch of the new HPE Building contents. The green hatched box indicates demolition, the blue hatched box indicates the new HPE Building footprint, and the red hatched box indicates where a concrete deck will be placed over existing CCT No. 2.

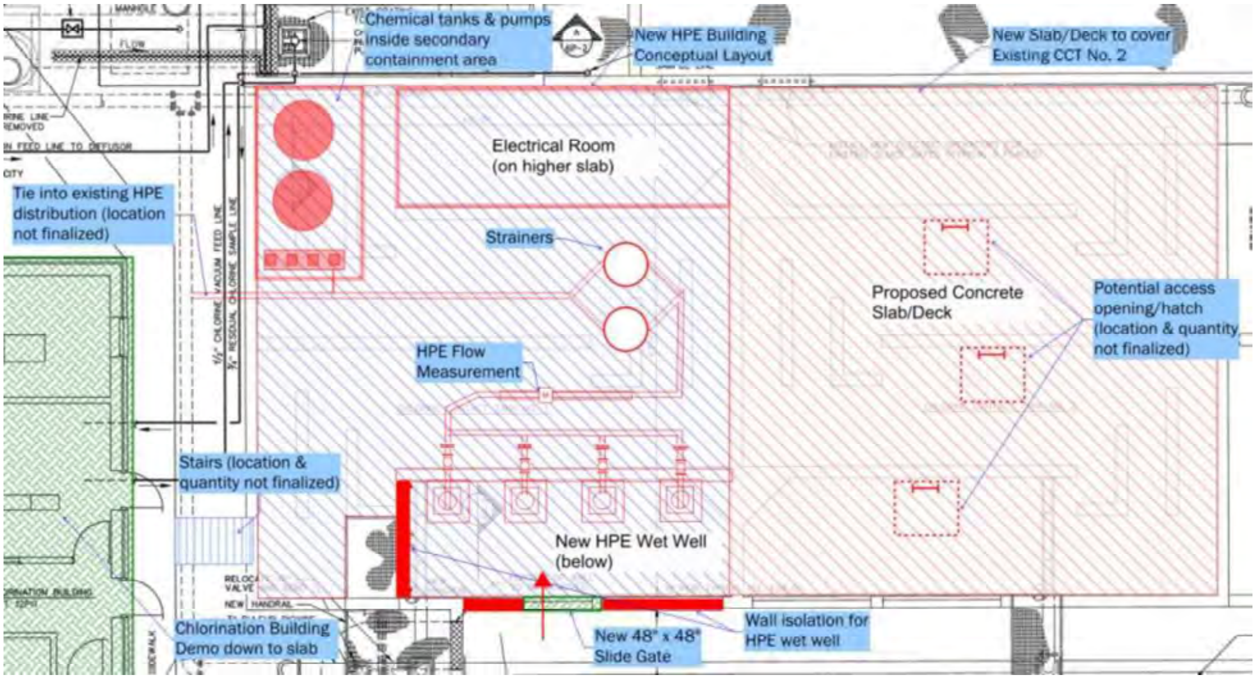

Figure 6-3. Preliminary Layout for HPE Building and Surrounding Area

6.4.2.1 HPE Pumping Systems

As shown in Figure 6-3, the new HPE pump station will be located over the existing CCT No. 1. A chamber of CCT No. 1 in close proximity to the existing final effluent channel will be walled off completely to create the HPE wet well and a new intake gate will be installed to direct effluent to this wet well from the final effluent channel, downstream of UV disinfection.

In this new wet well, four new vertical turbine pumps will be installed. The four pump discharges will manifold together to direct flow to the new strainers. This discharge piping will be located above the new floor deck of the HPE Building in order to provide easy maintenance access to check valves and isolation valves on each pump discharge, as well as a new 12" magnetic flow meter installed on the manifold line. Accurate flow measurement is critical for not only pump performance but also accurate chemical dosing. A bypass line will be provided for this new flow meter. Refer to Appendix B for a preliminary process and instrumentation diagram of the new HPE pumps and flow meter.

As discussed further in section 14 of this report, electrical components installed as part of this project will be installed above the flood protection elevation of 439.0' wherever possible and practical. One exception to this elevation will be the motors of the new HPE pumps, which will be installed as high as feasible. The HPE Building will include a dedicated electrical room with a floor slab elevation of 439.0'.

After passing through the strainers and chemical injection points, as discussed in the sections below, the combined HPE discharge pipe will reconnect with the existing HPE distribution system in the yard. The specific tie-in point or points will be determined during detailed design and will be configured to minimize interruption of the HPE system during construction.

6.4.2.2 HPE Strainer System

Two new automatic strainers will be provided on the ground floor of the new HPE Building to replace the existing strainers. The main features of the new strainer system are summarized below. For a preliminary P&ID of the HPE strainer system, refer to drawing I-35-102.

- Each strainer will be sized for the ultimate future HPE demand to provide full redundancy for the system.
- The straining technology to be used with be similar to the existing equipment at both DCWRF and Central WRF Biosolids Effluent Pump Station, which has performed reliably for years. The strainer opening size will match the current size used at the Central WRF Biosolids Effluent Pump Station.
- Backwash from the strainers will be routed back to the tank drain system utilizing the existing CCT ae drain piping. A lifting system will be provided for removal of the new strainers from the building.
- A manual bypass for the strainers will be provided if desired.

6.4.2.3 HPE Disinfection System

The HPE wet well intake will be located downstream of the plant effluent UV disinfection system. However, there is a need to provide periodic chlorination of the HPE distribution piping and prevent regrowth of algae. Therefore, a sodium hypochlorite disinfection system will be provided inside the new HPE Building. This will consist of two sodium hypochlorite storage tanks, sized to provide a 30-day supply at an anticipated dose of 1.0 – 2.5 mg/L, and peristaltic metering pumps to adequately dose the sodium hypochlorite into the process stream.

It must be noted that the odor control biofilter irrigation – an intermittent demand – requires HPE that has not been chlorinated in order to preserve the biomass. An isolation valve will be installed to ensure that while the HPE is being shock-chlorinated, no feed water will be sent to the biofilter during this duration. Specifics on the control strategy will be determined during detailed design.

6.4.2.4 Other HPE Building Considerations

Other design considerations will include:

- Process drains and floor drains located in the new HPE Building will be routed to the existing tank drain well located near the return sludge building. Since the process and floor drains from the chlorine building are being eliminated, no net impact on the tank drain pump station is expected due to these modifications. This will be confirmed during detailed design.
- Existing CCT 2 will be provided with a new concrete cover slab to keep rain and other water out of the tank. All openings to the tank will be closed and new access hatches provided to allow for maintenance access for dewatering or other purposes.

6.4.3 Plant Water Distribution Improvements

Sections of the existing HPE piping must be upsized to deliver higher flow rates to the new BDF and other areas around the plant. Section 7.5 includes a figure and brief description of the yard piping improvements. This will include approximately:

- 600 feet of 10” HPE pipe upsized to 16”
- 660 feet of 6” HPE pipe upsized to 10”
- Relocation and upsizing of the existing 6” HPE piping between the Filter Building and the grit tanks, due to construction of the new Headworks Facility

6.4.4 Potable Water Back-up Provisions

A backup connection to the potable water service will be provided to supply potable water in the event of a system failure. It was noted in the February 24, 2022, Workshop that the potable water service line from Madison Utilities may have limited pressure, so a booster pump may be required to effectively use this service for HPE demands. Verification of the service line size, available pressure, and fire flow will be determined during detailed design and coordinated with the potable water needs in other areas of the plant as discussed in Section 7.

6.4.5 Preliminary Process Control Strategies

Preliminary process and equipment control strategies for the major plant water system components are provided below.

6.4.5.1 HPE Pumping System

The new HPE pumps will be operated using VFDs to maintain a minimum system pressure of 90 psig at all locations. A detailed system model has not yet been developed for conducting a transient analysis, and further consideration of water hammer or other transient impacts will be completed during detailed design.

- The pumps will operate in a lead-lag sequence with the number and speed of pumps controlled to main the set point system pressure.
- Pumps will be set with a minimum speed limitation to restrict operation outside the pumps Preferred Operating Region (POR, per ANSI/HI 9.6.3) at low demands conditions.
- It is anticipated that low demand conditions may fall below the practical minimum speed flow rate of the new pumps. To avoid the pumps running at shut-off conditions, a self-controlled relief valve will be provided in the pump discharge line to bleed excess flow back into the wet well under these conditions.

6.4.5.2 HPE Strainer System

The two strainers will be redundant, so that only one will be operational at a time. The control strategy for the strainer system will be generally as follows:

- Strainer operation will be controlled via vendor control panel(s).
- Operation of the strainers will be independent of the HPE pump operation.
- The straining technology to be used with be similar to the existing equipment at both DCWRF and Central WRF which has performed reliably for years. The strainer size will match the current size used at the Central WRF.
- Manual alternation of the duty/standby strainer is envisioned; however, automatic alternation based upon runtime or time interval may be provided.
- The strainers baskets will rotate continuously when in operation.
- Backwashing will be regulated using a control valve on the backwash chamber drain line that opens either on a timed-interval or high differential pressure across the strainer unit.

6.4.5.3 HPE Disinfection System

The control strategy for the HPE/SW chemical disinfection system will generally be as follows:

- Each of the two sodium hypochlorite tanks will be dedicated to the HPE or SW system, respectively. A transfer/recirculation pump can be provided to pump chemical from one tank to the other or provide mixing as required.
- Sodium hypochlorite pump operation will be controlled via the plant DCS.
- Operation of the chemical pumps will be independent of the HPE pump operation.
- The variable speed sodium hypochlorite metering pumps will vary their speed to provide required dosing to the HPE and spray water service lines. The dose to each service line will be a calculated value based on the HPE or spray water flow rate, respectively.

- Manual alternation of the duty/standby pumps is envisioned; however, automatic alternation based upon runtime or time interval may be provided.

6.5 Spray Water System Improvements

The existing spray water system will be largely untouched as it pertains to this project. Improvements to the system are summarized below, generally providing improved performance and monitoring capabilities.

- A new magnetic flow meter will be installed on the existing 14" spray water header leaving the station. Preliminary sizing is 12" and a bypass will be provided.
- A new chemical injection point for sodium hypochlorite addition will be added for intermittent maintenance of the spray water system.

The chemical equipment associated with these improvements is included in Table 6-1 and will be located in the new HPE Building. However, it is anticipated that a valve vault situated on the existing spray water piping will house the new magnetic flow meter and chemical injection point. Refer to drawing I-35-104 for a preliminary process and instrumentation drawing of the modified SW system.

Discussions with MWS staff indicate a desire to feed additional hypochlorite via the SW system in two various process channels and tankage for process control purposes. These needs will be further evaluated during detailed design and along with considerations for additional chemical storage to accommodate these needs.

6.6 Plant Drain System Improvements

6.6.1 Preliminary Design Criteria and Major Equipment

Due to the overall site layout of Dry Creek WRF, a new process drainage pump station will be provided in the basement of the New Biosolids Drying Facility. This will allow process and floor drainage from this new building to be pumped directly to the influent screen common effluent channel in the Headworks Facility instead of crisscrossing the WRF to the existing tank drainage pump station and pumped again, which would have greater overall impact on existing pumps and yard piping. As provided in Table 3-2, the maximum anticipated flowrate of the New Biosolids Drying Facility sump pump station is 3.0 MGD and is accounted for in the plant recycle flows impacting the sizing of the Headworks Facility screening system.

As the layout of the New Biosolids Drying Facility is finalized, the best pump design for this sump pump station will be determined. As of the writing of this report, both submersible pumps and dry-pit centrifugal pumps were under consideration. Refer to Table 4-8 for the anticipated flow and pressure design criteria of these pumps. Consideration will also be given to potential failure scenarios, within reason, to ensure the sump pump station is large enough to prevent equipment damage if a system failure occurs.

6.7 Maintenance of Plant Operations (MOPO) and Construction Sequencing

6.7.1 HPE System MOPO and Sequencing

The existing HPE system can continue to operate without interruption while the new HPE pump station and building are under construction. The new HPE pump station must be complete and operating prior to start-up of the new Headworks Facility and the new Biosolids Drying Facility to supply the required demand for these new facilities. Some final testing may be delayed until the ultimate demand points can be achieved to supply these new systems. Additionally, the existing demands at the Filter Building cannot be fully demolished until the new Biosolids Drying Facility is running, so demands at both locations may simultaneously be drawing HPE demand during this period. Further consideration of the construction and start-up schedules will be completed during detailed design.

For the transfer to the new system, a bulkhead will be installed in the final effluent channel so that the CCT #1 wall can be partially demolished for construction of a new gate to the new HPE pump station. Refer to Figure 6-3 above for the location of the new wet well and influent gate.

6.7.2 Spray Water System MOPO and Sequencing

The SW system can continue to operate without interruption while the vault for the new SW flow meter and chemical injection is under construction. A brief shut-down will be required for installation of the new flowmeter and tap for the chemical injection point.

6.7.3 Drain System MOPO and Sequencing

Project improvements are anticipated to have minimal impact on the existing tank drainage pump station. The dedicated sump pump station for the New Biosolids Drying Facility will be constructed within that structure

Section 7

Site Development and Civil Design

This section addresses key site development considerations and civil design criteria associated with the DCWRF Headworks and Class A Biosolids Improvements Project.

7.1 Existing Site Description

This existing DCWRF is located in Madison, Tennessee. The plant is situated between Myatt Drive (to the east), the Cumberland River (to the west), Edenwold Road and CSX Railroad to the north, and Dry Creek (to the south). The Edenwold Connector Road currently runs through the DCWRF property between Edenwold Road and the connection to Myatt Drive. There are a few private (commercial) properties on Edenwold Road which utilize the Edenwold Connector as the sole source of roadway access.

The plant entrance is on a connector road which is accessed from the east side of Myatt Drive. Site access is through an existing security gate at the west end of the plant, which requires all traffic to check-in and obtain approval prior to entering the site.

The DCWRF property is historically within the floodway of Dry Creek and the Cumberland River and endured significant flooding during the May 2010 event. As described in Section 1, a flood wall project is currently underway (in design, by others), which will protect the plant site from future flooding up to (2-feet above) the 500-year design event.

The DCWRF is an active treatment facility with ongoing construction projects, which will remain in service throughout the duration of this Project. Construction staging, sequencing, and temporary access facilities must be considered as part of the project delivery.

7.2 Site Improvements Layout Considerations

The project includes expansion of facilities, construction of new facilities, re-purposing existing facilities, and relocation of a public roadway. In addition, the proposed improvements will expand the footprint of the active plant property and site fence line. The existing plant entrance and security guard building will be relocated westward toward Myatt Drive as part of the plant site expansion.

New or expanded facilities will need to account for truck access and turning movements as well as maintenance activities on equipment using forklifts, cranes, or other service vehicles. New utility routing (process mechanical piping, gravity piping, electrical/comm duct banks) will be contending with existing buried utilities and active roadway access corridors. Throughout the duration of the construction project, plant access for trucks and staff must be adequately maintained.

Key considerations for specific site layout options include flood elevations, conflicts with existing utilities, existing and proposed vehicle access paths, and coordination with existing ground surface elevations.

7.2.1 Floodway Considerations

The elevation of the site and proximity to the confluence of Dry Creek and the Cumberland River creates implications with flood elevation that must be addressed in the design of the DCWRF Project (see Section 1.5.2). Design consideration will be placed on critical (electrical/mechanical) components being two feet above the 500-year flood elevation. An elevation of 439.00' will be used based on the approved protection elevation specified in the new flood wall drawings (currently under design by Barge Design Solutions).

This project scope assumes that any floodway mitigation for cut/fill within the plant site will be completed as part of the flood wall project (outside the scope of this project).

7.3 Site Layout

The site civil components of the Project are grouped into four general categories based on the location of the improvements as follows:

1. Edenwold Connector Road Relocation
2. Headworks Facility
3. BDF and Future Plant Expansion Area
4. Plant Water and Chlorination Building Area

An overall site plan with the location of each improvement area is shown below on Figure 7-1.

Figure 7-1. Site Aerial with Locations of Major Improvements

To accommodate the project, the following site work and design criteria are necessary:

- Maintain public access between Myatt Drive and Edenwold Road throughout project.
- Maintain access for MWS staff and suppliers to DCWRF site and processes that need to function concurrently throughout construction, which may include temporary asphalt or gravel drives for access.
- Construct grading improvements (structural fill) at the Future Plant Expansion Area to within 1-foot of anticipated future grades.
- Capture and manage stormwater runoff in accordance with Metropolitan Nashville – Davidson County Stormwater Management Manual 2021 edition (SWMM)

- Design and construct stormwater treatment and conveyance facilities for full build-out of the Future Plant Expansion Area assuming 90% coverage with impervious roofs and/or pavement.
- New access for solids (pellet) handling from new dryer facility will be required.
- New access for chemical and material delivery will be required at:
  - dewatering facility
  - biogas conditioning system
  - pellet loadout
- Maintenance vehicle access to indoor and exterior equipment at dryer facility will be required.
- New access for solids handling from new grit and screening facility will be required.
- Maintenance vehicle access to key locations at headworks facility will be required.
- New personnel stairway at west end of headworks screening structure is desired.
- Personnel and visitor parking will be required at:
  - Security Booth (2 spaces plus one space for golf cart)
  - Dryer Facility (10 spaces, including 1 ADA parking space)
- Access for chemical delivery at existing polymer room in Filter Building must be maintained.
- Access for chemical delivery at new HPE Pump and Disinfection Building must be developed.

Key components of design for specific improvement locations are listed in the sections below.

7.3.1 Edenwold Connector Road Relocation

Public access to Edenwold Road must be maintained throughout the duration of the project. However, the Edenwold Connector Road (between Myatt Drive and Edenwold Road) is in the location slated for the new BDF. As such, the construction of these improvements will be completed as an early completion item during construction. Alternatively, this project work plan includes provision for design and construction of the Edenwold Connector Road Relocation as a separate (stand-alone) project on an accelerated schedule ahead of the construction of the DCWRF plant improvements. If needed, construction of the Edenwold Connector Road Relocation project in advance of the plant site improvements would allow the (relocated) public access path to be established and maintained throughout construction of the larger project – without delaying construction or staging of the larger project.

One of the goals for the Edenwold Connector Road relocation is to maximize the available plant expansion area to the west. As such, design of the relocated public access roadway should optimize access to and expansion of the plant site, while maintaining adequate and safe roadway design for the public users.

The areas slated for the relocated connector road, new BDF, and future plant expansion will require soil import (fill) in order to bring the surface to the intended grades for the improvements. A secondary goal for the Edenwold Connector Road relocation project is to perform the mass grading for the road relocation and the entire expansion area under this construction effort. This construction sequence will limit the impacts of soil import to one construction mobilization effort and also shorten the construction timeline for the (later) plant improvements project.

The intended scope of the Edenwold Connector Road relocation project includes the following elements:

- Mass grading for the roadway relocation
- Construction of the new public roadway improvements, including drainage facilities

- Anticipated connector road design to Residential Medium Density Minor and Local Street standard with 50-foot right of way dedication
- 27-foot paved width, plus curb and gutter
- Grass shoulders – no sidewalk or bicycle lane anticipated along connector road
- Mass grading for the expanded plant site area
- Drainage improvements (as necessary) to support the mass grading changes on the expanded plant site
- Construction of an expanded site security fence
- Development of new plant site entrance(s)
- Plant entrance security gate controls will include card-key access for entry and automatic opening for exit
- Construction of the New Security Booth

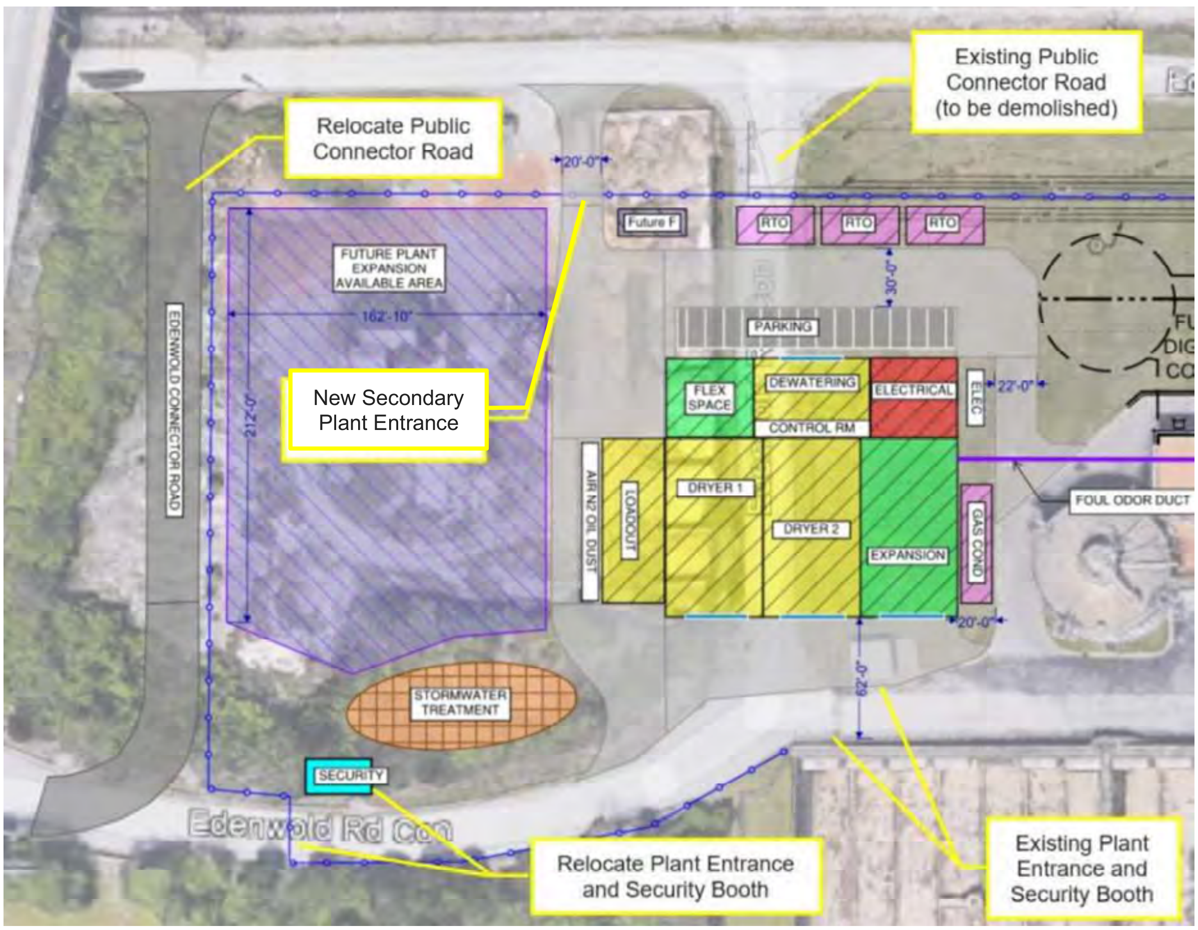

Figure 7-2. Proposed Relocation Concept for Edenwold Connector Road and New Biosolids Dryer Facility

The construction package for the Edenwold Connector Road relocation will be able to be bid as a stand-alone project or be incorporated into the bid package of the larger improvements project. The decision to solicit the Edenwold Connector Road relocation project ahead of (or with) the larger improvements project will be determined at a later date during design.

7.3.2 Headworks Facility

The Headworks facility improvements will expand the infrastructure footprint onto the existing (solids handling) truck turning area.

7.3.2.1 Access During Construction

Truck access to the existing biosolids loadout and chemical delivery point at the polymer room must be maintained during construction of the Headworks facility improvements. A suitable truck turn-around location will need to be identified for use once demolition and construction begin near the Headworks facility.

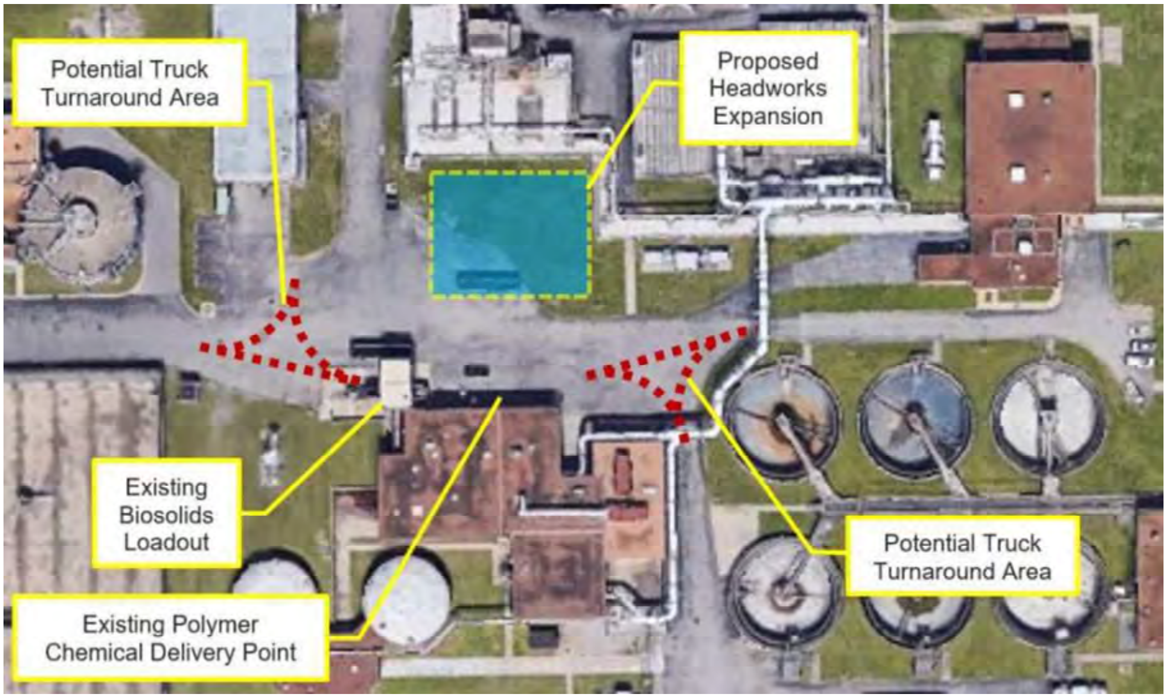

Figure 7-3. Potential Truck Turnaround Provisions around New Headworks Solids Processing Building

7.3.2.2 Ultimate Design

The Headworks facility improvements will require truck access and maintenance vehicle access to several key locations. Solids screenings and grit removed from the wastewater influent will be dewatered and conveyed to roll-off container units in the new headworks building. Truck access to load/unload the roll-off containers inside the building entrance must be provided in the ultimate design. Forklift and boom-truck access must be provided to several key locations along the west and south building walls for equipment maintenance activities. In addition, large crane access must be available to lift the headworks screens and grit dewatering units through skylight openings in the roof of the new Headworks Solids Processing Building.

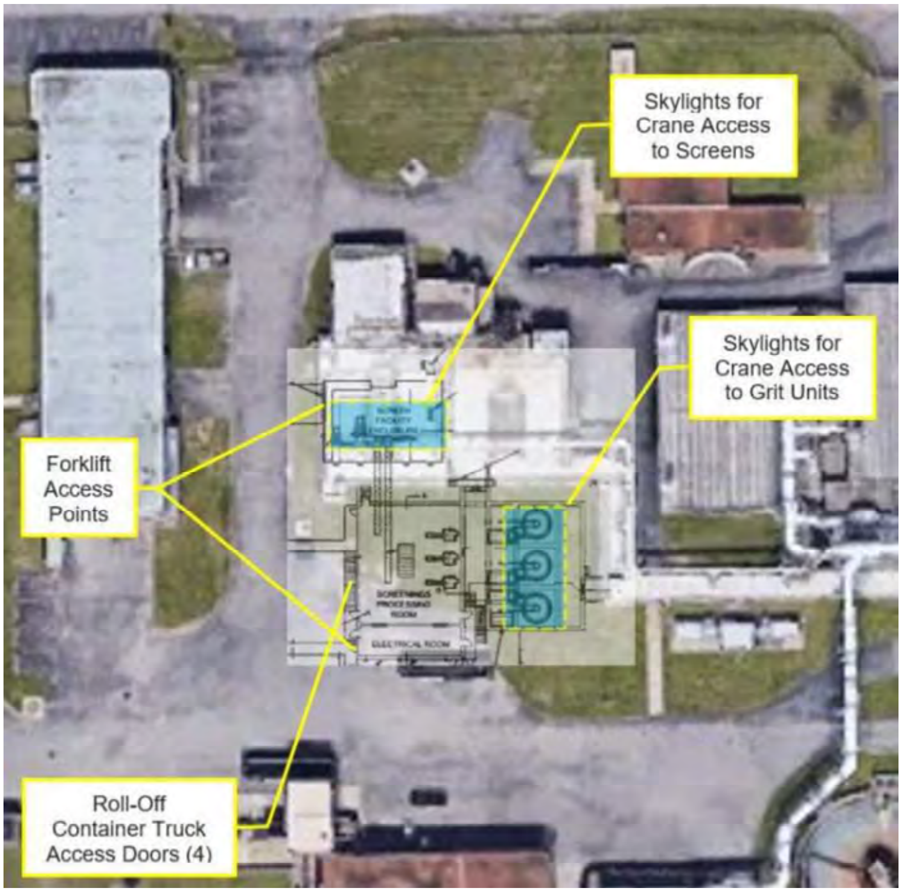

Figure 7-4. Access Considerations around Headworks Facility

7.3.2.3 Stormwater Management

Stormwater runoff from the expanded headworks facility will be captured and routed into the existing storm drain collection system piping in the paved drive aisle. The existing stormwater piping conveys flows to a treatment unit located between the Filter Building and Final Settling Tanks (see Section 6.5.9).

The existing stormwater treatment unit may already be sized to handle the additional runoff flows from the proposed headworks improvements. Verification of the stormwater treatment unit sizing and capacity will be performed as part of the improvements design. If necessary, the treatment unit will be expanded/improved to handle the additional flow as part of the project.

7.3.3 Biosolids Dryer Facility and Future Plant Expansion Area

The new BDF will be constructed west of the existing anaerobic digesters. The footprint of the new facility and ancillary components will extend past the existing (west) plant fence line and connector road. The design intent is to construct the finish floor elevation of the BDF at an elevation of 438.8', which will maintain all equipment pads above the flood protection level. For equipment pads located outside the building, we will specify a finish surface elevation at or above 439.0' for flood protection.

Vehicle paths and grades will be designed to provide delivery and maintenance access to several key locations on the building faces and at ancillary equipment, as shown on Figure 7-5.

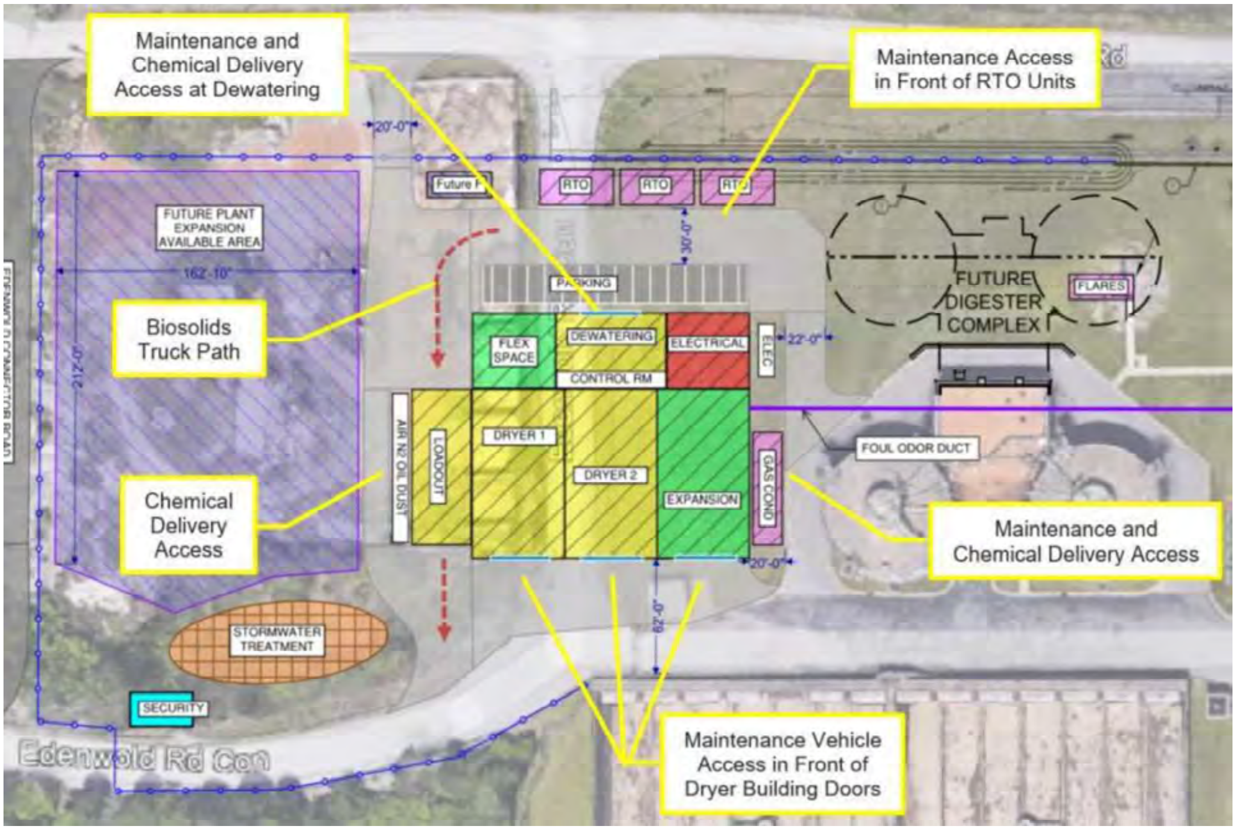

Figure 7-5. Vehicle Travel Patterns around New Biosolids Dryer Facility

Key design considerations for the BDF and Future Plant Expansion Area are listed below.

- Future Plant Expansion Area will be mass graded to within 1-foot of anticipated future grades. Assume future uses may include maintenance and/or administrative buildings and associated vehicle access and parking improvements.
- Future Plant Expansion Area will be graded (sloped) to sheet-flow surface runoff to the southeast direction, toward the proposed storm water treatment zone.
- Stormwater treatment unit(s) and conveyances serving the BDF and Future Plant Expansion Area will be sized for ultimate buildout. Assume a 90% impervious (roofs and pavement) coverage over the Future Plant Expansion Area for design.
- Existing stormwater outfall piping from the Edenwold Connector Road drain inlets will be utilized for stormwater discharge from dryer facility and plant expansion area.
- Equipment pads located along the Floodwall Project berm must be designed to maintain the integrity of the protection berm.
- Provisions for relocating the flare(s) to the north fence line in the future should be incorporated into the improvements design. This would include power and communication conduits as well as gas piping to the future location.
- Construction of the future digesters will require excavation to approximately 28-feet below grade for access and form work. Buried utilities in the vicinity of the future digesters must account for the future construction disturbance.
- Truck access around buildings and equipment will be designed for worst-case large semi-trailer combo and fire engine access

7.3.4 High Pressure Effluent and Chlorine Building Area

The area around the existing Chlorine Building currently acts as construction staging and storage for multiple projects, as well as active receiving area for (disinfection) chlorine cylinders. The old Equipment Building and covered storage area were originally scheduled for demolition as part of this Project. However, MWS may still have some desire to use portions of the building and covered storage. The current scope planning is to leave the Equipment Building and covered storage area in place.

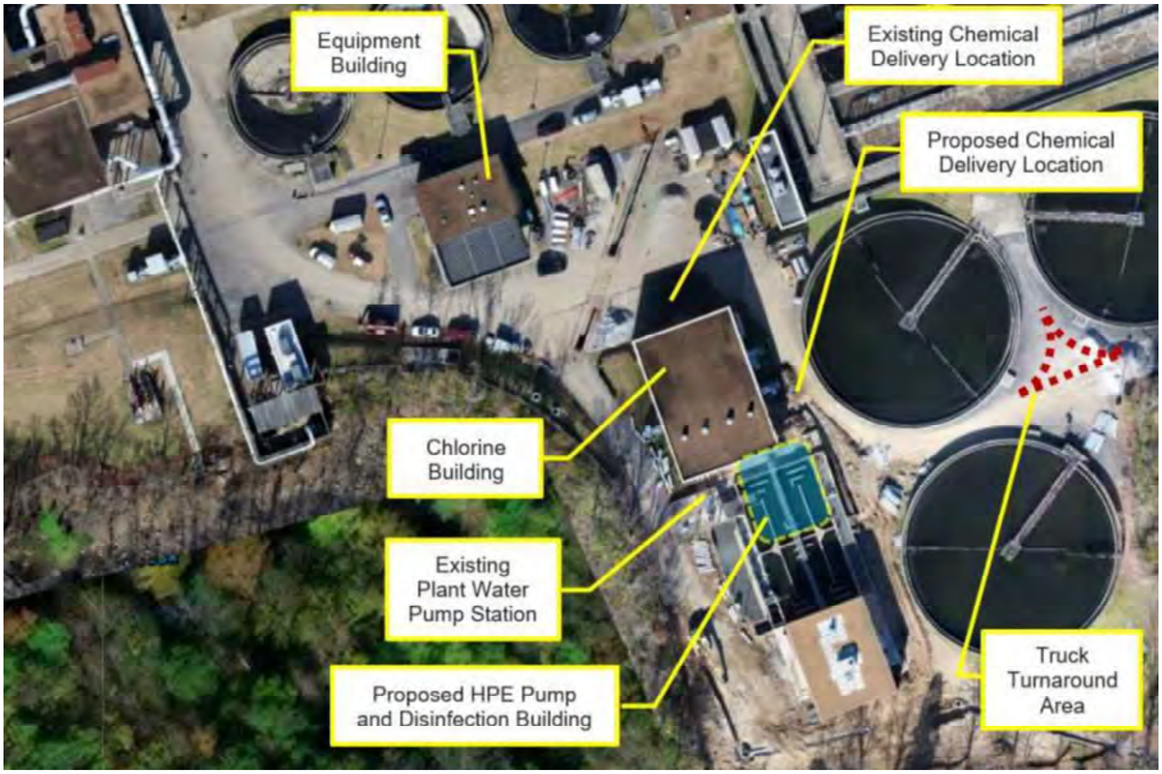

Figure 7-6. Proposed Location for new HPE Building

The HPE system will be upgraded to provide higher flows and pressures to the headworks and dryer facilities as part of the Project. This upgrade will require a new MCC for the larger HPE plant water pumps.

The (effluent) chlorine disinfection systems are no longer necessary since completion of the UV Disinfection project. CCT #1 and CCT #2 are empty and all effluent flow is routed through the new UV building, which was constructed over the CCT #3 footprint. The current design plan is to construct a new HPE pump and disinfection building over the CCB #1 footprint and demolish the existing Chlorine Building structure (leaving the foundation slab in place). CCT #2 will be covered with a slab to prevent accumulation of debris and rainwater inside the empty tank.

Site civil design and improvements around this area will include considerations for bulk chemical delivery to the HPE pump and disinfection building and maintenance vehicle access to the existing and new equipment.

7.4 Biogas Conditioning Media Handling

The proposed biogas conditioning system equipment (adjacent to the new BDF) may include media which requires removal for regeneration or disposal handling. A container loading or transfer area may be necessary to accommodate the siloxane removal media handling during maintenance. Candidate sites for media handling currently include:

- area around existing Chorine Building and Equipment Building
- portion of the Future Plant Expansion Area

Additional details on the biogas conditioning media handling will be developed during preliminary design.

7.5 Site Yard Piping

As part of improvements in the major process areas, yard piping outside the building/structural envelope will need to be demolished, relocated, and new piping constructed. Yard piping improvements discussed in this section include:

- Potable Water
- High Pressure Effluent (HPE) Plant Water
- Natural Gas
- Digester Gas
- Digested Sludge
- Influent Bypass
- Process Drains
- Centrate Force Main
- Storm Drains

A brief description of the yard piping improvements is provided below.

7.5.1 Potable Water

A new potable water connection will need to be constructed from the water main in Edenwold Road to the BDF. This connection will be sized to provide fire flow capacity to the building as well as a backup water supply connection for the HPE demands in the BDF. This will include a new water meter and backflow prevention as required by the water utility provider.

7.5.2 High Pressure Effluent

Flow and pressure demands on the plant water HPE system will be significantly increased as a result of the improvements at the Headworks and BDF. In addition, the pumping and disinfection components for the HPE system will be located in a new area (over the existing CCB #1). HPE piping improvements will be necessary as follows:

- New connection from new HPE pumping and disinfection building to existing HPE distribution piping
- Relocation of HPE piping at footprint of proposed Headworks (grit system) structure
- Extension of new HPE piping to BDF

The Figure 7-7 on the next page shows a general layout of the potable water and HPE piping improvements anticipated as part of the detailed design.

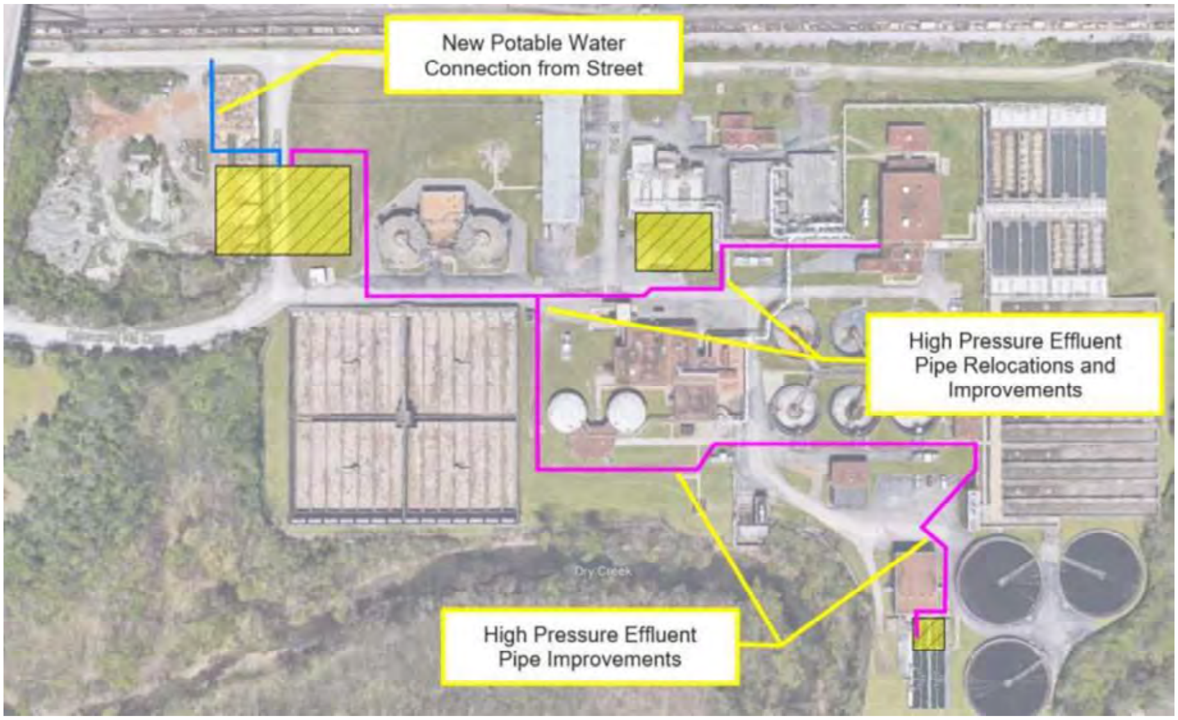

Figure 7-7. Potable Water and HPE Yard Piping

7.5.3 Natural Gas

The BDF heating and drying equipment will largely run on digester gas. However, natural gas is required for start-up and supply when digester gas is insufficient (quantity or quality) to run the dryer systems. A new natural gas supply will be constructed from the utility main in Edenwold Road to serve the BDF. See Figure 7-8 for proposed location.

7.5.4 Digester Gas

The BDF will be constructed immediately adjacent to the existing digester headhouse. Digester gas piping will be constructed from the digester headhouse to a biogas conditioning system located at the BDF. A second biogas flare will be constructed adjacent to the existing flare, which will require a new pipe to the new flare.

In addition, we will design the biogas pipe to the future flare location (along the north property boundary) for construction as part of this Project. Constructing the pipeline for the future flare location will avoid trenching and pavement repair around the BDF in the future. Figure 6-8 on the next page shows a general layout of the natural gas, digester gas, digested sludge, and influent bypass piping improvements anticipated as part of the detailed design.

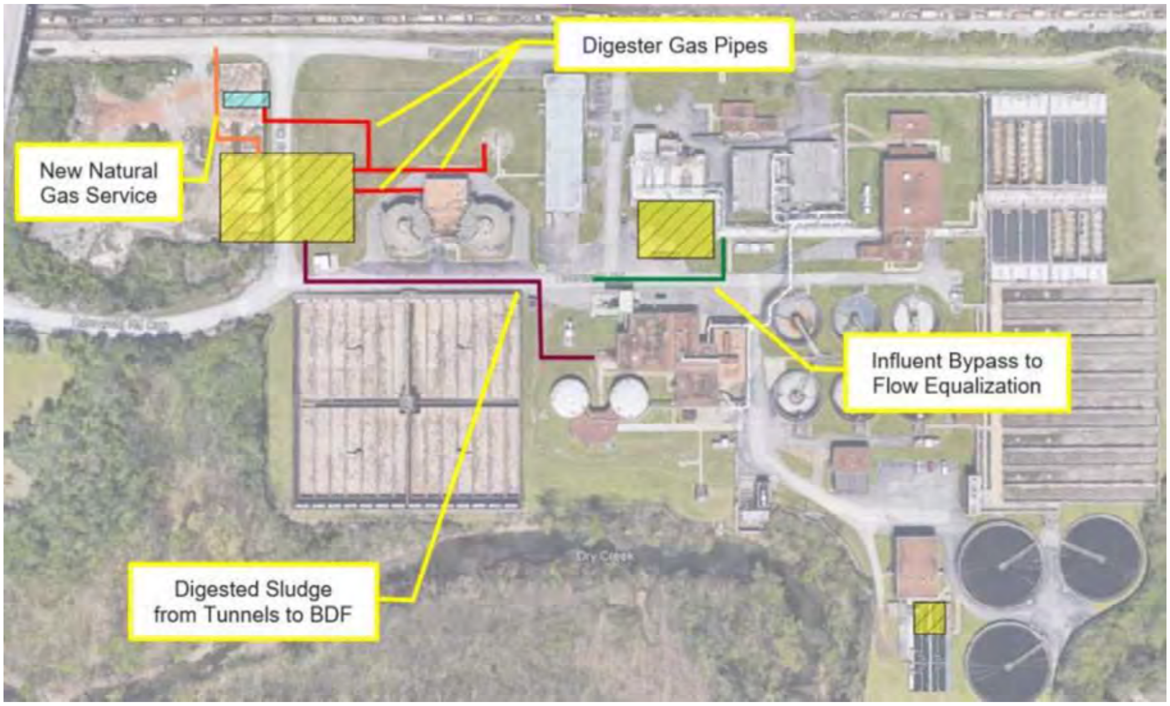

Figure 7-8. Natural Gas, Digester Gas, Digested Sludge, and Influent Bypass Piping Improvements

7.5.5 Digested Sludge

Construction of the new BDF at its proposed location will require new digested sludge transfer piping to convey sludge from the DSSTs to the BDF. See Figure 7-8 for proposed location. The existing digested sludge transfer piping includes four (4) ductile iron pipes located within the tunnel between the DSST headhouse and the Filter Building. Current planning includes construction of two (parallel, buried) digested sludge transfer pipes intercepting the existing pipes within the tunnel space, and heading between the Digesters and EQ Basin to the new BDF. Pipe sizing and detailed route will be determined as part of Preliminary Design.

7.5.6 Influent Bypass

Part of the overall Headworks improvements design includes a new bypass downstream of the proposed grit handling systems to the EQ Basin. See Figure 6-8 for proposed location. The existing influent bypass piping has connections and capability to divert flows from the Headworks to the EQ Basin at three locations:

- from the Dry Creek force main prior to the flow metering flume
- downstream of the flow metering flumes prior to entering the aerated grit chambers
- downstream of the existing aerated grit chambers

The current connection downstream of the existing aerated grit chambers will be maintained in place but will now be located (process flow) between the new headworks screens and grit removal systems. This project will maintain the existing bypass pipe connection points and will add another connection for bypass downstream of the new grit removal system.

This new bypass pipe will connect to the existing bypass line in the paved area between the Filter Building and the Maintenance Building. Pipe sizing and location details will be developed during the Preliminary Design Phase.

7.5.7 Process Drains

The Headworks improvements and the new BDF will both require process drainage systems for floor drains and process unit discharges. The existing process drain piping located in the paved area between the Filter Building and Headworks will be extended to serve the improvements at the Headworks facility.

Process drainage flows captured at the BDF will be collected in a sump located within or adjacent to the BDF, and pumped through a pressure force main to the plant Headworks for treatment. The anticipated discharge point is downstream of the proposed Headworks screens and upstream of the grit removal systems.

Centrate flow from the sludge dewatering centrifuges and wet scrubber blow-down from the sludge dryers will be captured and handled separately within the BDF. Centrate and wet scrubber blow-down will be run through a separate solids thickening process for removal of solids prior to returning the liquid stream flows to the process drain sump at the BDF.

Figure 7-9 provides a general layout of the process drain piping main improvements anticipated as part of the detailed design.

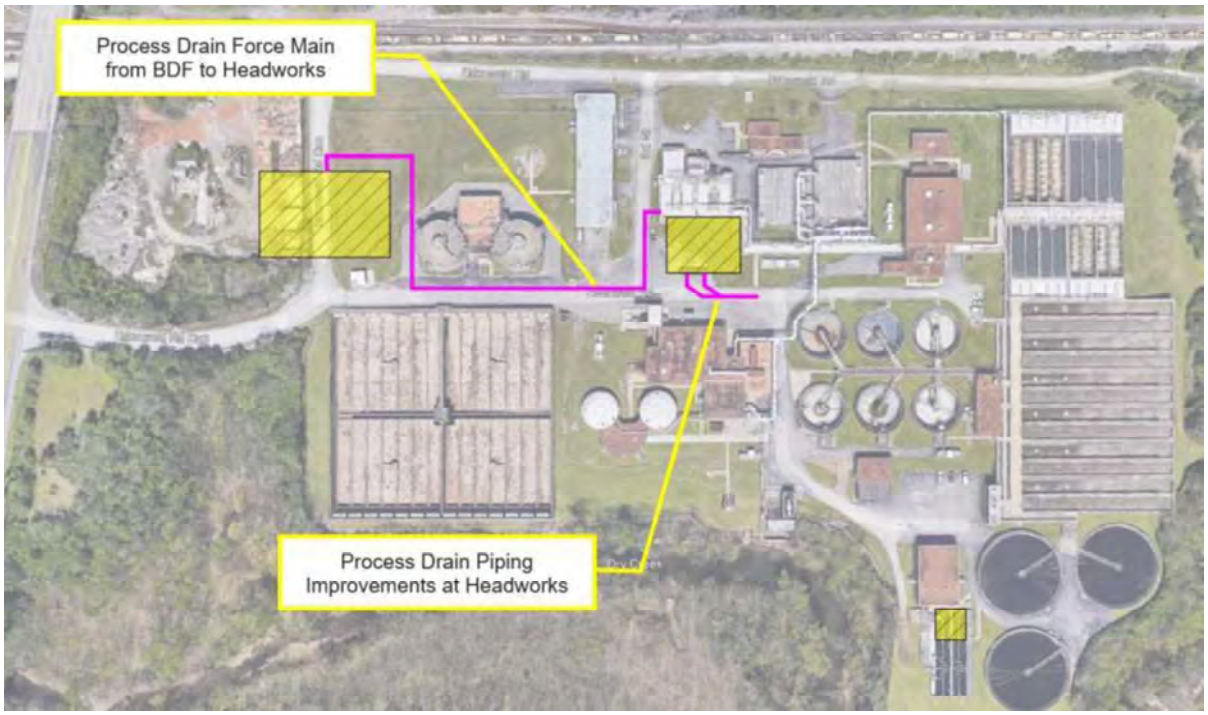

Figure 7-9. Process Drain Piping Improvements

7.5.8 Storm Drains

Building and paving improvements at the Headworks will require relocation and expansion of the existing storm drain collection system in that area. Roof downspouts and new catch basins will be tied-in to the existing storm drain system serving this area, which drains to an existing stormwater treatment unit.

Improvements at the BDF and Future Plant Expansion Area are outside the existing plant storm water collection system drainage shed. Stormwater runoff from this area will be collected and conveyed to a new stormwater treatment feature, proposed along the north edge of the existing connector road (in the west lot). Treated stormwater will then be conveyed to the existing storm drain outfall pipe located along the west edge of the Equalization Basin.

It is assumed that stormwater runoff from the (relocated) Edenwold Connector Road is not required to be routed through a stormwater treatment unit. Runoff from this public right-of-way will be collected and conveyed to an existing culvert under the raised roadway for discharge along the historic overland flow route.

Stormwater runoff from the proposed improvements at the existing chlorine contact basin (HPE Building and slab cover) will be routed to the new bioretention treatment unit south of the new U.V. Building. It is assumed that the treatment unit south of the U.V. Building is sized for the additional flow from this area.

Figure 7-10 on the next page shows a general layout of the storm drain piping and storm water management improvements anticipated as part of the detailed design.

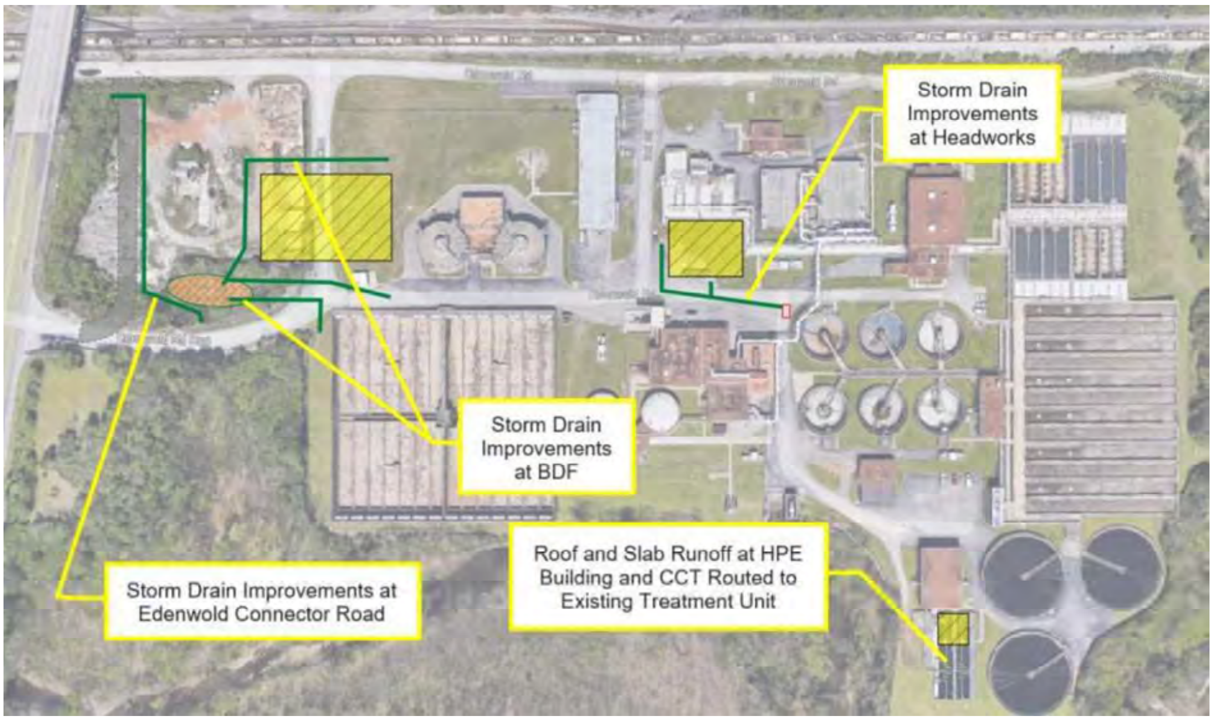

Figure 7-10. Storm Drain Piping Improvements

7.6 Stormwater Management

Stormwater management is a consideration for the DCWRF Expansion. In developing the storm water management approach, the minimum performance standards listed in the *Metropolitan Nashville – Davidson County Stormwater Management Manual 2021 edition* will be followed to address both water quality and quantity impacts. In general, the impact of post-construction runoff on the watershed will be reduced by the following actions:

- Maximize use of site design and nonstructural (e.g., natural or pervious) methods to reduce runoff
- Manage and convey stormwater runoff through structural controls, such as ponds, swales, and treatment units prior to discharge
- Implementation of pollution prevention measures to reduce potential for stormwater contamination at containment/handling areas for chemical delivery, biosolids loadout, and headworks screening dumpster loading area

7.6.1 Grading, Drainage, Detention, and Water Quality

Grading as part of this Project will include a combination of cut and fill to bring the site to proposed grades and elevations. Import fill will be required at Area 1 (Edenwold Connector Road Relocation) and Area 3 (BDF and Future Plant Expansion Area) to raise the final grades by 3 to 15 feet. Site grading will be designed to maintain positive drainage away from buildings and structures and into storm water conveyance facilities (swales and/or catch basins).

In general, minimum slopes on pavement and hard-scape areas will be maintained at 0.5% while minimum slopes on grass and non-paved areas will be 1.0%. Maximum slopes for paved areas in front of vehicle access doors (at buildings) and at material handling areas will be 2.0%. Maximum (longitudinal) slopes in paved areas may be as high as 10% on access drives and roadways. Maximum slopes in non-paved areas will be designed based on recommendations from the Geotechnical Report (still in progress) but are anticipated to be up to 2:1.

In general, storm drains will be sized (at minimum) for the 10-year design storm in accordance with the Minor Stormwater Management System definition in the SWMM. Conveyance facilities will be a combination of open channels (lined or grassed) and conduit (pipe). The minimum diameter for all storm drain piping will be 15 inches and pipe will be reinforced concrete.

Detention facility design will control post-improvement peak flows at the outlet to be equal to or less than pre-improvement peak flows for the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year design storms. Detention systems will be designed to function as sediment traps and require minimal maintenance (by design). A Stormwater Control Measure Maintenance Document will be prepared and submitted with the Grading Permit in accordance with the SWMM guidelines.

No Water Quality Buffers (as defined in Section 6.10.1 of SWMM Volume 1) are known (or suspected) within the footprint of the proposed site improvements.

Low Impact Development (LID) goals require that site design will capture initial runoff for infiltration, evaporation, and/or use for a rain event when preceded by 72 hours of no measurable precipitation. This Project will seek the runoff reduction Redevelopment Credit (reducing runoff reduction requirement from 80% to 60%) as a previously developed site, in accordance with Section 7.2.1 of SWMM Volume 1.

Pollutant removal will be accomplished by approved Stormwater Control Measures using a combination of Green Infrastructure Practices and Permanent Treatment Practices as discussed in Section 7 of SWMM Volume 1.

7.6.2 Hazardous Spill Containment

In locations with the potential for hazardous spills to impact stormwater, measures such as use of canopies, sloping pavement toward containment drains, curbing, and other containment techniques will be used to limit this potential. Water quality inlets may also be used in selected locations.

7.6.3 Soil Erosion and Sediment Control Plans

Metro's requirements for Erosion Prevention and Sediment Control (EPSC) measures are consistent with those of TDEC's Construction General Permit Number TNR 100000 (CGP). The Project area of disturbance will be greater than 1-acre, which will require adherence to the CGP. All BMP's will be reviewed with the MWS Stormwater division early in the design process. Soil erosion and sediment control plans will be developed that address clearing and grubbing, along with measures related to excavation and grading during construction. EPSC plans will follow the standard erosion control practices illustrated in Section 6.11 of SWMM Volume 1 to meet pollution prevention criteria and requirements in keeping with National Pollutant Discharge Elimination System (NPDES) and municipal separate storm sewer system (MS4) permit stipulations.

Soil EPSC plans will be prepared for three phases of construction: demolition, final grading, and final stabilization. The location and identification of specific erosion and sediment control measures will be delineated on a plan that will include proposed grading and drainage improvements. Details of each erosion and sediment control measure will be included. Permanent stabilization will include grassing over all disturbed areas.

A comprehensive stormwater monitoring plan will be prepared within the construction documents that specifies all requirements related to sampling, testing, documentation, recording, inspection, spill prevention, and pollution prevention.

Section 8

Structural Design and Geotechnical Considerations

8.1 Codes and Standards

8.1.1 Governing Code

The Governing Building Code for this project is the 2018 International Building Code. The strength, serviceability, and quality standards for all aspects of the project will meet the requirements of the Governing Code.

8.1.2 Standards

Applicable provisions of the following standards will be used for the structural design.

- ASCE 7-16 – Minimum Design Loads for Buildings and Other Structures
- ASCE 24-14 – Flood Resistant Design and Construction
- ASCE 37-14 – Design Loads on Structures during Construction
- AASHTO Standard Specification for Highway Bridges, 16th Edition.

8.2 Materials

For materials to be used in each area or building, see Section 8.7 for the Design Approach.

8.2.1 Concrete

8.2.1.1 Codes, Standards, and Design Documents

- ACI 318-14 – Building Code Requirement for Structural Concrete
- ACI 350-06– Code Requirements for Environmental Engineering Concrete Structures
- ACI 350.3-06 – Seismic Design of Liquid-Containing Concrete Structures
- ACI 301-10 – Specifications for Structural Concrete

8.2.1.2 Material Properties

Concrete material properties will comply with Table 8-1.

Table 8-1. Material Properties

Class	Usage	Min. 28-day Compressive Strength, f'_c	Max. Aggregate Size, ASTM C33 (nominal)
A	Conc with t>36"	5000	467 (1-1/2")
B	Non-structural (sidewalks, curbs, etc.)	3000	57 (1") or 67 (3/4")
C-1	All conc u.o.n.	5000	57 (1") or 67 (3/4")
C-2	Precast conc	5000	57 (1") or 67 (3/4")

Table 8-1. Material Properties			
Class	Usage	Min. 28-day Compressive Strength, f'c	Max. Aggregate Size, ASTM C33 (nominal)
D-1	Precast conc topping	4000	8 (3/8")
D-2	Wall starter course	5500	8 (3/8")
E	Pipe and conduit encasement, fill concrete	2000	57 (1")
F	Encasement of reinforcement for future construction	500 (min) 1000 (max)	--

- Cement: Type II or V Cement per ASTM C150
- Pozzolan: ASTM C618, Class F
- Pozzolan is mandatory for all cast-in-place structural concrete, including Class A, C-1, and D-2, Concrete
- Reinforcement: ASTM A615, Grade 60, Deformed

Minimum temp and shrinkage reinforcement:

- per ACI 318 for non-environmental structures
- 0.005 for environmental structures, ACI 350

8.2.2 Masonry

8.2.2.1 Codes, Standards, and Design Documents

- TMS 402-16 – Building Code Requirements for Masonry Structures

8.2.2.2 Material Properties

Table 8-2. Masonry Material Properties	
Concrete block (CMU):	ASTM C90, Normal Weight
Specified prism compressive strength:	f'm=2500 psi
Mortar:	ASTM C270, Type S
Grout:	ASTM C476, course grout with 3,000 psi, 28-day compressive strength
Reinforcing:	ASTM A615, Grade 60, Deformed

8.2.3 Steel

8.2.3.1 Codes, Standards, and Design Documents

- AISC Steel Construction Manual – 15th Edition
- AISC 360-16 – Specifications for Structural Steel Buildings
- AISC 341-16—Seismic Provisions for Structural Steel Buildings
- AWS D1.1 – Structural Welding Code - Steel, Latest Edition

8.2.3.2 Material Properties

Table 8-3. Steel Material Properties	
Wide flange and WT shapes:	ASTM A992, Fy = 50 ksi
Channels and angles:	ASTM A36

Table 8-3. Steel Material Properties	
Plates:	ASTM A36
Hollow structural sections:	ASTM A500, Grade B, Fy=46 ksi
Pipe sections:	ASTM A53, Type E or S, Grade B, Fy = 35 ksi
Bolted steel connections:	ASTM F3125, Grade A325 (Type 1) bearing bolts, galvanized, fully tensioned typical at steel framing connections in non-corrosive areas
Welding structural steel:	E70XX low hydrogen electrodes, operators AWS qualified

8.2.4 Stainless Steel

8.2.4.1 Codes, Standards, and Design Documents

- ASCE 8 – Specifications for the Design of Cold-Formed Stainless Steel Structural Members, Latest Edition
- AWS D1.6 – Structural Welding Code – Stainless Steel, Latest Edition
- AISC Steel Design Guide 27, Structural Stainless Steel

8.2.4.2 Material Properties

Table 8-4. Stainless Steel Material Properties	
Bars and shapes:	ASTM A276
Plate, sheet, strip:	ASTM A240/A480
Alloy:	Type 316 (S31600), Fy = 30 ksi Type 316L (S31603), Fy = 25 ksi, when subject to welding Use Type 304 (S30400) /304L (S30403) for architectural applications
Bolted connections (1/4-in. to 5/8-in.):	ASTM F593/F594, Condition CW, match type of stainless steel connected (Fu = 100 ksi, Fy = 65 ksi).
Bolted connections (3/4-in. to 1 ½-in.):	ASTM F593/F594, Condition CW, match type of stainless steel connected (Fu = 85 ksi, Fy = 45 ksi).

8.2.5 Aluminum

8.2.5.1 Codes, Standards, and Design Documents

- Aluminum Design Manual, 2015 Edition, The Aluminum Association
- AWS D1.2, Structural Welding Code – Aluminum, Latest Edition

8.2.5.2 Material Properties

Table 8-5. Aluminum Material Properties	
Structural shapes:	6061-T6 per ASTM B308
Bolts:	Stainless steel ASTM F593, Alloy Group 2 for aluminum framing connections
Guardrails and handrails:	6063-T832 or 6063-T6 per ASTM B241
Floor and cover plates:	6061-T6 per ASTM B209
Grating:	6061-T6 per ASTM B221
Contact with concrete:	Coat aluminum with heavy coat of bituminous paint

8.2.6 Fiberglass Reinforced Plastic (FRP)

Absent of any current nationally recognized codes or standards for the structural design of FRP, proprietary design manuals will be utilized. Examples are:

- Design Guide, Bedford Reinforced Plastic
- Dynaform® Fiberglass Structural Shapes – Design Guide, Fibergrate Composite Structures, Inc.
- EXTREN® and Other Proprietary Pultruded Products – Design Guide, Strongwell Corporation

8.2.7 Concrete Anchorage

- Type 316 stainless steel: at all submerged, buried, and corrosive areas
- ASTM F1554, Grade 55, galvanized at covered, non-corrosive areas
- High strength anchor bolts (if required): Stainless steel ASTM A193, Grade B8M Class 2, Type 316
- Post-installed Anchors (anchors set in hardened concrete): Will be adhesive or wedge type.
- Adhesive anchors are required at all submerged or buried locations and where subject to vibration. They will not to be used where high temperatures (> 140˚F) are possible.
- Basis of design for post-installed anchors will be: cracked concrete; f'_c = specified 28-day strength for new structures, f'_c will be per as-built documents for existing structures, f'_c = 3,000 psi for existing structures without documentation; maximum long-term temperature of 100ºF; maximum short-term temperature of 140ºF.

8.3 Design Loads

8.3.1 Dead Loads

Dead loads used in the calculations will consist of only permanent, stationary loads, defined as weight of the structural member, weight of material of construction incorporated into the buildings to be supported permanently by the structural members, weight of partitions, and weight of permanent building mechanical service equipment. Weight of process equipment will be considered a live load.

Typical dead load allowance for lighting and sprinkler piping unless noted otherwise: 5 psf

Note that process piping, conduit and cable tray loads are accounted for in the superimposed dead load section.

Table 8-6. Design Material Densities

Steel, including stainless:	490 pcf
Aluminum:	168 pcf
Water:	62.4 pcf
Sludge:	65.5 pcf
Reinforced Concrete:	150 pcf, 135 pcf when used for uplift resistance
Concrete Masonry (normal weight CMU):	125 pcf (Density of the Units)
Clay Masonry	120 pcf
Compacted Soil, Moist	120 pcf to 125 pcf

8.3.2 Superimposed Dead Loads

Superimposed dead load will consist of an allowance for process piping, conduit, and cable tray loads.

Table 8-7. Design Dead Loads	
Roofs (except electrical and control rooms):	10 psf
Electrical and control room roofs:	30 psf
Process area elevated concrete floor:	50 psf (unless noted otherwise)
Elevated grating floors:	20 psf
Equipment platforms, walkways/catwalks:	10 psf

8.3.3 Live Loads

Live loads are loads produced by the use and occupancy of the building and include process equipment loads and associated concrete pads. Equipment loads and pads that obstruct the placement of the specified live load over their entire area do not have to be independently accounted for if they do not exceed the uniform design live load. Equipment loads will be those listed on the specified equipment's cut sheet multiplied by 1.5 to account for equipment weight variation and to allow for impact as required by ASCE 7, Article 4.6.3. Vibration will also be specifically considered in accordance with Section 8.6.5.

Table 8-8. Design Live Loads	
Roofs:	20 psf
Roof HVAC mechanical equipment areas:	150 psf
Process area slab-on-grade:	400 psf
Non-process area slab-on-grade:	100 psf
Electrical and control room floor:	300 psf
HVAC mechanical room floor:	150 psf
Process area elevated concrete floor:	300 psf
Elevated grating floors:	100 psf (foot traffic only)
Stairs, landings and exit ways:	100 psf
Equipment platforms, walkways/catwalks:	100 psf (other than exit ways)
Truck access areas:	AASHTO HL93 loading Use AASHTO Standard Specification for highway bridges for impact forces due to moving wheel loads
Monorails:	
Vertical	25% of hoist rated capacity
Transverse	2% of lifted load
Longitudinal	10% of lifted load
Bridge cranes (pendant operated):	
Vertical	15% of crane and load
Transverse	20% of trolley and load
Longitudinal	10% of maximum operating wheel loads
Hangers supporting floors and platforms:	33% of live and dead load

8.3.4 Snow Loads

All roof structures and building frames will be adequately designed for the required snow loads. Due consideration will be given to drifting, rain on snow loading, and the possible formation of ice dams resulting in ponding of water on uninsulated roofs.

Table 8-9. Design Snow Loads	
Ground snow load, pg:	10 psf
Minimum roof snow load:	12 psf
Snow Importance Factor Is:	1.1
Risk Category:	III

8.3.5 Wind Loads

Table 8-10. Design Wind Loads	
Nominal design 3 second gust wind speed, V:	110 mph
Exposure:	C
Risk Category:	III

8.3.6 Seismic Loads

Table 8-11. Design Seismic Loads	
0.2 Sec. Mapped Spectral Response, Ss:	0.273 g
1.0 Sec. Mapped Spectral Response, S1:	0.138 g
Site class:	C (estimated)
0.2 Sec. Design Spectral Response, SDS:	0.236 g (based on Site class C)
1.0 Sec. Design Spectral Response, SD1	0.138 g (based on Site class C)
Seismic Importance Factor Ie:	1.25

8.4 Geotechnical Information

The Geotechnical Report is pending as of this report. Modification of the design to incorporate the recommendation of the Geotechnical Report may be required. The Geotechnical Report will be incorporated as an Appendix into the PER as it becomes available. The following geotechnical information is an estimate.

8.4.1 Geotechnical Design Criteria

Table 8-12. Geotechnical Design Criteria	
Willow Footings	3,000 psf
Allowable Bearing Pressure	
Native Soil	3,000 psf
Bedrock	10,000 to 12,000 psf
Soil Friction Coefficient Resisting Sliding @ Foundations	0.3 (for newly paced soils 0.35 (for residual soils)
Modulus of Subgrade Reaction for Concrete Floor Slabs-on-Grade	100 pci

8.4.2 Lateral Earth Pressure

Unless indicated otherwise, design of all subgrade walls will use at-rest pressure. Where retaining wall design becomes excessive using at-rest pressure, the structural engineer may elect to use active pressure, taking into consideration the required wall movement necessary to establish the active condition. If required, passive pressure may be used in establishing a structure’s overall lateral stability to sliding but should not be used for sliding resistance for cantilever retaining walls, except when a key below the wall footing is utilized. When passive pressure is required for sliding resistance, the walls must be checked for this load condition. Geotechnical design parameters are summarized in Table 8-13.

Table 8-13. Geotechnical Design Parameters

Material	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Friction Angle	Earth Pressure Coefficient		
				At Rest K_0	Active K_a	Passive K_p
Newly Placed Fill and Existing Fill	120	130	28°	0.53	0.36	2.77
Residual Soils	130	135	28°	0.53	0.36	2.77
PWR	145	150	38°	0.38	0.24	4.20
Rock	175	175	42°	0.33	0.20	5.04

- Surcharge pressure, unless otherwise shown, use a minimum of 2-ft of earth for walls where vehicular loads come within H/2 of the wall. This surcharge pressure is limited to vehicles that are H10 loading or less. Contact the geotechnical engineer for the surcharge pressure from large cranes located next to facilities to remove equipment.

When below grade walls are subjected to seismic loads, the dynamic earth pressure will be used, as prescribed by the geotechnical report, and in accordance with the load combinations presented in ACI 350.3, Seismic Design of Liquid-Containing Concrete Structures.

8.5 Frost Depth

All foundations for buildings and other structures supporting settlement sensitive equipment will extend below the frost line or will be supported on non-frost susceptible structural fill down to the frost line. The design frost line for foundations will be 12-inches.

8.6 Design Criteria and Serviceability Considerations

8.6.1 Liquid Loads

Concrete walls that retain liquids (process liquids or groundwater) will be designed in accordance with ACI 350, Code Requirements for Environmental Engineering Concrete Structures.

To reduce the stresses in reinforcing steel, and therefore control the cracking of the concrete, ACI 350, Section 9.2.6 requires the use of the *environmental durability factor*, S_d, in calculating the required flexural reinforcement and the portion of shear resisted by reinforcing steel. The environmental durability factor is calculated using permissible reinforcing steel stresses, f_s, based on the service conditions of the concrete.

Environmental exposures are defined as:

- Normal environmental exposure: pH > 5, sulphates < 1000ppm
- Sever environmental exposure: pH ≤ 5, sulphates ≥ 1000 ppm

Consideration of the distribution of the reinforcing steel will also be made, as required by ACI 350, Section 10.6.

The following static load conditions will be considered:

- Overflow condition (liquid level at built-in overflow control elevation), without backfill, including environmental durability factor.

- Overtopping condition (liquid level at top of basin or channel walls), without backfill, without environmental durability factor.
- Backfill with flood groundwater elevation, tank empty, environmental durability factor.
- For multi-cell tank, consider any tank cell empty or full in any combination with or without backfill.

In addition to the static load cases above, walls subject to liquid loads will also be designed to resist seismic loads in accordance with ACI 350.3, Seismic Design of Liquid-Containing Concrete Structures.

8.6.2 Safety Factors

A safety factor of 1.5 should be used to resist overturning and sliding.

Safety factor against buoyant uplift will be a minimum of 1.25 for 100-year flood elevation and 1.10 for maximum flood elevation.

Resistance to uplift includes the dead weight of the structure and the column of soil above the footing extension. With confirmation from the geotechnical engineer, a soil wedge may be used if necessary to resist uplift forces. The angle of the soil wedge from vertical will be provided by the geotechnical engineer. The submerged weight of soil should be used below the water table. Use of side friction between soil and structure to resist buoyant uplift should be avoided.

8.6.3 Seismic Design of Non-Structural Components

Non-structural components refer to architectural, process related mechanical, mechanical (HVAC, plumbing, fire protection), electrical and instrumentation equipment and appurtenances. A structure's Seismic Design Category is the classification assigned based on its intended use and the severity of the design earthquake ground motion at the site. Depending on the seismic design categories (A-F) assigned to the structures, the building code provides specific requirements for bracing non-structural components in the structures. As part of this project, the seismic design categories of new and existing buildings requiring work will be determined based on-site accelerations assigned in the code, building use and site geotechnical data. Seismic design of non-structural components will be incorporated into the project in accordance with the building code requirements based on site specific geotechnical and building usage category information gathered during design.

8.6.3.1 Component Importance Factor

Based on ASCE 7-16, the importance factor (Ip) assigned to non-structural component is as follows:

- Fire protection sprinkler systems: Ip = 1.5
- Components which contain hazardous, toxic, or explosive material: Ip = 1.5
- Components inside or attached to a Risk Category IV structure: Ip = 1.5
- All other components: Ip = 1.0

8.6.3.2 Architectural Components

Level of seismic design required for architectural components:

- Seismic design category C and higher = Required

8.6.3.3 Mechanical and Electrical Components

Level of seismic design required for mechanical and electrical components:

- Seismic design category C = Required only if Ip = 1.5

8.6.4 Deflection

Maximum permissible deflections used for sizing structural elements will be as follows:

- Floors, concrete: Per ACI 318
- Floors, structural metal framed L/360 (LL only)
- Grated access platforms: L/240 (LL only)
- Roofs: L/240 (LL only)
- Beams, lintels, or slabs supporting masonry: L/720

8.6.5 Vibration

The effects of vibrations caused by mechanical and process equipment will be adequately mitigated by applying the following guidelines:

- Operating frequency, unbalanced loads, and design recommendations from equipment manufacturers will be considered in the design.
- To minimized resonance of the equipment with the structure, the structure will be designed so that the ratio of its natural frequency (fn) to the operating frequency (f) does not fall between 0.5 and 1.5. It is always preferable to “high-tune” (fn/f > 1.5) so that the equipment speed does not ramp up and down through resonance; however, this is not always achievable.
- Equipment will be mounted to concrete structures whenever feasible.
- Concrete pads/foundations will be provided with a mass equal to the greater of: 1) 10x the rotating mass of the equipment or 2) 3x the gross mass of the equipment.
- Vibration isolators or dampeners will be used when appropriate.
- Although the equipment load factor of 1.5, indicated in Section 1.4.3, need not be applied in analyzing equipment-induced vibration, an allowance of 15 percent will be used to account for equipment weight variation.

8.7 Design Approach

8.7.1 Existing and New Structures

The demolition, modification, and the construction of structures will be staged with the requirements of process mechanical to facilitate minimum disruption to the operations of the DCWRF.

8.7.2 New Screening Building

The New Screening Building will be a pre-engineered structural steel moment frame structure, with light gauge metal exterior. The building will be erected on top of Grit Tanks 3 and 4. The building columns will be anchored to the concrete that forms the walls and walking surface.

The existing Grit Tanks 3 & 4 will be modified to become four individual screening channels. A series of gates will be added to the screening channels. A reinforced concrete bulkhead will be designed at the existing influent channel between the existing grit tanks two and three.

The top of Grit Tanks 3 & 4 will be raised approximately three feet. The tanks, outside of the new channels, will be filled with a low strength light weight cementitious material. The additional weight of the grit tanks will be reviewed as it pertains to the soil bearing capacity, settlement, differential settlement, and the effects on the adjacent structures and channels.

The new screening channels will be covered with aluminum plates as part of the odor control program.

8.7.3 Headworks Grit Removal System

The grit removal system consists of an influent channel, three smaller channels that feed into a multi-cell tank that will contain grit removal equipment, and a weir that drops the liquid into an effluent channel. At the effluent channel wall, a diversion box will be added to allow the effluent to be directed to the EQ Basin. Below the influent channel is a grit pump room and pipe gallery.

The grit removal channels, multi-cell tanks, diversion box, and pump room will be constructed of reinforced concrete, per ACI-350. The pump room will extend beyond the influent channel to the south. At this location, an exterior aluminum floor hatch will be placed in the pump room roof/top slab to facilitate moving large equipment in and out of the room

The influent channel and the effluent channel will extend to the existing grit tank effluent channel, which will contain the screening effluent. The wall of the existing channel will be modified to allow the screening effluent to flow in and out of the grit removal system.

A series of gates will be added to the grit removal channels, the diversion box, and the existing grit tank effluent channel. The influent channel will be covered with a structural slab. The area between the smaller channels, that feed into the multi-cell tanks, will be filled with a low strength light weight cementitious material and covered with a slab.

The effluent channels, the smaller channels, the multi-cell tanks, and the diversion box will be covered with aluminum plates as part of the odor control program.

Currently, the foundation is assumed to be a shallow foundation: raft footing.

8.7.4 Existing Grit Tank Effluent Channel

The top of the existing grit tank effluent channel(s) is approximately 11.5' above grade. The top of the walls will be approximately the same elevation as the new grit removal system walls.

The area between the existing and new structures will be capped with a concrete slab. If the area is filled with granular material, the channel walls and base slab will be reviewed. The bending capacity will be determined to ensure the wall can resist the pressure. The channel base slab allowable bearing capacity and settlement will be evaluated. The evaluation will include the influence of the granular fill on the soil immediately adjacent to the channel. If the area is not filled with granular material, a structural slab will bridge between the two structures.

8.7.5 Headworks Screenings/Grit Processing Building

The Screenings/Grit Processing Building is a new structure that consists of two levels.

The lower level is the solids process room. The walls will be reinforced concrete, and the floor slab will be, approximately, at grade. The walls will be cast monolithically with the grit removal influent channel and the pump room roof and walls.

The upper floor will be divided into two rooms: the grit dewatering room and the electrical room. The partition will be a non-load bearing concrete masonry unit (CMU) wall. The exterior walls will be load bearing CMU with a clay masonry veneer. The floor system will be a concrete slab and beam assembly with a floor live load of 300 psf for the electrical room and the grit dewatering room. Floor openings will be provided, as needed, for the grit equipment. A set of light capacity jib cranes will be located adjacent to the grit equipment to facilitate equipment maintenance.

The roof system will consist of precast double tees. A set of large roof hatches will be located over the grit equipment.

Currently, the foundation is assumed to be a shallow foundation, spread footing on a stem wall.

8.7.6 Existing Filter Building

Process equipment will be changed within the existing filter building by adding RDTs in the place of the existing GBTs. The concrete floor over the thickened sludge well and the tunnel in the thickening room will be evaluated per the new equipment's maximum operating load.

Additional personnel doors can be installed as needed. Due to the moist environment and to facilitate washdown operations, the new door headers and jamb reinforcing will consist of removing the face shell of the CMU, installing jamb and header reinforcing, grouting, replacing the face shell, and applying a coating/painting system.

A three-ton monorail hoist will be incorporated into this room for the new RDT equipment. The existing precast roof structure's capacity is unknown. The new monorail hoist will be supported by the CMU walls and the roof system will provide lateral bracing to the monorail beam. The walls will be evaluated to determine their capacity and modified as required.

8.7.7 Digested Sludge Storage Tanks (DSSTs)

Several aluminum roof hatches will be added to the existing aluminum dome on each of the two existing digester tanks to accommodate new process equipment. To access the equipment, a set of aluminum stairs and landings will be provided directly adjacent to the tank perimeter. The stairs and landings will be designed for a 100 psf live load. For the design, the live load and the roof snow load will not act concurrently.

8.7.8 Biosolids Drying Facility

The biosolids drying facility will be a new structure. The structure will be a steel framed building with precast exterior walls. Roof assembly will consist of steel joist girders or wide flange beams, bar joists, and galvanized metal deck. Floor systems will be framed with either steel bar joists or wide flange steel beams with a metal and concrete deck. Partition walls will be either light gage metal studs with gypsum wall board or CMU. Currently, the foundation is assumed to be a deep foundation system, drilled concrete piles with concrete pile caps.

The building dimensions will be approximately 150' by 135' by 45' tall. A vehicle loadout structure will be attached to one of the shorter walls. This structure will be of similar construction as the BDF. The structure will be approximately 90' by 35' by 40' tall. Biosolids drying facility preliminary plan shown in Figure 8-1.

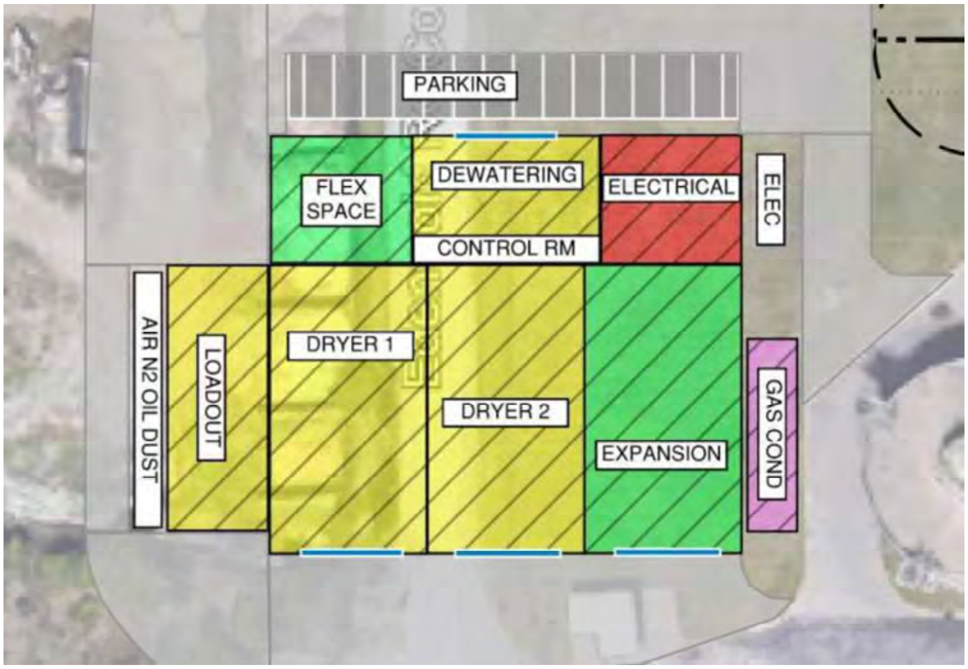

Figure 8-1. New Biosolids Drying Facility Preliminary Plan

Most of the BDF's footprint will be three large bays that will be dedicated to the drying equipment. The bays will be approximately 90' by 50'. Each bay will have a 20-ton bridge crane. The dryer area slab will be supported by deep foundation elements.

The remainder of the building will be dedicated to a control room, three levels of electrical rooms, three levels of dewatering equipment, and three levels of personnel rooms (flex space). This area will be approximately 150' by 45' and divided into three levels. Located in a sublevel, under the center part of this area, will be concrete tanks for feeding sludge and the water from the dewatering operations.

The electrical rooms will be approximately one third of the floor area and be located at one end of the building. Approximately one third of the floor area, located at the opposite end of the building from the electrical room, will be flex space. The middle third of this area will contain dewatering equipment and the control room. The control room will be on the third floor. The electrical rooms, control room, and dewatering area will be designed for a 300 psf live load. The flex space will be designed for a 100 psf live load.

The third-floor dewatering area will require a heavy concrete floor to mitigate equipment vibration. The third-floor dewatering area will have a 6-ton bridge crane and a designated permanent laydown area. The bridge crane will be able to move large dewatering equipment from the third floor down, through a series of floor openings, to the first floor. The laydown area will be located between the third floor opening and the dewatering equipment and be used during maintenance of the equipment. The laydown area will be visually identified and will be designed for a 400 psf live load.

8.7.9 Existing Chlorination Building

The existing Chlorination Building will be demolished down to the top of the floor slab. A load rating will be provided for the remaining slab on grade.

8.7.10 High Pressure Effluent Building

CCT 1 will be partially utilized as a wet well for the new HPE system. The new HPE building will be erected on top of existing CCT 1. The existing tank will be covered with a structural slab. Currently, all slabs in the HPE building will be designed for a 300 psf live load. The slab capacity at the pumps and chemical storage will be evaluated and revised as needed. The new slab will have, at least, two exterior aluminum floor hatches to allow access to the tank below.

CCT 1 has Pressure Relief Valves (PRV) that, when the tank is empty and there is high ground water, allow ground water into the tank. The PRVs were incorporated in the design to prevent the tanks from floating (buoyancy) during a high-water event (flooding). The tank will require periodical monitoring and draining of accumulated ground water.

The floor space will be divided into several areas: HPE pumps, effluent strainers, chemical storage tanks, chemical pumps, flow measurement, chemical injection, and an elevated electrical room.

The electrical partitions will be non-load bearing CMU walls. The exterior walls will be load bearing CMU with a clay masonry veneer. The roof diaphragm will be galvanized metal roof deck on galvanized bar joists.

The floor of the electrical room will be elevation 439.00. The electrical room will be accessible by an aluminum stair and landing.

The chemical storage tanks will be in the corner of the building along two exterior walls. A secondary containment vessel is required for the chemical storage tanks. Part of CCT 1, under the chemical storage tanks, will become a containment vessel. Reinforced concrete knee walls will be cast between the exterior tank walls and the baffle walls to form a tank. The floor slab will have a trench drain ringing the storage area with a piping system to deliver any spillage to the containment area.

The influent gate for CCT 1 will be removed, and the opening filled with reinforced concrete. The effluent weir wall will be filled with reinforced concrete.

Within the tank, a concrete wall will be placed between the end of the last baffle wall and the exterior wall near the effluent weir. The wall will isolate this area from the rest of the tank. This area will be the wet well for the HPE pumps. Below the effluent weir, a square opening will be made in the concrete wall and a slide gate installed over the opening to permit flow from the adjacent effluent channel to enter.

8.7.11 Existing Chlorine Contact Tank Number 2

The existing CCT 2 will be covered with a structural slab. The influent gate will be removed, and the opening filled with reinforced concrete. The effluent weir wall will be filled with reinforced concrete. The new slab will have, at least, two exterior aluminum floor hatches to allow access to the tank below. The slab will be designed for a 100 psf live load. For the design, the live load and the ground snow load will act concurrently.

CCT 2 has PRVs that, when the tank is empty and there is high ground water, allow ground water into the tank. The PRVs were incorporated in the design to prevent the tanks from floating (buoyancy) during a high-water event (flooding). The basin will require periodical monitoring and draining of accumulated ground water. Draining can be accommodated by maintaining the existing mud-valve (connected to the tank drain system) or by lowering portable sump pumps into the space.

8.7.12 Security Booth at Main Gate

The new security booth will be a pre-manufactured modular structure. The new structure will be on a shallow foundation, slab-on-grade with a turndown at the edges. Adjacent to the booth will be a car port consisting of steel moment frames with a metal deck, drilled foundation piers, and a slab-on-grade. The car port will be used by MWS security vehicles only.

Section 9

Architectural Design

This section addresses key architectural considerations and design criteria associated with the new structures to be constructed under this project.

9.1 Overall Site Architectural Approach

The architectural design of the buildings will incorporate a “Green Building” approach, in which recycled-content materials for construction, the use of natural lighting, and energy efficient systems and configurations will be incorporated into the design. In addition, materials will be evaluated for long-term durability and low maintenance. Strong, simple geometric building forms will contextually blend the New Screening Building, New Solids Processing Building, High Pressure Effluent Building, New Biosolids Drying Building and the New Main Gate Security Booth into the existing site.

9.2 New Buildings for This Project

The work for this project includes construction of the following new buildings.

- New Screening Building
- New Screenings/Grit Processing Building
- High Pressure Effluent Building
- New Biosolids Drying Facility
- Main Gate Security Booth

The architectural design considerations for each of these buildings is described in the following sections.

9.3 New Screening Building

9.3.1 Design Criteria

The New Screening Building is approximately 1,800 square feet with overall dimensions of 50-feet by 36-feet with a maximum building height of approximately 20-feet and will be constructed on top of the existing Grit Tanks 3 and 4. The single-story building configuration includes one open space for screenings equipment. The building will be a pre-engineered metal building with insulated metal wall and roof panels. Skylights will be provided on the roof for equipment removal and two overhead coiling doors will be provided on the south elevation for equipment access and repair. Multiple single doors will be incorporated for egress and building circulation. A third overhead coiling door will also be provided on the west elevation for equipment removal. Reference Figure 9-1 for 3D representation of the New Screening Building.

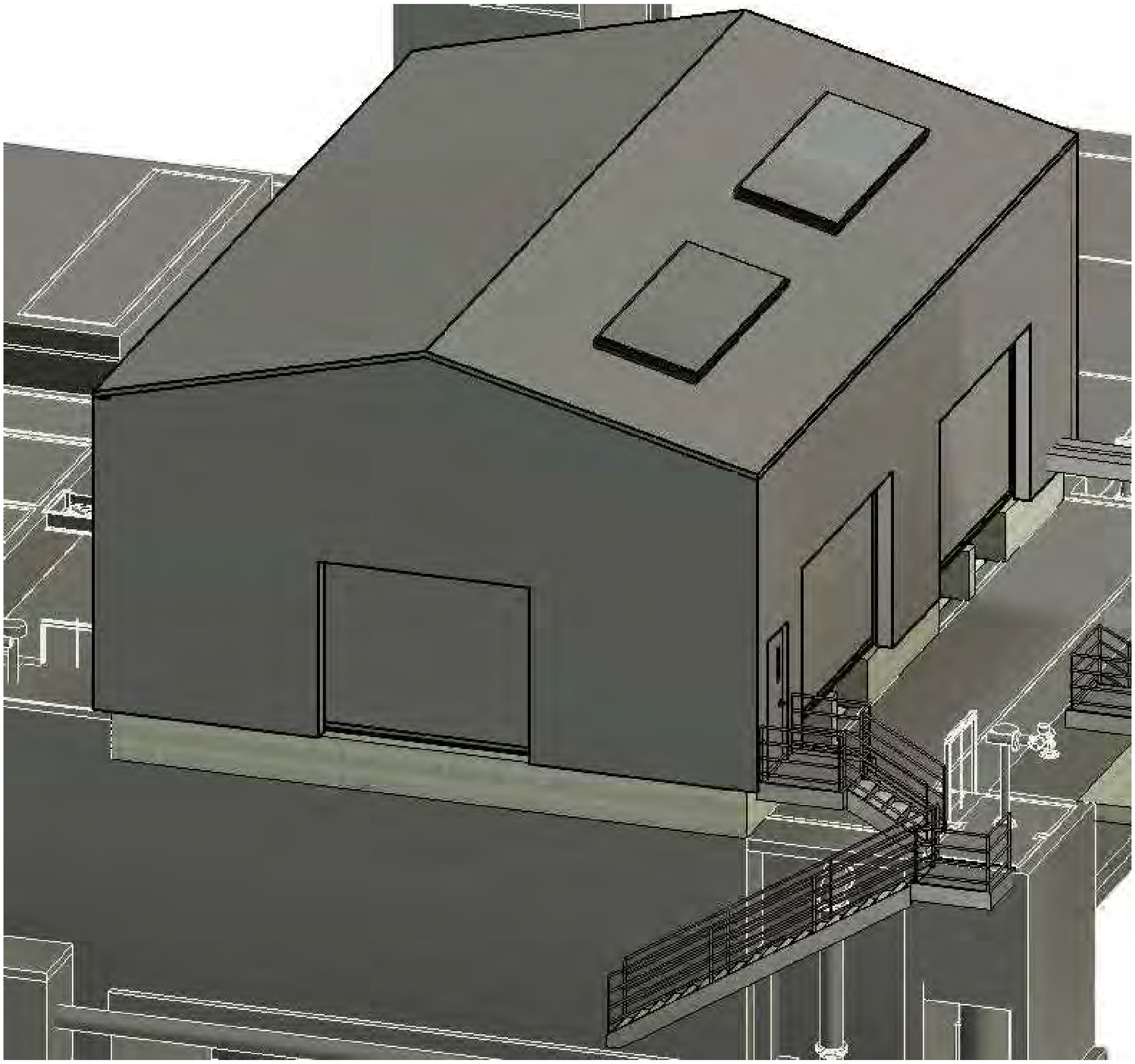

Figure 9-1. New Screening Building

9.3.2 Building Materials

The proposed building materials for the New Screening Building are outlined below:

- **Exterior Walls:** The exterior walls will be insulated metal panels (factory finished) fastened to the pre-engineered metal building girt system. The interior side of the exterior walls will incorporate a liner panel system fastened to the girts.
- **Roofing Systems:** The roof system will be insulated metal panels (factory finished) fastened to the pre-engineered metal building purlin system. The roof system will also integrate removable skylights for equipment removal. A lightning protection system will also be incorporated into the design.
- **Roof Drainage:** Gutter and downspouts will be provided. Downspouts will discharge into a below grade stormwater collection system. The gutters and downspouts will be factory finished.
- **Doors:** Single and double doors will be painted hollow metal doors and frames with vision panels.

- **Door Hardware:** Commercial-grade stainless-steel hardware (mortise locksets and latchsets, panic exit hardware, hinges, closers, overhead holders and stops, stripping and seals, and thresholds). Lever handles will be provided on all locks and latch sets. Panic exit devices will be incorporated on all egress doors. The exterior doors will also incorporate electronic hardware with card readers.
- **Louvers:** 6-inch aluminum louvers with a factory finish.
- **Handrails/Guardrails:** The handrails and two rail guardrail system will be clear anodized aluminum. The guardrail system will also incorporate toe-plates at the base of the rail system.
- **Fire and Safety Equipment:** Fire extinguishers and a first-aid cabinet will be provided.
- **Signage:** Building signs, room signs, pipe labels, equipment identification, and hazard and safety signs will be provided.
- **Floors:** General areas will be exposed concrete with a protective sealer.
- **Interior Wall Surfaces:** The interior side of the pre-engineered metal building will integrate a factory finished liner system installed on the building girt system as noted above. All primary framing steel framing will be galvanized steel.
- **Ceilings:** The underside of the insulated metal panel roof system will be painted with a factory finish and the exposed secondary framing purlin system will be painted on site.
- **Stairs:** The stair system where required will be aluminum with grating treads and landings.

9.4 New Screenings/Grit Processing Building

9.4.1 Design Criteria

The New Screenings/Grit Processing Building has a building footprint of approximately 3,808 square feet with overall dimensions of 56-feet by 68-feet with a maximum building height of approximately 40-feet and will be constructed south of the New Screening Building. The two-story building configuration will house the screenings sluiceways, screenings washer/compactors, and dumpsters for the dewatered screenings and grit on the first floor and the second floor will include a grit washing / dewatering area and a separate electrical room. The exterior of the building will include a cast-in-place concrete wall on the first floor and cavity wall construction with a brick veneer on the second floor. A composition of clerestory translucent windows will be integrated into the second-floor walls that will allow natural light to filter into the interior spaces. The building will be roofed with a flat roof that includes a perimeter parapet wall. The roof will also include removable skylights for equipment removal. A network of interior and exterior stairs will be provided for vertical circulation. Overhead coiling doors will be provided on the first floor for dumpster access and multiple single and double doors will be incorporated for egress and building circulation. Reference 9-2 for 3D representation of the New Screenings/Grit Processing Building.

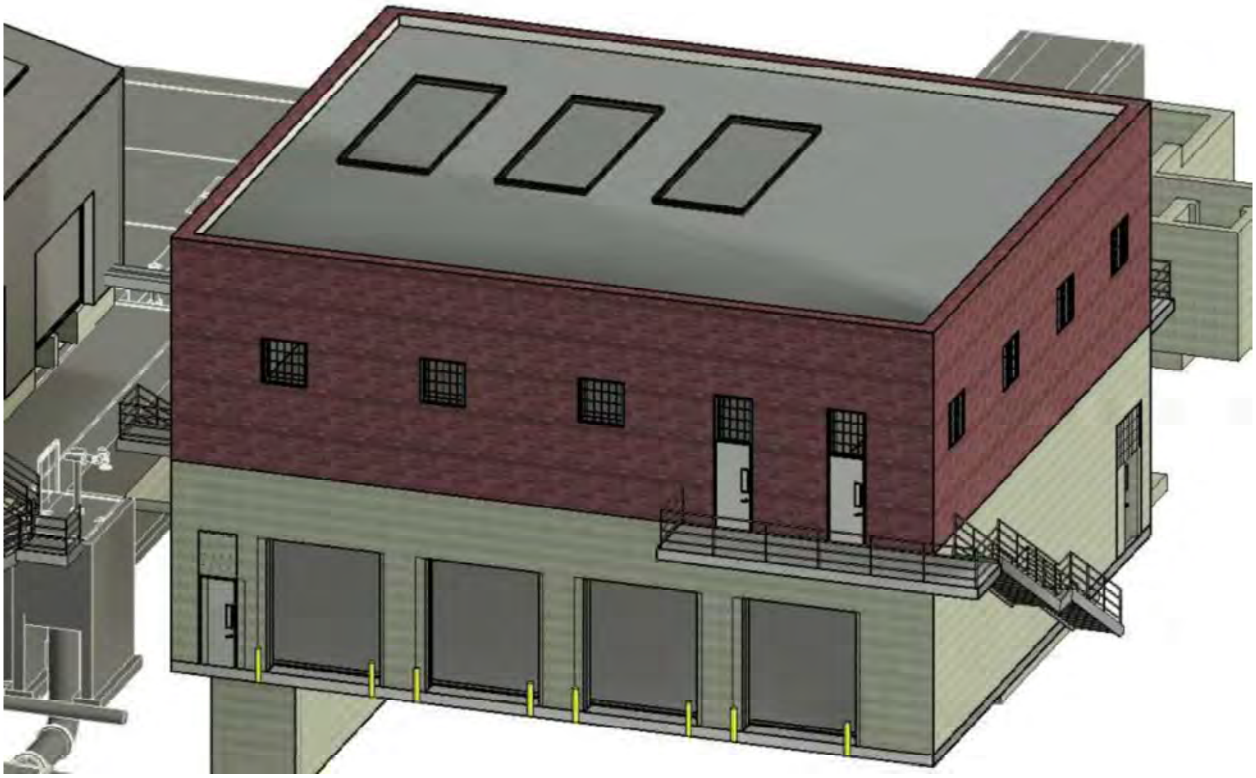

Figure 9-2. New Screenings/Grit Processing Building

9.4.2 Building Materials

The proposed building materials for the New Solids Processing Building are outlined below:

- **Exterior Walls:** The exterior walls for the first floor will be cast-in-place concrete with either a rubbed finish or a formliner finish and the second floor walls will be cavity wall construction (interior wall wythe will be concrete masonry units and the exterior wythe will be a brick veneer to match the existing UV Building). The exterior walls of the second floor will incorporate a composition of clerestory translucent windows.
- **Roofing Systems:** The roof system will consist of a single-ply membrane roofing system (20-year warranty) on tapered roof insulation (R-30). A lightning protection system will also be incorporated into the design.
- **Roof Drainage:** An internal roof drainage system will be provided.
- **Parapets:** The perimeter parapet will be capped with a metal coping system with a factory finish.
- **Doors:** Single and double doors will be painted hollow metal doors and frames with vision panels.
- **Overhead Coiling Doors:** The insulated steel doors will be electrically operated and will be factory finished and will incorporate additional weatherstripping.
- **Door Hardware:** Commercial-grade stainless-steel hardware (mortise locksets and latchsets, panic exit hardware, hinges, closers, overhead holders and stops, stripping and seals, and thresholds). Lever handles will be provided on all locks and latch sets. Panic exit devices will be incorporated on all egress doors. The exterior doors will also incorporate electronic hardware with card readers.

- **Louvers:** 6-inch aluminum louvers with a factory finish.
- **Handrails/Guardrails:** The handrails and two rail guardrail system will be clear anodized aluminum. The guardrail system will also incorporate toe-plates at the base of the rail system.
- **Fire and Safety Equipment:** Fire extinguishers and a first-aid cabinet will be provided.
- **Signage:** Building signs, room signs, pipe labels, equipment identification, and hazard and safety signs will be provided.
- **Floors:** The process areas on the first and second floors will be finished with a heavy-duty concrete topping. The concrete floor in the electrical room will be finished with a protective sealer.
- **Interior Wall Surfaces:** Exposed concrete walls and concrete masonry walls will be painted.
- **Ceilings:** The concrete slab and beam assembly above the first floor will be painted. The precast double tee roof system above the second floor will not be painted.
- **Stairs:** The stair system where required will be aluminum with grating treads and landings.

9.5 High Pressure Effluent Building

9.5.1 Design Criteria

The HPE Building is approximately 1,720 square feet with overall dimensions of 40-feet by 43-feet with a maximum building height of approximately 20-feet and will be constructed on top of the existing CCT 1. The single-story building configuration includes a process area, a chemical storage area, and an elevated electrical room. The exterior of the building incorporates cavity wall construction with a brick veneer and clerestory translucent windows that allow natural light to filter into the interior spaces, the building will be roofed with a flat roof that includes a perimeter aluminum gravel stop. Overhead coiling door access to the process area will be provided and multiple single doors will be incorporated for egress and building circulation

9.5.2 Building Materials

The proposed building materials for the HPE Building are outlined below:

- **Exterior Walls:** The exterior walls will be cavity wall construction (interior wall wythe will be concrete masonry units and the exterior wythe will be a brick veneer to match the existing UV Building). The exterior walls will also incorporate clerestory translucent windows.
- **Roofing Systems:** The roof system will consist of a single-ply membrane roofing system (20-year warranty) on tapered roof insulation (R-30). A lightning protection system will also be incorporated into the design.
- **Roof Drainage:** An internal roof drainage system will be provided.
- **Parapets:** A perimeter gravel stop system will be incorporated along the edge of the roof.
- **Doors:** Single and double doors will be painted hollow metal doors and frames with vision panels.
- **Overhead Coiling Doors:** The insulated steel doors will be electrically operated and will be factory finished and will incorporate additional weatherstripping.
- **Door Hardware:** Commercial-grade stainless-steel hardware (mortise locksets and latchsets, panic exit hardware, hinges, closers, overhead holders and stops, stripping and seals, and thresholds). Lever handles will be provided on all locks and latch sets. Panic exit devices will be incorporated on all egress doors. The exterior doors will also incorporate electronic hardware with card readers.

- **Louvers:** 6-inch aluminum louvers with a factory finish.
- **Handrails/Guardrails:** The handrails and two rail guardrail system will be clear anodized aluminum. The guardrail system will also incorporate toe-plates at the base of the rail system.
- **Fire and Safety Equipment:** Fire extinguishers and a first-aid cabinet will be provided.
- **Signage:** Building signs, room signs, pipe labels, equipment identification, and hazard and safety signs will be provided.
- **Floors:** General areas will be exposed concrete with a protective sealer. The chemical area will be finished with a chemical resistant concrete topping.
- **Interior Wall Surfaces:** Exposed concrete masonry walls will be painted.
- **Ceilings:** Exposed galvanized metal deck and galvanized bar joists will not be painted.
- **Stairs:** The stair system where required will be aluminum with grating treads and landings.

9.6 New Biosolids Drying Facility

9.6.1 Design Criteria

The New Biosolids Drying Facility has a building footprint of 23,400 square feet with overall dimensions of approximately 185-feet by 135-feet with a maximum building height of 45-feet and will be constructed in the northwest corner of the existing site.

The building is segmented into three distinct areas: The Dryer Area in the center of the building, the Loadout Area to the west, and the Multipurpose Area to the north.

- The Dryer Area of the building will be a composition of three single-story bays 50-feet by 90-feet by 45-feet tall and will house the dryer systems and equipment platforms.
- The Loadout Area of the building is a single-story bay 35-feet by 90-feet by 40-feet tall. The drive-through Loadout Area will be provided to store and offload dried product in silos.
- The Multipurpose Area is three-stories with a basement and is 150-feet by 45-feet by 45-feet tall. Each story is divided into three areas (flex area, process area, and electrical area).
  - The basement level will house the centrate feed well and pumping system.
  - The first floor (lower level) will accommodate personnel facilities (restrooms, lockers, and showers), dewatering process, and an electrical room.
  - The second floor (intermediate level) includes offices, break room, and storage, dewatering process, and an electrical room.
  - The third floor (upper level) will incorporate a laboratory area, control room, dewatering process, and an electrical room.
  - The Multipurpose Area will also include two stair towers and an elevator for vertical circulation.

The New BDF will be a steel framed building. The materials being evaluated for the cladding of the building include Architectural precast concrete, insulated metal wall panels, brick veneer or a composition of these materials. Clerestory translucent windows will be integrated into the exterior facades that will allow natural light to filter into the interior spaces. The building will be roofed with a flat roof that includes a perimeter parapet wall. Overhead coiling doors will be provided on the first floor for large equipment access and multiple single and double doors will be incorporated for egress and building circulation

9.6.2 Building Materials

The proposed building materials for the New Biosolids Drying Facility are outlined below:

- **Exterior Walls:** As noted above architectural precast concrete, insulated metal wall panels, brick veneer or a composition of these materials are being evaluated for the exterior cladding of the building. The exterior walls will incorporate a composition of clerestory translucent windows.
- **Roofing Systems:** The roof system will consist of a single-ply membrane roofing system (20-year warranty) on tapered roof insulation (R-30). A lightning protection system will also be incorporated into the design.
- **Roof Drainage:** An internal roof drainage system will be provided.
- **Parapets:** The perimeter parapet will be capped with a metal coping system with a factory finish.
- **Doors:** Single and double doors will be painted hollow metal doors and frames with vision panels.
- **Overhead Coiling Doors:** The insulated steel doors will be electrically operated and will be factory finished and will incorporate additional weatherstripping.
- **Door Hardware:** Commercial-grade stainless-steel hardware (mortise locksets and latchsets, panic exit hardware, hinges, closers, overhead holders and stops, stripping and seals, and thresholds). Lever handles will be provided on all locks and latch sets. Panic exit devices will be incorporated on all egress doors. The exterior doors will also incorporate electronic hardware with card readers.
- **Louvers:** 6-inch aluminum louvers with a factory finish.
- **Handrails/Guardrails:** The handrails and two rail guardrail system will be clear anodized aluminum. The guardrail system will also incorporate toe-plates at the base of the rail system.
- **Fire and Safety Equipment:** Fire extinguishers and a first-aid cabinet will be provided.
- **Signage:** Building signs, room signs, pipe labels, equipment identification, and hazard and safety signs will be provided.
- **Floors:** The process area floors will be finished with a concrete hardener. The concrete floor in the electrical rooms will be finished with a protective sealer. The floor finishes for the flex area will be presented once the design for each of the areas has been developed.
- **Interior Walls and Surfaces:** Exposed concrete walls, concrete masonry walls and steel frame will be painted. The gypsum wallboard walls in the flex areas will be painted. The restrooms, lockers, and showers areas will incorporate ceramic wall tile.
- **Ceilings:** The concrete ceilings in the process areas will be painted. The galvanized metal deck and steel framed roof system will be painted. The flex area ceilings will incorporate an acoustical lay-in ceiling system.
- **Stairs:** The stair system where required will be aluminum with grating treads and landings.

9.7 Main Gate Security Booth

9.7.1 Design Criteria

The Main Gate Security Booth will be a pre-manufactured modular structure. Contiguous to the Main Gate Security Booth will be a free-standing canopy with a standing seam metal roofing system to accommodate security vehicles.

9.8 Applicable Codes and Standards

The building code is intended to provide minimum requirements to safeguard the public health, safety, and general welfare of the occupants of new and existing buildings and structures. The code also addresses structural strength, means of egress, sanitation, adequate ventilation and lighting, energy conservation, and life safety as they relate to new and existing buildings, facilities, and systems.

In general, the provisions of the building code apply to the construction, alteration, movement, addition, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

The following are building codes referenced for the Preliminary Engineering Report:

Governing codes and standards:

- IBC: International Building Code, 2018
- NFPA 1: Fire Code, 2018
- NFPA 70: National Electrical Code, 2017
- IECC: International Energy Conservation Code, 2018
- NFPA 101 – Life Safety Code
- NFPA 820 – Standard for Fire Protection in Wastewater Treatment Collection Facilities
- 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design

Table 9-1 summarizes the International Building Code (IBC) criteria for the new Headworks Screening Building.

Table 9-1. International Building Code Criteria

Item	Design Criteria	International Building Code
Use and Occupancy Classification	Low-Hazard Factory Industrial Group F-2	IBC, Section 306.1
Type of Construction	Type II-B (non-sprinklered)	IBC, Table 601
Allowable Area	Allowable Height: 55 feet *Actual Height: 20 feet* Allowable stories: Three stories (3) *Actual stories: One Story (1)* Allowable Area: 23,000 SF *Actual Area: 1,800 SF*	IBC, Table 504.3 IBC, Table 504.4 IBC, Table 506.2
Occupant Load	Occupant Load Factor = 300 / Occupant Load = 6 Occupants	IBC Table 1004.5
Maximum Distance to Exit	300 feet	IBC Table 1017.2

Table 9-2 summarizes the IBC criteria for the New Solids Processing Building.

Table 9-2. International Building Code Criteria		
Item	**Design Criteria**	**International Building Code**
Use and Occupancy Classification	Low-Hazard Factory Industrial Group F-2	IBC, Section 306.1
Type of Construction	Type II-B (non-sprinklered)	IBC, Table 601
Allowable Area	Allowable Height: 55 feet *Actual Height: 40 feet* Allowable stories: Three stories (3) *Actual stories: Two Stories (2)* Allowable Area: 23,000 SF *Actual Area: 3,808 SF*	IBC, Table 504.3 IBC, Table 504.4 IBC, Table 506.2
Occupant Load	Occupant Load Factor = 300 / Occupant Load = 13 Occupants	IBC Table 1004.5
Maximum Distance to Exit	300 feet	IBC Table 1017.2

Table 9-3 summarizes the IBC criteria for the High Pressure Effluent Building.

Table 9-3. International Building Code Criteria		
Item	**Design Criteria**	**International Building Code**
Use and Occupancy Classification	Low-Hazard Factory Industrial Group F-2	IBC, Section 306.1
Type of Construction	Type II-B (non-sprinklered)	IBC, Table 601
Allowable Area	Allowable Height: 55 feet *Actual Height: 20 feet* Allowable stories: Three stories (3) *Actual stories: One Story (1)* Allowable Area: 23,000 SF *Actual Area: 1,720 SF*	IBC, Table 504.3 IBC, Table 504.4 IBC, Table 506.2
Occupant Load	Occupant Load Factor = 300 / Occupant Load = 6 Occupants	IBC Table 1004.5
Maximum Distance to Exit	300 feet	IBC Table 1017.2

Table 9-4 summarizes the IBC criteria for the New Biosolids Drying Facility.

Table 9-4. International Building Code Criteria		
Item	**Design Criteria**	**International Building Code**
Use and Occupancy Classification	Business Group B Low-Hazard Factory Industrial Group F-2	IBC, Section 304.1 IBC, Section 306.1
Type of Construction	Type II-B (sprinklered)	IBC, Table 601
Allowable Area	Group B	IBC, Table 504.3

Table 9-4. International Building Code Criteria		
Item	**Design Criteria**	**International Building Code**
	Allowable Height: 75 feet *Actual Height: 45 feet* Group F-2 Allowable Height: 75 feet *Actual Height: 45 feet*	
	Group B Allowable stories: Four stories (4) *Actual stories: Three Story (3)* Group F-2 Allowable stories: Four stories (4) *Actual stories: Three Story (3)*	IBC, Table 504.4
	Group B Allowable Area: 69,000 SF *Actual Area: 2,025 SF* Group F-2 Allowable Area: 69,000 SF *Actual Area: 21,375 SF*	IBC, Table 506.2
Occupant Load Group B Occupant Load Group F-2	Occupant Load Factor = 150 / Occupant Load = 41 Occupants Occupant Load Factor = 300 / Occupant Load = 119 Occupants	IBC Table 1004.5
Maximum Distance to Exit Group B Maximum Distance to Exit Group F-2	300 feet 400 feet	IBC Table 1017.2

Table 9-5 summarizes the fire resistance rating criteria for the New Screening Building, New Solids Processing Building, High Pressure Effluent Building, and the New Biosolids Drying Facility.

Table 9-5. Fire-Resistance Rating Requirements For Building Elements Type II-B – Table 601	
Building Element	**Rating (Hours) (1)**
Primary Structural Frame (3)	0
Bearing Walls Exterior	0
Bearing Walls Interior	0
Non-Bearing Walls and Partitions Exterior	0
Non-Bearing Walls and Partitions Interior	0
Floor Construction and Associated Secondary Members	0
Roof Construction and Associated Secondary Members	0

Fire Alarm and Detection Systems and Fire Suppression Systems for each building will be provided in accordance with the International Building Code and NFPA 820.

Section 10

Building Mechanical Systems

This section outlines the various building mechanical support systems and basis of design information used during the detailed design phase.

10.1 HVAC Systems

10.1.1 General

The various new facilities will have HVAC systems (only heating/ventilation in some locations) that will operate in conjunction with the odor control systems discussed in Section 2. In general, the facilities will use powered supply and exhaust systems. Air exhaust through the odor control system will be at a higher rate than the supply air to keep the buildings under slight negative pressure. The amount of ventilation used will be dependent upon NFPA 820 and the associated desired electrical classification without changing the classification status. For non-process areas, airflow rates will be dictated by applicable building codes and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards.

The project will be designed to comply with applicable portions of the codes and standards listed in Table 10-1 and any local codes and amendments.

Table 10-1. Typical Codes and Standards for HVAC Design

Code	Description
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
OSHA	U.S. Department of Labor Occupational Safety and Health Administration
NEC	National Electrical Code
NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air and Air-Conditioning Systems
NFPA 820	Standard for Fire Protection in Wastewater Treatment
SMACNA	Sheet Metal and Air Conditioning Contractors Association
IBC	International Building Code
IFC	International Fire Code
IMC	International Mechanical Code
IPC	International Plumbing Code
IECC	International Energy Conservation Code
UL	Underwriters Laboratories

10.1.2 Overall HVAC Design Criteria

Table 10-2 lists the outdoor design conditions that will be used for this project. Also included in the table are the 10-year extreme temperatures based upon ASHRAE weather design data.

Table 10-2. Outdoor Design Conditions

Outside Design Conditions		Notes
Weather Data	ASHRAE, 2021 Fundamentals	WMO: 723270, Nashville, TN
Winter Design Temperature	14.9°F dry bulb	99.6% ASHRAE design temperature
Winter Design (extreme)	2.0°F dry bulb	N=10 years. ASHRAE Extreme
Summer design temperature	94.4°F dry bulb, 74.7°F wet bulb	0.4% ASHRAE design temperature
Summer Design (extreme)	102.2°F dry bulb, 82.0°F wet bulb	N=10 years. ASHRAE Extreme

The summer and winter inside design temperatures for the various areas are listed in Table 10-3.

Table 10-3. Indoor Design Conditions

Location	Winter	Summer	Notes
Electrical Rooms (MCC or switchgear)	65°F	75°F	Positive pressure and air purification where needed, Electric Unit heater to provide heating
Mechanical Rooms	65°F	Ambient condition, ventilation only	Mechanical cooling will be considered as needed
Process Areas	50°F	Ambient condition, ventilation only	Negative pressure, no recirculation
Administration/Laboratory/Control Rooms/Main Security Booth	70°F	75°F	Positive pressure and air purification where needed, Electric Unit heater to provide heating
Restrooms	68°F	Ambient condition, ventilation only	Mechanical cooling is admin areas only

All process mechanical and electrical equipment will be specified to operate properly in the environmental conditions where they are located.

10.2 HVAC Basis of Design

The following sections present the HVAC design concepts for each of the major areas.

10.2.1 Existing Headworks Facility

10.2.1.1 New Screening Building and New Screenings Processing Room

The screening building will be provided to house the new screens and screening conveyance. The new screen room will be provided with primary and secondary ventilation systems. The primary system will continuously ventilate and heat the entire area at a minimum of 3 ACH to minimize energy requirements when staff are not present in the space. The ventilation system will circulate outside fresh air provided via makeup air unit (MAU) through a system of FRP ductwork to distribute air evenly across the room. The supply air will be filtered and heated via a MAU that is equipped with electric heater and filter. Similarly, exhaust air will be picked up through a series of ductwork at each level and exhausted outside via a constant-speed, FRP inline exhaust air fan (EAF).

The screenings processing room will contain an area for capturing/storing solids for transport via a dumpster room. Although the screenings dumpster room will be physically separated from the screening areas, supply air to this room will be provided by the primary screening area MAU for continuous ventilation of this area also. The primary MAU and makeup air unit will be sized to provide a ventilation rate of 12 ACH for minimizing the odors in this area. Exhaust air will be delivered through the series of ductwork to the odor control system supply fans described in Section 4.

When staff are present in the space, the ventilation rate will be increased to 12 ACH. Supplemental air will be provided via a secondary Supply Air Fan (SAF) and EAF system sized for 9 ACH. Similar to the primary system, a disposable filter will be provided for the SAF and FRP construction will be provided for both the fans and ductwork.

The control strategy for the system will be generally as follows:

- The primary screenings area supply fan will be controlled by fan “ON-OFF” switch and will operate continuously.
- The secondary supply fan will be controlled by fan switch located at each entrance to the screening area on the upper level of the structure and will operate when someone enters the space.
- The secondary exhaust fan will be provided with “HAND-OFF-AUTO” switch and operate in AUTO mode and will be interlocked with the primary supply fan.
- Both primary and secondary fans will be monitored by the DCS
- A combustible gas detection system will be utilized

10.2.1.2 Grit Dewatering Room and Grit Pump Room

The Grit Dewatering Room and Grit Pump Room will be provided with primary ventilation systems. The primary system will continuously ventilate and heat the entire area at a minimum of 12 ACH. The ventilation system will circulate outside fresh air provided via makeup air unit (MAU) through a system of FRP ductwork to distribute air evenly across the room. The supply air will be filtered and heated via a MAU that is equipped with electric heater and filter. Similarly, exhaust air will be picked up through a series of ductwork at each level and exhausted outside via a constant-speed, FRP inline exhaust air fan (EAF).

The control strategy for the system will be generally as follows:

- The ventilation system will operate continuously and be monitored as defined by NFPA 820, including PLC/DCS monitoring for the operating status of each fan, air flow, outside ambient temperature and smoke detection.
- The air handling unit will operate at high speed when outdoor air temperature is above 50 degrees F or someone enters the room.
- Whenever the outdoor air temperature is 50°F or lower the air handling unit will operate at low speed (50 percent speed) as permitted by NFPA 820 to reduce heating cost.
- The exhaust will be interlocked with air handing unit supply fan and will operate at high speed when air handling unit is operating at high speed and operate at low speed when air handling unit is operating at low speed.
- Each entrance to the space will be provided with a “Go/No-Go” panel (Local control Station – LCS) to indicate safe/not safe to enter (Green “Go” indicator light – safe to enter; Red “No-Go” indicator light – Not safe to enter).
- Inside the room an alarm horn and beacon will be provided to alert personnel of ventilation system failure and that evacuation should take place immediately.

10.2.1.3 Electrical Room and Mechanical Room

The electrical room will be air conditioned and heated. An HVAC system including two air handling units at 100 percent capacity complete with economizers and two matching condensing units will be used. These systems will be required to maintain the indoor design conditions specified previously in Table 9-4. The outdoor condensing units are exposed to humid and corrosive air, so the condensing units will be provided with special corrosion resistant coatings such as heresite or similar coating processes. In addition to mechanical cooling, an air purification unit and pressurization unit will be provided in the electrical room to keep the room under positive pressure and minimize the infiltration of corrosive air. The humidity will be controlled via cooling. The humidity will be controlled via cooling. The electric unit heater will provide heating for the electrical room, though little heating is anticipated.

The control strategy for the system will be generally as follows:

- The electrical room cooling will be controlled by wall mounted room thermostat for each air handling unit.
- The cooling will be set at 83°F for air handling unit 1 and 85°F for air handling unit 2.
- The electric unit heater located in the electrical room will be controlled by wall mounted room thermostat and set at 65°F for heating.

The mechanical room will be ventilated and heated only unless the Owner specifically requests mechanical cooling.

10.2.2 High Pressure Effluent Building

10.2.2.1 HPE Pump, Strainer, and Chemical Room

The HPE room will be ventilated based on the IMC. Based upon room temperature, increased ventilation rates will be considered. The ventilation system will circulate outside fresh air provided by variable speed air handling units through a system of ductwork to distribute air evenly across each level. Each drywell will be provided with an air handling unit with V-bank disposable filter to supply air. The outdoor air and the drywell will be heated via an electric duct heater. Similarly, exhaust air will be picked up through a series of ductwork at each level and exhausted outside via variable-speed inline EAF.

The control strategy for the system will be generally as follows:

- The ventilation system will operate continuously and be monitored as defined by the IMC, including PLC/DCS monitoring for the operating status of each fan, air flow, outside ambient temperature and smoke detection.
- The air handling unit will operate at high speed when outdoor air temperature is above 50°F or someone enters the HPE room.
- Whenever the outdoor air temperature is 50°F or lower the air handling unit will operate at low speed (50 percent speed) as permitted by the IMC to reduce heating cost.
- The exhaust will be interlocked with air handing unit supply fan and will operate at high speed when air handling unit is operating at high speed and operate at low speed when air handling unit is operating at low speed.
- Each entrance to the space will be provided with a “Go/No-Go” panel (Local control Station – LCS) to indicate safe/not safe to enter (Green “Go” indicator light – safe to enter; Red “No-Go” indicator light – Not safe to enter).
- Inside the room an alarm horn and beacon will be provided to alert personnel of ventilation system failure and that evacuation should take place immediately.

10.2.2.2 Electrical Room and Mechanical Room

The electrical room will be air conditioned and heated. A split system including two air handling units at 50 percent capacity and two matching condensing units and air purification unit will be used. These systems will be required to maintain the indoor design conditions specified previously in Table 9-4. The outdoor condensing units are exposed to humid and corrosive air, so the condensing units will be provided with special corrosion resistant coatings such as heresite or similar coating processes. In addition to mechanical cooling, an air purification unit and pressurization unit will be provided in the electrical room to keep the room under positive pressure and minimize the infiltration of corrosive air. The electric unit heater will provide heating for the electrical room. The ceiling exhaust fan will be provided for rest room exhaust. The wall mounted electric unit heater will provide for heating for the restroom.

The control strategy for the system will be generally as follows:

- The electrical room cooling will be controlled by wall mounted room thermostat for each air handling unit.
- The cooling will be set at 73°F for air handling unit 1 and 75°F for air handling unit 2.
- The air purification unit which will be located in the electrical room will be controlled by ON-OFF switch and will operate continuously.
- The electric unit heater located in the electrical room will be controlled by wall mounted room thermostat and set at 65°F for heating.
- The restroom exhaust fan will be controlled by light switch.
- The wall mounted electric heater in the restroom will be controlled by an integral thermostat.

The mechanical room will be ventilated and heated only unless the Owner specifically requests mechanical cooling.

10.2.3 New Biosolids Drying Facility (BDF)

10.2.3.1 Dryer and Dewatering Area

The Dryer and Dewatering Areas will be ventilated based on the IMC. Based upon room temperature, increased ventilation rates will be considered. The ventilation system will circulate outside fresh air provided by variable speed air handling units through a system of ductwork to distribute air evenly across each level. Each area will be provided with an air handling unit with V-bank disposable filter to supply air. The outdoor air and the drywell will be heated via an electric duct heater. Similarly, exhaust air will be picked up through a series of ductwork at each level and exhausted outside via variable-speed inline EAF.

The control strategy for the system will be generally as follows:

- The ventilation system will operate continuously and be monitored as defined by IMC, including PLC/DCS monitoring for the operating status of each fan, air flow, outside ambient temperature and smoke detection.
- The air handling unit will operate at high speed when outdoor air temperature is above 50°F or someone enters the dryer and dewatering rooms.
- Whenever the outdoor air temperature is 50°F or lower the air handling unit will operate at low speed (50 percent speed) as permitted by IMC to reduce heating cost.
- The exhaust will be interlocked with air handing unit supply fan and will operate at high speed when air handling unit is operating at high speed and operate at low speed when air handling unit is operating at low speed.

- Each entrance to the space will be provided with a “Go/No-Go” panel (Local control Station – LCS) to indicate safe/not safe to enter (Green “Go” indicator light – safe to enter; Red “No-Go” indicator light – Not safe to enter).
- Inside the room an alarm horn and beacon will be provided to alert personnel of ventilation system failure and that evacuation should take place immediately.

10.2.3.2 Electrical Room, Mechanical Room, and Administration

The electrical room, mechanical room and restroom will be air conditioned and heated. An HVAC system including two air handling units at 100 percent capacity complete with economizers and two matching condensing units will be used. These systems will be required to maintain the indoor design conditions specified previously in Table 9-4. The outdoor condensing units are exposed to humid and corrosive air, so the condensing units will be provided with special corrosion resistant coatings such as heresite or similar coating processes. In addition to mechanical cooling, two air purification units and pressurization units will be provided in the electrical room to keep the room under positive pressure and minimize the infiltration of corrosive air. The humidity will be controlled via cooling. The electric unit heater will provide heating for the electrical room. The ceiling exhaust fan will be provided for rest room exhaust. The wall mounted electric unit heater will provide for heating for the restroom.

The control strategy for the system will be generally as follows:

- The electrical room cooling will be controlled by wall mounted room thermostat for each air handling unit.
- The cooling will be set at 73°F for air handling unit 1 and 75°F for air handling unit 2.
- The electric unit heater located in the electrical room will be controlled by wall mounted room thermostat and set at 65°F for heating.
- The restroom exhaust fan will be controlled by a light switch.
- The wall mounted electric heater in the restroom will be controlled by an integral thermostat

The mechanical room will be ventilated and heated only unless the Owner specifically requests mechanical cooling.

The Administration area will be heated and cooled via heat pump mini-split systems. Ventilation air will be provided to occupied areas as required by the local building and mechanical codes.

Table 10-4 provides a general summary and additional information relative to the anticipated approach to HVAC for the various areas.

Table 10-4. Preliminary HVAC Considerations

Area	Air Conditioning	Heating	Odor Control	Ventilation[1]	
				Continuous	Intermittent
Influent Channel	N/A	N/A	✓	See Remark 2	See Remark 2
Influent Screen Equipment Enclosures	N/A	N/A	✓	See Remark 3	See Remark 3
Screens and Screenings Handling Area	N/A	✓[4]	N/A	3 ACH	9 ACH
Screenings Processing Room	N/A	✓	✓	12 ACH	---
Grit Dewatering Room	N/A	✓	N/A	---	---
Grit Pump Room	N/A	✓	N/A	---	---
Biosolids Dryers/Dewatering/Conveyance	N/A	✓	✓	6 ACH	---

Table 10-4. Preliminary HVAC Considerations

Area	Air Conditioning	Heating	Odor Control	Ventilation[1]	
				Continuous	Intermittent
Biosolids Dewatering Feed Well/Polymer Storage	N/A	✓	N/A	6 ACH	---
Biosolids Pellet Off-Loading	N/A	✓	✓	6 ACH	---
HPE Pump/Strainer/Chemical Storage Room	N/A	✓	N/A	See Remark 8	---
Administration Rooms	✓	✓	N/A	---	---
Electrical Rooms	✓	✓	N/A	See Remark 5	---
Mechanical Rooms	N/A	✓	N/A	N/A	---
Restrooms	N/A	✓	N/A	N/A	---
Main Security Booth	✓	✓	N/A	---	---

Remarks:

1. *ACH - Air changes per hour.*
2. *Influent channel ventilation rate will be based upon an average leakage rate across the entire influent channel area equal to 0.5 cfm per square foot.*
3. *Influent screen enclosure ventilation will be as specified in Section 2.*
4. *Heating requirements for screen and screenings handling areas will be based upon the continuous ventilation rate listed only.*
5. *Electrical room will be air conditioned. Air will be dehumidified by cooling. No additional humidity controls will be provided.*
6. *The odor control system will be sized for the continuous ventilation rate listed only. See Section 2.3.6 for additional discussion on odor control systems. Supplemental ventilation will be exhausted to atmosphere.*
7. *Intermittent ventilation will be activated by door switch when someone is entering the space.*
8. *Ventilation will be provided per IFC and IMC requirements.*

10.2.4 Existing Filter Building

10.2.4.1 Gravity Belt Thickener Room (existing)

The existing GBTs will be converted to RDTs. Exhaust air connections at the RDTs will be ducted to the odor control system. The conversion of open GBTs to enclosed RDTs may reduce the overall airflow into the building. Brown and Caldwell will evaluate the required airflow rates and provide ventilation and heating as required for the new space conditions and equipment. Additionally, BC will evaluate the required airflow during the summer to meet the indoor design conditions mentioned for process spaces. Unless specifically directed to do so, mechanical cooling systems will not be provided.

10.2.4.2 Rotary Drum Thickener Room (new)

The updated RDT room will be continuously ventilated and heated at a rate of 12 ACH. The ventilation system will circulate outside fresh air provided by variable speed air handling units through a system of ductwork to distribute air evenly across each level. Each drywell will be provided with an air handling unit with V-bank disposable filter to supply air. The outdoor air and the drywell will be heated via an electric duct heater. Similarly, exhaust air will be picked up through a series of ductwork at each level and exhausted outside via variable-speed inline EAF.

The control strategy for the system will be generally as follows:

- The ventilation system will operate continuously and be monitored as defined by NFPA 820, including PLC/DCS monitoring for the operating status of each fan, air flow, outside ambient temperature and smoke detection.

- The air handling unit will operate at high speed when outdoor air temperature is above 50°F or someone enters the GBT room.
- Whenever the outdoor air temperature is 50°F or lower the air handling unit will operate at low speed (50 percent speed) as permitted by NFPA 820 to reduce heating cost.
- The exhaust will be interlocked with air handing unit supply fan and will operate at high speed when air handling unit is operating at high speed and operate at low speed when air handling unit is operating at low speed.
- Each entrance to the space will be provided with a "Go/No-Go" panel (Local control Station – LCS) to indicate safe/not safe to enter (Green "Go" indicator light – safe to enter; Red "No-Go" indicator light – Not safe to enter).
- Inside the room an alarm horn and beacon will be provided to alert personnel of ventilation system failure and that evacuation should take place immediately.

10.2.5 Main Gate Security Booth

The Main Gate Security Booth will be heated and cooled with a mini-split heat pump system. Natural ventilation is assumed to be adequate (leakage at windows, doors, etc.), but a direct ventilation connection to the equipment will be considered once more is known about the space and occupancy.

10.3 Plumbing and Plant Water Systems

The plant is currently served by both potable water (from City) and plant water (secondary treatment process effluent). For identification purposes, the Table 10-5 summarizes the naming conventions used on the Drawings.

Table 10-5. Water Supply Piping Naming Conventions

Piping Naming Convention	Description
PW	Potable Water
HPE	High Pressure Effluent
TW	Tepid Water (potable, for emergency fixtures)

New processes included with the DCWRF Expansion design will add water demands on both the existing PW and HPE systems. Tables 10-6 provides a summary of PW demands of the major water usages for the facilities included under this project. Refer to Section 6 for HPE sources and demands.

Table 10-6. New PW Demands

Process Area	Equipment/Area	Quantity	Flow Demand (GPM)	Type of Use	Supply Pressure (PSI)	Connection Size/Type	Description
Headworks Facility	Outside Fire HF	2	1000	Intermittent	95	8	
Biosolids Drying Facility	Restroom - Sink	TBD	2.2	Intermittent	60	1" - NPT	
	Restroom - Toilet	TBD	1.6	Intermittent	60	1" - NPT	
	Laboratory Sinks	TBD	2.2	Intermittent	60	1" - NPT	
	Laboratory Emergency Eyewash	TBD	25	Intermittent	60	1" - NPT	Tepid Water

Table 10-6. New PW Demands

Process Area	Equipment/Area	Quantity	Flow Demand (GPM)	Type of Use	Supply Pressure (PSI)	Connection Size/Type	Description
	Locker Room Showers	TBD	2.2	Intermittent	60	1" - NPT	
	Outside Fire HF	2	1000	Intermittent	95	8	
HPE Building	Emergency Shower/Eyewash Station	1	25	Intermittent	60	1" - NPT	Tepid Water

Note: Quantities to be determined during detailed design.

Planned improvements include providing additional PW and HPE piping and isolation valves to create additional redundancy within the systems. The plant water improvements include new NPW and PW loops around the Biosolids Facility and connected to the existing PW/HPE. Tie-in locations for new piping to route plant water to proposed areas with the Expansion project will be coordinated with the overall plant water system rehabilitation.

The project will be designed to comply with applicable portions of the codes and standards listed in Table 10-7.

Table 10-7. Codes and Standards for Plumbing

Code	Description
IBC	International Building Code
IPC	International Plumbing Code
IECC	International Energy Conservation Code
OSHA	U.S. Department of Labor Occupational Safety and Health Administration
UL	Underwriters Laboratories
ANSI, Z358.1	American National Standards Institute, Standard for Emergency Eyewashes and Shower Equipment
PDI	Plumbing and Drainage Institute
AWWA	American Water Works Association

10.3.1 Tepid Water

Tepid water (TW), as required by the International Plumbing Code, and as defined by ANSI/ISEA Z358.1-2014 will be provided for all new emergency showers and fixtures. Tepid water is defined as water in the temperature range of 60°F – 100°F. Brown and Caldwell designs TW systems for 80°F – 85°F. Tepid water may be produced via instantaneous water heaters or by tank water heaters, either gas or electric. The final TW system type will be determined during the design phase. If existing emergency fixtures do not meet current TW requirements, Brown and Caldwell will coordinate with the Owner to ensure compliance with their internal safety standards.

10.4 Fire Protection Systems

Fire protection for the site, if determined to be necessary, will be provided via potable water. The fire service will be supplied from the largest nearby water main.

The project will be designed to comply with applicable portions of the codes and standards listed in Table 10-8 and any local codes and amendments.

Table 10-8. Typical Codes and Standards for Fire Protection	
Code	**Description**
NFPA 13	Standard for the Installation of Sprinkler Systems
NFPA 14	Standard for the Installation of Standpipe and Hose Systems
NFPA 45	Standard on Fire Protection for Laboratories Using Chemical
NFPA 72	National Fire Alarm and Signaling Code
NFPA 241	Standard for Safeguarding Construction, Alteration, and Demolition Operation
NFPA 2001	Standard on Clean Agent Fire Extinguishing Systems
IFC	International Fire Code
IMC	International Mechanical Code
IPC	International Plumbing Code
UL	Underwriters Laboratories

Improvements will be made to the system as necessary to support the new facilities. It is anticipated that a fire alarm system will be located throughout the DCWRF. A fire protection system for the dryers building is anticipated, but further assessment of codes and standards are needed to confirm.

10.5 Freeze Protection

The project includes pipelines that are located outdoors will be minimized, the following criteria will generally be utilized for heat tracing and insulating these lines:

- Regardless of whether flow in the pipe is continuous or intermittent, all piping 6-inch and smaller will receive heat trace and insulation. Exceptions include very short sections of piping (< one foot, such connections to piping air valve assemblies) where the connecting piping is of sufficient size to limit the potential for freezing. These instances, determined on a case-by-case basis, may receive insulation only.
- Piping up to 10-inch that is susceptible to low or intermittent flow without allowance for draining will also be heat traced and insulated
- Screenings sluices will need to be insulated and heat traced in the uncovered area where they extend from the proposed light weight screenings building to the proposed Screenings/Grit Processing Building.
- Exposed digester gas appurtenances

All interior building areas will be heated to a minimum temperature of 40°F to avoid the need for heat tracing and insulation.

Section 11

Electrical System and Power Distribution Modifications

11.1 General

The design criteria for the upgraded electrical power distribution system at the DCWRF will focus on providing a suitable power system, capable of providing power for existing, added via this project, and future foreseeable loads. The new work and modifications to the existing power distribution system will comply with the NFPA 70 (National Electrical Code, NEC), and/or the adopted local electrical code based on the NEC.

The design intent is to provide a safe and reliable means to distribute power to the anticipated new loads identified in this report. The system will be designed to provide a high level of reliability, safety, ease of use/maintenance.

The electrical distribution system improvements at the DCWRF will consist of the following:

- Design a new NES redundant service west of the current location nearby the northeast corner of the new Biosolids Drying Facility (BDF).
- Design a new 5 kV Medium Voltage (MV) double-ended substation at the northeast corner of the new structure housing the new BDF. The new substation will replace the aging substation located at the existing blower building. The new substation will include new liquid cooled power transformers on a yard next to the building.
- a new elevated electrical room at the new Headworks structure. The room elevation will be above the prescribed flood elevation for this project. The electrical room will house all the required control and electrical gear designed for the new and existing process equipment. The power source will be the existing unit substation U-9
- Incorporate a new elevated electrical room serving the High-Pressure Effluent (HPE) pump station. The electrical room will house all the designed required control and electrical gear for the new process equipment.
- Design the replacement gear for the existing aging 5kV MV switchgear and MCC at the blower building. The new MV switchgear will extend the “B” bus of the new substation.
- Incorporate in the design a MV metal enclosed pad mounted multi-switch into the modified power distribution network. This switch is preliminary, and it will be determined during the 30% design phase.
- Design new buried duct banks and manholes required to interconnect the new main substation to the existing power distribution network.
- Indicate the removal of the existing NES service drop nearby the blower building after the new west substation powers the site existing electrical unit substations.

11.2 General Design Criteria

The electrical design will conform to Metro Water Service standards and will be generally as follows:

- Except for packaged equipment, motor starters will be located in a MCC and have a red indicating pilot light for off, green indicating pilot light for on, and amber indicating pilot light for alarm or failure.
- The new main distribution switchgear will be designed as main tie main and fitted with multifunction microprocessor-based relays with flexible protective settings and arc flash detection. The relays logic features will be used for the auto transfer scheme. The gear will be fitted with revenue grade meters and a network switch. A clock using the GPS satellite constellation will be included in the switchgear design.

The new main distribution switchgear will be housed in an environmentally controlled electrical room at the NW side of the building ground floor of the new biosolids facility structure. The room will be isolated from the rest of the structure to avoid corrosive contaminants and dust.

Two electrical rooms will be above the main electrical room at the NW side of the biosolids facility structure. The second and third floor electrical rooms will house the balance of electrical equipment, MCCs, control panels, LV switchgear, switchboards, panelboards, freestanding VFDs, etc., that serve the biosolids equipment. Means to move the equipment in and out of these electrical rooms will be determined during the 30% design phase.

Medium voltage transformers will be located at the outside yard next to the building. The coolant fluid on these units will be ester based and low flammability. The high side will accept the existing utility supply voltage and the secondary voltage will be the same as the existing site distribution voltage. Pad mounted liquid filled transformers will use low flammability cooling fluid as well. These units will be placed outdoors and will comply with the ANSI standards. Additional requirements will be incorporated during the design development.

Low voltage dry type transformer temperature rise will be limited to 80 Deg. C and will be in the new electrical rooms. Potted transformers will be used where required in areas that might be subject to contamination.

- A ground ring will be provided around all new buildings, and secondary substations. All ground rings and existing grounds will be tied together via the ground wire installed in duct banks.
- Power receptacles, small process loads, and lighting loads will be supplied from 208Y/120-volt, 3-phase lighting panels to balance phase loading on the 480-volt system. Dry Type Transformers for panelboard will range in size from 30 kVA to 75 kVA depending on the load supported by the corresponding distribution panelboards.
- Low voltage panelboards will be rated at 22kA bracing minimum.
- Weatherproof receptacles will be utilized outdoors, in chemical feed and storage areas, and in sprinkled, wet, and damp locations. All weatherproof receptacles will be provided with ground fault interrupting (GFI) capability and weatherproof, hard duty, in-use covers.
- Electrical conduit will be routed concealed as much as possible. Where the conduit emerges from the concrete, it will be PVC coated galvanized steel conduit for mechanical strength. Exposed conduit routed indoors will vary in material type based upon the classification of the indoor areas as follows:
- Material: PVC -Coated Rigid Conduit
  - Area: Locations with possible leakage sources of corrosive vapors and process areas with residuals piping subject to hose down during cleaning and maintenance. All mounting and supporting hardware will be PVC Coated or stainless steel 316 depending on the corrosive atmosphere.
- Material: Aluminum Conduit

  - Area: Exposed conduit for areas other than above. All mounting and supporting hardware will be aluminum or stainless steel. Where galvanized supports are allowed, the conduit straps will have an insulating medium.
- Conduit concealed in concrete walls, concrete slabs, and underground concrete-encased duct banks will be PVC Schedule 40.
- PVC-coated rigid steel will be used as follows:
  - Conduit which turns out of concrete slabs, walls, or duct banks will be connected to a 90-degree elbow of PVC-coated rigid steel conduit before it emerges.
  - Conduits will have PVC-coated rigid steel coupling embedded a minimum of 3 inches when emerging from slabs or walls and the coupling will extend a minimum of 2 inches from the wall, slab, or duct bank.
  - Flexible conduit will be liquid-tight, non-metallic. Liquid tight metallic conduit will be used where PVC- Coated conduit where required.
- Underground electrical duct banks will be concrete encased with reinforced steel. Concrete handholes will be installed with minimum ½ inch of handhole body to be above finished grade. Grade paving or concrete will feather to the edge of the handhole box. Design will provide separate manholes for 4.16kV, 600V, and instrumentation/fiber optic/ethernet.
- Area lighting duct banks will be sand, or soil encased. Wiring handholes will be installed in the ground with covers at least one inch above grade in non-traffic areas.
- Area lighting conduits will be direct-buried, PVC SCH 80 with in-ground splice boxes.
- Low voltage power cables will be rated for 600 volts and have type XHHW-2 insulation for cables #4AWG or greater.
- Low voltage power cables will be rated for 600 volts and have type THHW insulation for cables smaller than #4 AWG for non-process loads.
- Low voltage control cable will be rated for 600 volts and have type XHHW-2 insulation.
- Low voltage control cable will be rated for 600 volts and have type XHHW insulation.
- Low voltage signal and data (4-20mA, 24VDC, CAT 6 Ethernet, Modbus, Device Net, telephone, etc.) will be rated for 600 volts (type as required by equipment manufacturer or system supplier)
- All medium voltage power cables will be rated for 5kV and have ethyl-propylene rubber (EPR) insulation with a 133 percent rating for underground installation.
- Wire labeling:
  - Each individual wire in power, control, indication, instrumentation, lighting, and receptacle circuits will be provided with identification labels (heat shrinkable sleeves) at both ends and at any splices or junctions. Each wire will have the same identification label at all points. Identification labels will be machine printed with Brady “TLS 2200” label machine. Labels will be “PSPT XXX-1W” (1.01 inch wide) or “PSPT-XXX-175W” (1.76 inch wide) as required for number of characters. Exact labeling will be coordinated with Owner and Engineer but will be no smaller than 7 point for #14 & #12 conductor and 10 point for #8 and larger. Labels will be heat shrunk after installation.
  - All wiring labels will follow the relevant standard detail included in the drawing set.
  - Both ends of the conductor will be labeled identically.
  - All spare/unused/abandoned conduits will be labeled with the destination (MCCs, Switchboards, Power Panels, Switchgear, Control Panels, Handhole Nos., etc.)

- Power conductors will be color-coded with marking tape or factory colored insulation. For 208/120 volt, 3 phase, 4 wire Black/Red/Blue, Neutral – White. For 120/240 volt, single phase, 3 wire Black/Red, Neutral – White. For 480 volt, 3 phase, 3 wire Brown/Orange/Yellow. All ground conductors color coding will be solid green. Any other wire color coding will be coordinated with and approved by the Owner. Power wiring #6 AWG and smaller will have continuous factory colored insulation without exception; power wiring larger than #6 AWG will be color-coded with marking tape.
- Motor starters, separately enclosed breakers, and disconnects will be provided with nameplates identifying the controlled equipment and source of power, and the equipment name served.
- Device plates for light switches and receptacles will have identification markers with source panel and circuit designation. Identification markers will be machine-printed with 1/8-inch letters.
- Free standing electrical equipment will be installed on housekeeping pads.
- All interior control panels will be either NEMA 12, A316SS, or NEMA 4X, A304 SS. All exterior control panels, disconnects, panelboards, junction boxes, etc. will be NEMA 4X, A316 SS. This will apply to unclassified areas only. All exterior equipment enclosures shall be painted white.
- Electrical plans or specifications must reference structural drawings for required expansion/deflection couplings.
- Light poles bases will be 36" minimum (above grade) where exposed to vehicular traffic.
- No junction box, electrical pull box, or gutter will be smaller than 6-inches high by 6-inches wide by 4 inches deep. Latches on all boxes will be A304 stainless steel, ¼ turn latches.
- Conduits for control and signal conduits, will be provided with an equipment ground (minimum #14 AWG).
- Spare conduits will be provided with muletape. All spare conduits will be required with a plug to keep the conduit sealed.
- Motors will be specified with NEMA premium efficiency ratings.
- Lightning protection systems will be provided for all new structures as specified by NFPA 780.
- Equipment control panels, PLC panels, power and lighting panels, and motor control centers will be equipped with surge protective devices to provide protection against electrical transients caused by lightning, utility, and electro-mechanical and electronic equipment.

11.3 Codes and Standards

All electrical work will comply with the following codes:

- Tennessee Building Code
- Tennessee Energy Code
- National Electrical Code (NEC) (NFPA 70)
- Standard for Electrical Safety in the Workplace (NFPA 70E)
- Electrical Standard for Industrial Machinery (NFPA 79)
- National Electrical Safety Code (NESC)

In accordance with Tennessee Building Code Council, all electrical utilization equipment furnished and installed under this Contract, including all electrical equipment, instrumentation and equipment control panels, instrument devices, power distribution equipment, electric valve actuators, and miscellaneous electrical devices, will bear the label of an approved nationally recognized testing laboratory (NRTL). The label will convey the laboratory's declaration of the equipment safety and suitability for intended use on this Project.

This requirement will also apply to all equipment provided under this Contract that is fabricated under a national code or standard such as ASTM, ANSI, or NEMA and which references certification by a national testing laboratory as part of the equipment manufacturing process.

Manufacturer's model or catalog numbers referenced in the Specifications may not be provided with such NRTL labeling standard. It is the intent of this paragraph to require third party NRTL labeling of such standard equipment or substitution of equivalent equipment which does incorporate the NRTL label.

All electrical work will be performed by a licensed electrical contractor, will be permitted, and will be inspected in accordance with Davidson County building standards.

11.4 Power Distribution Planning

This expansion will include modifications to the DCWRF electrical distribution system to serve the new headworks and biosolids handling facility.

11.4.1 Existing Distribution System

Nashville Electric Service (NES) serves the DCWRF with two redundant primary sources at 23.9 kV. The metering equipment for both services is mounted at the Electrical Utility demarcation poles shown on Figure 11-1 below. The existing poles where the meters are mounted will be removed and the meters transferred to the NES poles on Edenwold Connector Road. The underground riser conduits interface at the two poles and connect the facility owned stepdown redundant transformers stepping down the voltage to 4.16 kV.

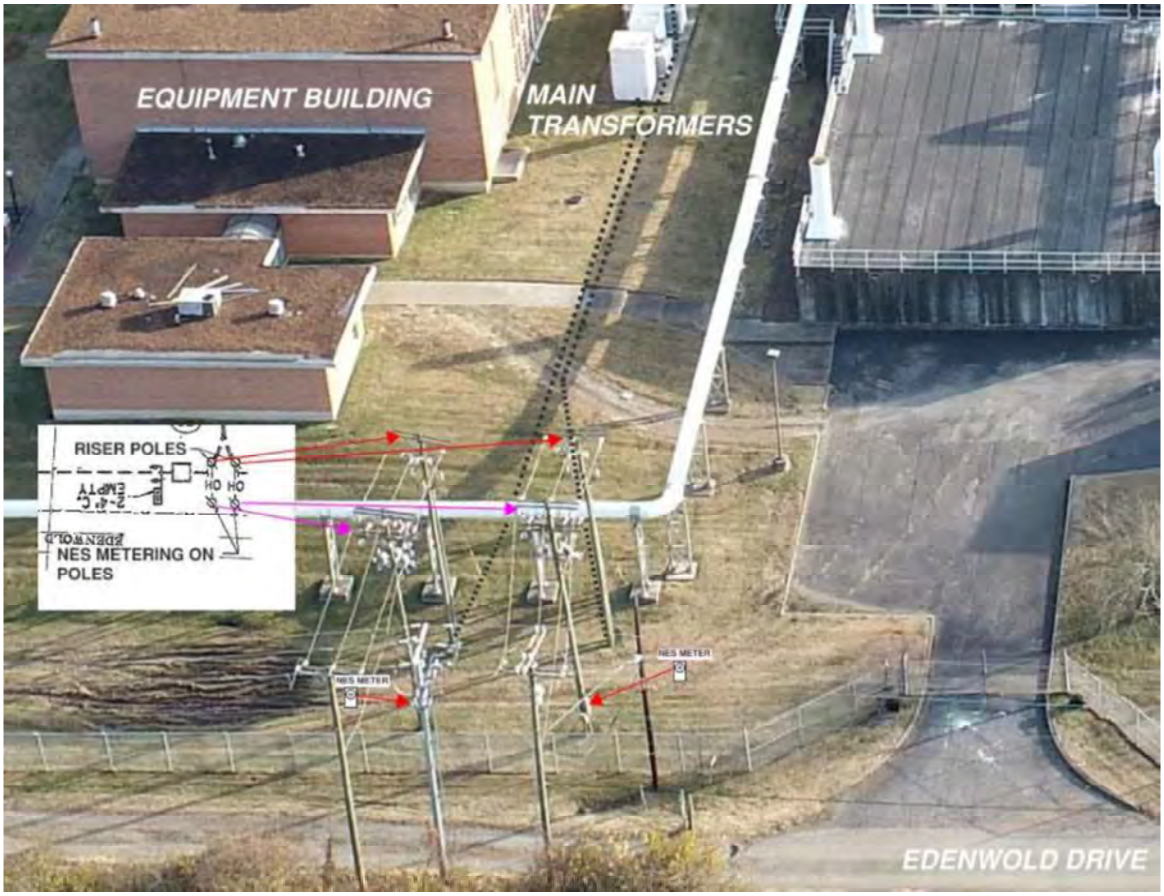

Figure 11-1. NES Service Arrangement

The secondaries of the transformers connect to a single bus via two main circuit breakers that are electrically interlocked. Only one breaker is normally closed, the other feeder is only closed when the feeder in service fails. A qualified individual executes the changeover to the healthy utility feeder.

From the main switchgear, power is distributed via a series of 4.16 kV radial feeders with more than one secondary substation feed from each breaker. In the field two secondary substations are connected in parallel from the same feeder. The secondary substations feed panel boards and MCCs that serve the facility loads. A simplified power distribution network is shown in Appendix E, drawing 000-E-20.

One medium voltage motor control center is fed from the main switchgear bus without a circuit breaker. The MCC is located a short distance from the main switchgear as shown on Figure 11-2 below.

Figure 11-2. MV Main Switchgear (left), MV Blowers MCC (right)

The facility existing main switchgear does not have additional room for expansion in the blower building. The switchgear was installed sometime in 1993, so it is approximately 29 years old. The switchgear is near the end design life of 20-30 years and should be rehabilitated or replaced. The unit is equipped with electromechanical relays and provide timed and instantaneous overcurrent, and ground fault protection. If the single bus were to develop a fault, the plant will suffer an extended outage.

In addition, the existing facility does not have onsite power generation or space earmarked to park a portable trailer mounted generator and fuel tank when needed.

11.4.2 Proposed Distribution System Modifications

The DCWRF has experienced significant growth since its switchgear was replaced in the early 1990's from two separate medium voltage buses to a single bus under project under project 89-SC-92. The existing gear has several breakers with more than one circuit. The new loads for this project would add to the existing feeder supplying Substation U7. The existing feeders cannot support these additional loads.

11.4.3 New Site Substation at Biosolids Facility

A new main utility substation with dual/redundant transformers and new medium voltage switchgear for distribution will be designed to supply power to the new biosolids facility and the plant Main Switchgear "BB" as discussed in the electrical workshop. The new substation and balance of plant as discussed in the electrical workshop. The new substation main switchgear design will have a main-tie-main configuration and will be equipped with programmable, multi-function digital relays such as those manufactured by General Electric Multilin 8 series, or ABB Relion 620 series or equal. The new main substation will be fed by a new, redundant NES overhead service with new pole-mounted meter compliant with NES requirements. From there, two five-inch conduits from each pole will be routed to each of the new transformers next to the new biosolids building. Each feeder will be sized so that electrical power interruption to the plant due to load growth is minimized. The secondary of each transformer will feed its corresponding main breaker in the new MV Main SWGR. Each feeder will include a power meter reporting to the site DCS system to trend energy use. See the switchgear description under the General Design Criteria header. At the same building, there will be electrical rooms on the second and third floors serving the dryers and all ancillary equipment. Space will be allocated for electrical gear for the third dryer train in the future.

11.4.4 Duct Bank Network Modifications

From the new substation switchgear, new duct banks will be designed. One duct bank will be designed to intercept the existing central duct bank network near the modified headworks facility. The second duct bank corridor will be designed at the north of the facility to interconnect the new MV switchgear "BB". Tags will be assigned to all new electrical gear.

11.4.4.1 Duct Bank Maintenance of Plant Operations (MOPO) and Construction Constraints 1

The work will require that the intercepted feeders from the new substation at biosolids new A-Bus (1A, 2A… etc.) feed the site existing unit substations "A" bus. Then the existing unit substations will be energized from the A bus feeder. Once this work is completed, the existing utility corridor that serves the switchgear at the blower building will be used for the "B"-bus duct bank connection to the new biosolids main substation B-Bus. Once the underground duct bank is near the existing main transformers next to the blower building, the existing NES service can be removed. The removal of the existing NES service will include the removal of the overhead metering equipment, the meters, the pole risers, and the existing customer and utility poles inside the fence line

11.4.5 Modifications at the Blower Building

A new MV switchgear lineup will replace the existing switchgear "BB" in the blower building. The new MV switchgear in the blower building will become a node for the "B" bus and feed the existing unit substations "B" bus using existing conductors if these are in good condition and are of the sufficient size. This will result in the least disturbance to the facility operations. Drawing E-01-601 included in the appendix illustrates graphically the description above.

11.4.6 Headworks Underground Obstructions

The new headworks foundation works will affect the duct banks feeding the existing unit substations U-8 and U-9. These duct banks need to be removed to accommodate the new structure foundations and must be relocated.

The central corridor is very congested with other utilities substructures. A route that accommodates the new electrical duct bank and all other services to the new biosolids structure will need to be coordinated. Figure 11-3 illustrates the proposed electrical network configuration and modifications to implement the new substation.

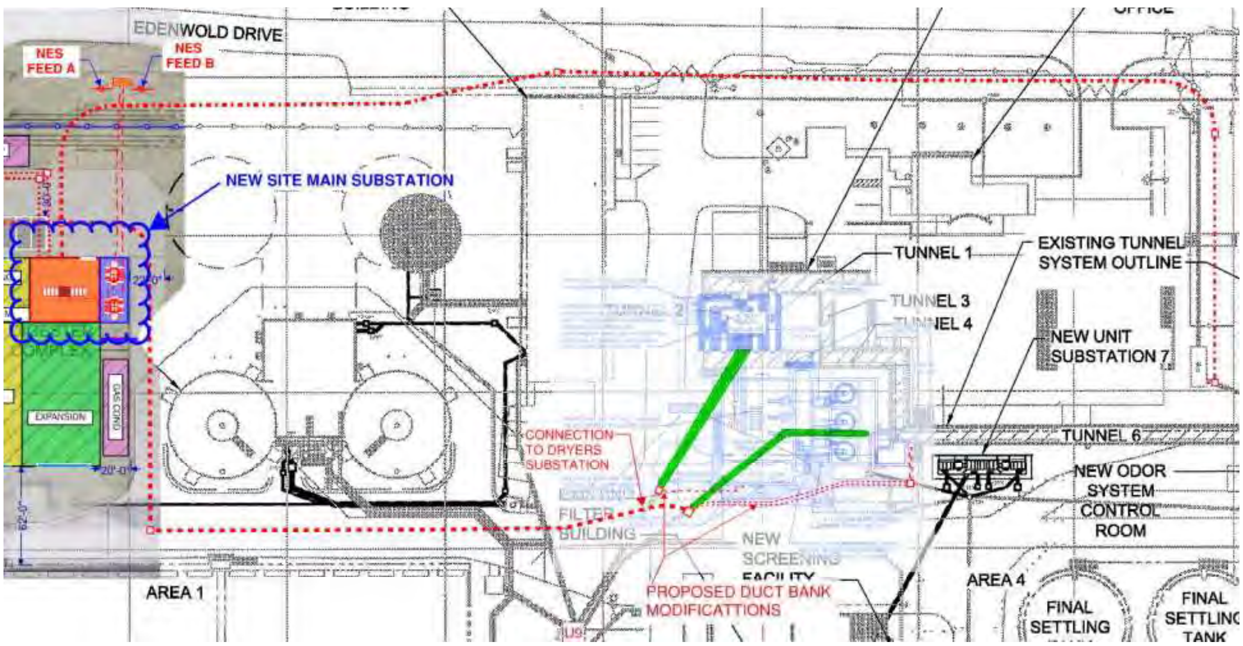

Figure 11-3 Dry Creek Facility Modified Electrical Layout

11.4.6.1 Maintenance of Plant Operations (MOPO) Headworks Construction

The duct banks that feed the existing unit substation U9, U8, and MCC-P91 need to be demolished. These unit substations need to continue to be energized to keep their loads energized. New underground facilities need to be in place to continue feeding U8 from a temporary nearby location. Field investigations are required to determine what will be the location that has capacity to feed U8. The U9 duct bank replacement should be constructed beforehand to transfer U9 to its permanent feed. MCC-P91 may be temporarily feed from U7 if there is capacity and space to add the required feeders for bus A and B. Once the new headworks facility is commissioned, the existing MCC-P91 will be demolished. Once these new duct banks are in place per the design, the existing duct bank sections under the new headworks can be removed.

11.4.7 High Pressure Effluent (HPE) Pump Station Electrical Service

The plant water facility will require a new unit substation to feed the improved high-pressure effluent (HPE) pump station. The existing substation U10 is at its load limit. A new substation U11 will be designed to be fed from existing U7. U11 design will include two transformers on an elevated pad and two MCCs with a tie breaker inside the new HPE pump station building. The new building will be constructed atop the former chlorine contact tank as described in the structural section above. The final configuration of U-11 will be determined during the detail design.

11.4.7.1 MOPO for HPE

Substation U11 feeder conduits will cross over the feeder from U10 to the recently built UV disinfection facility. The UV is in service and its power duct bank must not be damaged. The Chlorine building will be demolished including all its existing electrical equipment and feeder from U10. UU disinfection must continue to operate uninterrupted.

11.4.7.2 Fiber Optic (FO) Network Modifications

It is presumed that there is a fiber optic (FO) communications link patch panel in the UV electrical room or near to the plant control room. If this is not the case, a new FO node will be added at this location

The new design will extend the existing FO network from the nearby locations to each of the new facilities. Each new node will support the new facilities. The nearby locations will be determined during the design development phase.

11.5 Electrical Equipment

- Based on discussion with the client, all electrical equipment of same class (example: Unit Substations, Low Voltage Switchgears, MCCs, VFDs, etc.) will be specified to be bid by at least three qualified manufacturers.
- All electrical switchgear, power panels, MCC's and lighting panels bussing will be constructed using tin plated copper.
- The medium voltage switchgear will be as described in the General Design Criteria.
- "Door-in-door" type panelboard construction will be specified for all lighting and power panels.
- Lighting transformers and panels will not be installed in MCCs.
- Motor Protection
  - 480V starters will have motor management relays in each starter section. If the starter is free standing type and is fed from a dedicated breaker in a switchgear or MCC; the motor management relay will be located in the respective controller or its MCC bucket.
- Clock
  - The new substations gear will have a satellite clock for synchronization of all protective devices. The satellite clock will be compatible with whichever protective relay is selected. The clock's antenna will be mounted on the exterior of the building for access to the GPS satellite constellation.
- Power quality meter:
  - Meters will have Modbus TCP communications and have a 5" touchscreen.
  - Meters will be provided at:
    - 480V switchgear main breakers
    - 480V switchgear feeders to free standing motor starters, MCCs and power panels

- MCC Main breakers
- Switchboards

- Integral surge protection devices will be utilized on all MCCs, switchgear and 480V Switchboards; It will be provided with a disconnecting means in the equipment.

11.6 Lighting Requirements

Lighting levels will be provided following the suggested levels as stated in the IES Lighting Handbook. In general, voltages for site lighting fixtures and interior fixtures will be 120 volts, single phase.

In general, lighting will be as follows:

- Lighting in offices, laboratories, rest rooms, corridors, and control rooms will utilize LED.
- Lighting in shop areas, storage rooms, basement levels, and electrical rooms will be LED. These fixtures will be pendant mounted where necessary due to ceiling height.
- Battery powered emergency and egress lighting will be provided for temporary lighting during power outages. These will be separate fixtures and not battery packs provided as part of the other fixtures.
- The designed illumination systems will have a combination of manual switches, occupancy sensors, and controllers to manage the lighting in offices, process areas, and outdoors.
- In areas with ceilings above 12 feet, fixtures will be furnished with cord, loop, and plug for connection to each respective light.
- Exterior and building luminaries will be LED with remote ON/OFF/AUTO contactor and photocell control. More up to date controls might be designed in lieu of outdated devices. The exterior luminaires will be dark sky approved to minimize glare and deliver the light to the intended surface and minimize light trespass upwards.
- Lighting level calculations will be run for areas part of this project and standard recommended lighting levels will be observed.

11.7 Construction Sequencing Considerations

The facility must always maintain operations during construction. Constraints were enumerated above. However, the Contractor shall coordinate construction activities with Operations to minimize interruption of power to water treatment systems that must run.

Section 12

Instrumentation and Control (I&C) Systems

12.1 General

The design criteria for the new instrumentation and control system at the DCWRF will focus on integrating new processes into the existing Distributed Control System (DCS) in a manner that meets MWS standards and maintains a high level of reliability while utilizing modern safety and security guidelines. The design sets out to make a seamless transition between the supervisory-level DCS and vendor-provided packaged systems most notably in the New Biosolids Drying Facility. The design will include provisions for future equipment (most notably a third dryer train) and networking infrastructure will be selected such that future projects can build out from the New Biosolids Drying Facility (BDF), High Pressure Effluent (HPE) Building, and New Solids Processing Building.

12.2 I&C System Description

12.2.1 Existing Control System

DCWRF has a DCS consisting of ABB DCI System Six architecture with individual Distributed Control Units (DCU) and supporting patch panels located in the Main Plant Control Building, Filter Building, and Primary Digester Complex.

- The server for the DCS is located in the Main Plant Control Building, with a backup in the Administration Building.
- Additional client workstations are located in the Filter Building Control Room, Maintenance Building, and Primary Digester Complex.
- A recent project at the UV building has further extended the fiber optic network down towards the Chlorine Contact Tanks.

12.2.2 Proposed Control System

The ABB system will be expanded to new facilities with modern DCS components, the 800xA chiefly. In existing areas, the I/O will be landed in existing DCUs. Therefore, the proposed design approach by area is as follows::

- The New Solids Processing Building will be networked through an extension from the Main Plant Control Building and receive a new DCU.
- The High Pressure Effluent Building will be networked through an extension from the UV Building and receive a new DCU.
- The existing Filter Building will have new I/O placed in DCU-F.
- The New Biosolids Drying Facility will be networked through an extension from the Primary Digester Complex. There will also be a new DCS workstation located in the building.

Additional process equipment with vendor-provided control panels will connect with DCU through Ethernet so that a seamless integration will allow for control of vendor equipment from the DCS Workstation.

12.2.3 Control Locations

Each piece of basic equipment (such as a pump) will have local control at the equipment for manual and maintenance-type operation. This includes Hand-Off-Auto, Start-Stop, Emergency Stop, Open-Close, etc. Indicating pilot lights will be included locally. Local disconnects will be located at motors for equipment lockout.

Vendor-packaged equipment will be provided with a control panel, either mounted with the equipment on a skid, or in the case of larger equipment, a floor mounted control panel in a process area or control room. These panels will contain controls necessary to operate the equipment in a standalone manner.

VFDs will be capable of operating equipment manually from the electrical room. This will be strictly for maintenance purposes.

DCS Workstations will be capable of manually operating equipment through the use of mouse and keyboard-based controls. Certain control functions will be designed for automatic operation which will be achieved by entering setpoints into the DCS Workstation. The New Biosolids Drying Facility will have a dedicated control room with desk and workstation, mimicking the plant operations room, and the capability to view the dryers with a large window overlooking the room.

12.2.4 Power Monitoring

Electrical gear will be provided with power meters with networking capabilities (Ethernet/IP or Modbus TCP) and will be connected to the DCS. Electrical performance data will be displayed on DCS workstations including voltage, current, phase, harmonics, breaker status, and faults. The new medium voltage switchgear will be monitored for relay and breaker status.

12.2.5 Safety Considerations

Hazardous environments will be monitored for NFPA 820 compliance through the use of combustible gas detectors. Each entrance to a classified area will have GO/NO-GO indicating lights to show if the area is safe to enter. Within each classified area horns and strobes will be installed to warn of dangerous gas levels. Gas levels will be transmitted to the DCS for remote indication. Gas sensors will also be added to chemical areas, as applicable.

Chemical areas will have emergency eyewash and showers with flow switches connected to both a local alarm and also to the DCS for remote indication.

Exposed equipment will have emergency stops and pull-cords around the perimeter of the equipment to shut down the equipment upon activation and to transmit an alarm to the DCS for remote indication. Conveyors will also have horns and strobes that sound before movement begins.

12.2.6 Networking

The control system will have an Ethernet backbone operating at speeds of at least 1 Gigabit between locations. In individual buildings, a network cabinet will house Ethernet switches for connection with PLCs, VFDs, Power Monitors, and other devices. Cabling within each building will be Category 6.

Between buildings, fiber optic cables will be run between patch panels to extend the network of DCWRF. Each fiber run will contain at least 12 pair of multimode cable.

Vendor provided equipment will also be Ethernet based and the control panels will include a DIN-rail mounted Ethernet switch for connection of PLC, Operator Interface Terminal, and other related devices.

12.2.7 Fieldbus/HART

The use of fieldbus (Profibus) will be leveraged in areas with many devices (actuators) in the same vicinity. Profibus will be connected to the DCU for additional control and diagnostic functions. Redundant systems will be evaluated for critical devices.

Instrumentation with 4-20mA outputs will be selected with HART capabilities when applicable for additional diagnostic functions.

12.2.8 Security

The control system will be designed to separate device networks, control networks, and business networks. There will be no remote access, wireless, or cellular based instruments or controls. Vendor-provided equipment will not be permitted to house modems for remote diagnostics.

Networking equipment will be installed in lockable enclosures with port security preventing the plugging in of unauthorized computers and devices.

Workstations will run MWS standard anti-virus software.

12.3 Codes and Standards

The instrumentation and control components of the Project will be generally designed in accordance with the following codes and standards:

- International Society of Automation (ISA)
- Institute of Electrical and Electronics Engineers (IEEE)
- American National Standards Institute (ANSI)
- Underwriters Laboratories, Inc. (UL)
- National Electrical Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA)
- National Electrical Code (NEC)
- NEMA ICS 1 – General Standards for Industrial Control and Systems
- UL508A/UL698A- Industrial Control Panels
- NIST SP 800-82 revision 2 Guide to Industrial Control Systems (ICS) Security

Where reference is made to one of the above standards the revision in effect at the time of bid opening will apply.

12.4 Hardware and Software Requirements

12.4.1 Control Panels and Enclosures

12.4.1.1 Control Panel Fabrication

Control Panels used in the project will meet the following requirements:

- General Layout: Face-mounted instruments and devices will be mounted in the door a minimum of 36 inches above the finished grade. Enclosure will be provided with an interior frame or otherwise formed so as to provide a rigid structure. Doors will be hung on full-length piano-type hinges and equipped with vault-type latch capable of accepting a 3/8-inch-shackle padlock. Three-point latch hardware will be provided for doors exceeding 30 inches height. Where cabinet width exceeds 36 inches, multiple doors no wider than 34 inches will be provided. The enclosure sub-panel will be painted white.

- DCS panel construction will follow ABB and MWS standards for DCS systems.
- Enclosures will be constructed of the following materials and NEMA ratings based on location:

Location	Enclosure Material and NEMA Rating
Indoor: architecturally finished area	NEMA 12: mild steel
Indoor: electrical room	NEMA 12: mild steel
Indoor: process areas	NEMA 4X: 316 stainless steel
Indoor: corrosive area	NEMA 4X: 316 stainless steel
Outdoor: corrosive area	NEMA 4X: 316 stainless steel
Outdoor: non-corrosive areas	NEMA 4X: 316 stainless steel
Corrosive area (hypochlorite)	NEMA 4X: non-metallic
Hazardous area	NEMA 7: galvanized malleable iron or aluminum or NEMA 4X and UL listed or FM approved for the hazardous area. Where no such enclosure is available, enclosure ratings will be for the indoor or outdoor area and will be made intrinsically safe.
Hazardous and corrosive area	NEMA 7: iron or aluminum with factory-applied corrosion-resistant coating or NEMA 4X and UL listed or FM approved for the hazardous area. Where no such enclosure is available, enclosure ratings will be for the indoor or outdoor area and will be made intrinsically safe.

- Heating and Ventilating: Forced air ventilation will be provided for enclosed cabinets. Outdoor cabinets will also be provided with thermostatically controlled space heaters.

12.4.1.2 Panel Wiring

Control Panels used in the project will be wired as follows:

- Power and control wiring will be single conductor stranded copper NFPA No. 70 Type MTW No. 16 AWG minimum. Wiring for signal will be No. 16 AWG stranded copper NFPA No. 70 Type MTW.
- Terminal blocks will be tubular clamp type with closed cable funnels rated for 300 volts.
- Surge protectors will be provided at panel external terminal blocks for signal circuits which extend outdoors. Surge protectors will be provided at panel incoming power supply.
- Circuits will be fused. Fuses on 120V AC circuits will be ceramic tube type. Fuses for 24V DC circuits will be fast-acting glass tube type. Fuse holders for 120V AC control circuits will be drawout type and molded from melamine plastic. Fuses will include a neon blown fuse indicator lamp.
- Pilot devices will be heavy duty, NEMA 4X/13, 30.5 mm. Pilot lights will be push to test type and LED.
- DCS panel wiring will follow ABB and MWS standards for DCS systems.

12.4.1.3 Power Supplies and Conditioning

Power Supplies used on the project will meet the following requirements:

- The power supply for instrumentation systems will be 120 volts plus or minus 15 percent, 60 hertz plus or minus three hertz, 5 percent maximum total harmonic distortion unless note otherwise. Except for power supply units which form an integral part of an individual piece of equipment, all power supply and conditioning equipment will comply with UL 1012 and will be approved by UL, CSA, or FM for the application.

- All power supply equipment will be provided in redundant configurations such that failure of a single unit will not disable all or any part of the instrumentation and communication systems. Diode isolation will be provided for redundant direct current supply units, and the power supply negative output terminal will be grounded. An alarm will be indicated locally and on the DCS upon a power supply failure.
- Isolation transformers will be provided for AC powered instrumentation loads containing solid state circuitry where such is not included within the instrument.
- Each PLC and PC workstation will include a UPS as part of the package. Uninterruptible power supply (UPS) systems consist of a battery charger, battery, rectifier inverter, and bypass line transfer switch. The uninterruptible power supply will be an on-line, computer-grade system with isolated neutral. The uninterruptible power supply system will use a double conversion to provide isolation and power conditioning under normal operation.
- DCS enclosures will utilize redundant power feeds.

12.4.1.4 Anticipated Project Control Panels

The following process equipment and control areas are anticipated to have control panels:

- Dryers: Multiple control panels per system (vendor provided)
- Centrifuges: One control panel per unit (vendor provided)
- Polymer Blending Units: Each will have a skid-mounted control panel (vendor provided)
- Mechanical Screen: One control panel per unit (vendor provided)
- Screenings Washer/Compactor: One control panel per unit (vendor provided)
- Grit Washer/Dewatering Unit: One control panel per unit (vendor provided)
- Rotary Drum Thickener: One control panel per unit (vendor provided)
- HPE Strainer: One control panel per unit (vendor provided)
- DAFT: One control panel per unit (vendor provided)
- GBT: One control panel per unit (vendor provided)
- Plant Drain Pump Station: One control panel
- Sump Pumps: One control panel per system (vendor provided)
- Odor Control: One control panel per area
- Combustible Gas Detection: One control panel per area
- DCUs: New Solids Processing Building, High Pressure Effluent Building, New Biosolids Drying Facility
- Patch Panels/Network Enclosures: New Solids Processing Building, High Pressure Effluent Building, New Biosolids Drying Facility

12.4.2 Process Controllers and Operator Interfaces

The control system will consist of ABB Distributed Control Units and Workstation, as well as PLC-based systems and corresponding operator interface terminals used in vendor-provided packaged systems.

12.4.2.1 Distributed Control System

Nashville Dry Creek will have its Distributed Control System expanded under this project. One distributed control unit will be located at the New Biosolids Drying Facility, New Solids Processing

Building, and HPE Building. The DCUs will be designed around ABB 800xA. The New BDF control room will contain a DCS workstation.

12.4.2.2 Vendor Packaged Systems

Vendor systems are typically designed around Allen-Bradley equipment:

- Small vendor equipment with limited I/O will be designed around Allen-Bradley and the CompactLogix line of PLCs.
- Large-scale equipment such as the Dryers will be designed around Allen-Bradley and the ControlLogix line of PLCs, enabling redundancy.
- Vendor systems will utilize touchscreens when applicable and the design will include Allen-Bradley PanelView Plus 7, minimum of 15" diagonal.
- Each vendor PLC will have Ethernet capability, and the memory map will be provided to the system integrator so that monitoring and control functions can be added to the Distributed Control System. Managed Ethernet switches in vendor panels will be networked to building network enclosures.

12.4.3 Instruments

12.4.3.1 Transmitter Requirements

Transmitters used in the project will meet the following requirements:

- Output indicators will be provided with any transmitter that does not include an integral process variable indicator.
- Transmitters will be two-wire type with operating power derived from the signal transmission circuit.
- Transmitters will meet specified performance requirements with load variations within the range of 0 to 600 ohms with the power supply at 24 volts DC.
- Transmitters will output 4-20mA with HART, when available.
- Transmitter output will be galvanically isolated.
- Time constant of transmitters used for flow or pressure measurement, including level transmitters used for flow measurement, will be adjustable from 0.5 to 5.0 seconds.
- Transmitter output will increase with increasing measurement.
- Transmitter enclosures will be rated NEMA 250, Type 4, unless otherwise specified.
- Transmitters located outdoors will be provided with surge protectors.
- Transmitters located outdoors will be provided with aluminum or 316 stainless steel sunshields to protect the instrument from direct sunlight.
- Two-wire transmitters located in Class 1, Division 1 and 2 areas will be made safe by suitable intrinsic safety barriers.

12.4.3.2 Switch Requirements

Switches used in the project will meet the following requirements:

- Contact outputs used for alarm actuation will be ordinarily closed and will open to initiate the alarm.
- Contact outputs used to control equipment will be ordinarily open and will close to start the equipment.

- Contacts monitored by solid state equipment such as programmable controllers or annunciators will be hermetically sealed and designed for switching currents from 20 to 100 mA at 24 volts DC.
- Contacts monitored by electro-magnetic devices such as mechanical relays will be rated NEMA ICS 2, designation B300.
- Double barriers will be provided between switch elements and process fluids such that failure of one barrier will not permit process fluids into electrical enclosures.
- Switch electrical enclosures will be rated NEMA 250, Type 4 minimum.
- Contacts located in Class 1, Division 1 and 2 areas will be made safe by suitable intrinsic safety barriers or relays.

12.4.3.3 Anticipated Project Instrumentation

The following instruments will be used for specific process applications:

- Level, Discrete: Float Switches
- Level, Continuous: Ultrasonic, Radar, Hydrostatic Pressure
- Gas, Combustible: Infrared Sensor
- Gas, Toxic: Catalytic Bead Sensor
- Pressure, Discrete: Pressure Switch
- Pressure, Isolation: Diaphragm Seal, Inline Seal
- Pressure, Gauge: Bourdon-tube Pressure Gauge
- Pressure, Continuous: Gauge Pressure Transmitter
- Pressure, Differential: Differential Pressure Transmitter and Gauges for process pumps and fans
- Flow, Solids/Liquids: Electromagnetic Flowmeter
- Flow, Gases: Thermal Mass Flowmeter
- Temperature, Continuous: RTD with Thermowell
- Temperature, Discrete: Temperature Switch
- Temperature, Gauge: Bimetal Thermometer

12.4.3.4 Overall Metering Requirements

Metering will be used extensively to assist in the troubleshooting of processes and equipment. Solids will be tracked throughout the processes to assist in daily mass balancing. Gas will be tracked to balance digester gas production and usage. Metering will allow plant staff to determine key performance indicators and efficiency, chemical usage, energy usage, gas produced, etc.

Section 13

Equipment Access

13.1 Access Plan for Maintenance and Replacement of Equipment

This section documents the currently planned approach for providing sufficient building access, working space, and lifting equipment that will be provided with the Dry Creek WRF design to accommodate regular operational inspection, periodic maintenance, significant maintenance activity, and eventual equipment replacement.

13.1.1 Types and Frequency of Access

The anticipated types and frequency of operations and maintenance access are included in Table 13-1 below.

Table 13-1. Types and Frequency of Access

Access Type	Examples	Access Needed	Frequency
Operational Inspection	Regular Inspection of conditions while on rounds	Visual Inspection	Daily
Regular Maintenance Activity	Oil change, Instrument calibration	Access to equipment with hand tools, instruments	Monthly
Periodic Maintenance Activity	Motor Replacement, Inspection of bearings, GAC replacement	Access of equipment with hoist / lifting device for partial weight	Periodic
Equipment Replacement	Removal and replacement of equipment	Access of equipment with hoist / lifting device for full weight	Periodic

Equipment in each project area will require provisions suitable for accessibility depending on the type of access required. Table 13-2 provides a general overview of the planned access provisions to be made per access type.

Table 13-2. Planned Types of Access and Provisions

Type of Access	Planned Access Provisions
Provisions for Operational Inspection	• Provide sufficient walkway area to allow operators to gain access around equipment. • Mount any instrument devices with displays to be easily accessible / visible. • Remote operator stations, chains, etc. for equipment above 6 ft above floor elevation. • Use of remote operators, extension stems for equipment below floor level.
Provisions for Regular Maintenance Activity	• Provide access around motors, drives, pumps, and other equipment. • Provide outlets at building exterior and critical locations for power for maintenance equipment. • Provide hose bib and washdown connections for maintenance. • Size cover panels at regularly accessible areas for removal by 2 people. • Provide tie-off points of fall protection.
Periodic Maintenance Activity / Equipment Replacement	• Considerations for lifting equipment access including road access for temporary cranes. • Provision of bridge cranes, jib cranes, davit cranes, and/or gantry cranes in areas requiring regular equipment access. • Consideration in route of equipment removal from the process location to a truck loading location.

13.1.2 Planned Lifting Approaches

Provisions will be made for lifting and removal of partial and/or full weight of the equipment based on the frequency and other considerations. Table 13-3 highlights some of the currently planned equipment lifting approaches and associated project areas where the approach will be applied.

Table 13-3. Planned Lifting Approaches

Lifting Approach	Project Areas of Utilization	
Installed Full Capacity Bridge Crane	Biosolids Drying Facility (first and third floor dewatering area), HPE Building (pumps, strainers, chemical storage and feed)	
Installed Partial Capacity Bridge Crane	Biosolids Drying Facility (Dryers)	
Monorail Crane	Existing Filter Building (RDTs)	
Exterior Crane Access (through skylights or access hatch)	Headworks Screens, Grit Removal Units, Grit Washing/Dewatering Units, DSST (Submersible Mixers)	
Exterior Crane Access (direct)	Odor Control Fans, HPE Building (roof), Biosolids Drying Facility (roof)	
Telehandler (through access hatch or rollup door)	Headworks Small Equipment in Screening Building and Grit Pumps	

Table 13-3. Planned Lifting Approaches

Lifting Approach	Project Areas of Utilization	
Scissor / Platform Lift Accessible	Biosolids Dryer Facility, DSSTs	
Fork Lift / Powered Pallet Jack / Telehandler Accessible	Headworks Solids Handling Bldg: - Dumpsters (needed to place under tipping trough); - Screenings Washer/Compactors (if required to move for maintenance), HPE Building (small equipment and accessories)	
Gantry Crane	Gate and Other Small Equipment Removal at Headworks Screening, Headworks Grit Washing/Dewatering, and in Grit Pump Gallery, Biosolids Drying Facility, Existing Filter Building	
Davit Crane	Headworks Grit Washing/Dewatering Units for Small Motors, DSSTs (Submersible Mixers)	

13.1.3 Planned Access Approaches for Various Facilities

Table 13-4 provides a high-level summary of some of the key access provisions that will be incorporated with the design of each facility. Final access provisions will be further determined during detailed design.

Table 13-4. Key Access Approaches for New and Modified Areas

Facility	Access Approaches
Screening Building	• Skylights above screens for removal by crane • MWS to supply gantry crane(s) for use in removing smaller equipment from screens and transporting to 14' rollup door located on west side of building near existing road. Items can be picked by lift from outside and lowered to truck or ground.
Headworks Solids Handling Bldg: Upper Level	• Skylights above grit washing/dewatering units on second floor for removal by crane. • Jib crane or davit crane mounted near grit washing/dewatering units to access small motor on top of units to lower to floor. Could also use a gantry crane; but, would need to clear the 12' unit plus handrail. • Davit crane to lower small equipment and ancillary items lowered through floor hatch to first floor

Table 13-4. Key Access Approaches for New and Modified Areas

Facility	Access Approaches
Headworks Solids Handling Bldg: Lower Level	• Trucks will drop dumpsters outside south entrance to Solids Loadout Building. Existing Genie telehandler will be used to position dumpsters under screenings tipping trough and grit shoots from second floor. Guides will be provided for ease in placement and removal of dumpsters. Once dumpsters are full, they will be removed from building by Genie telehandler for loading onto trucks. • Dumpsters can be removed to allow access to washer/compactors for maintenance. Washer/compactors can be removed through roll-up doors by telehandler or forklift.
Headworks Solids Handling Bldg: Electrical Room	• Equipment will be removed through double doors located on the west side of the proposed Solids Loadout Building. A platform will be located where the double doors are on the electrical room to allow equipment to be temporarily staged prior to movement by crane to ground.
Grit Removal Units	• Removable covers above grit removal units for removal by crane.
Grit Pump Gallery	• Equipment removal hatch at south end of grit pump gallery for removal of pumps/equipment utilizing telehandler. Gantry crane provided by MWS will be used to move pumps/equipment from installed location to beneath equipment removal hatch.
Existing Filter Building: Rotary Drum Thickener Room	• Drums from RTDs and smaller equipment from the RTDs to be removed and transported utilizing MWS supplied gantry crane(s) to transport to the existing roll-up door. Items can be loaded by truck from outside.
Existing Filter Building: Polymer Storage and Feed Room	• Small equipment and ancillary items will be removed through double doors located within the Polymer Storage and Feed room. • Storage tanks will be lifted to be transported by exterior crane. • Further evaluation will be performed throughout the project for feasibility of access for storage tanks.
Digested Sludge Storage Tanks	• Propeller type submersible mixers mounted inside the tanks to the wall and floor. The mixers will ride up and down a rail system to allow for installation and removal. • Stairs, platform, and walkway/catwalk to provide access and maintenance provisions for each tank. Stairs, platforms, and walkways to be self-supported from the ground with minor attachments to the exterior wall of the tanks. • Existing access openings and hatches located in the geodesic dome cover of the tanks will be utilized for removal of the submersible mixers. Modifications will be made to the existing geodesic dome cover, and access openings and hatches for each tank. Provisions for new openings and access hatches will be further evaluated during detailed design.
Dryer Facility: Main Dryer Area (Lower Level)	• Dryers will be equipped with integral access hatches for maintenance activities. • Stairs and platforms to be provided for access around Dryer equipment and ancillary items. • Stairs and access doors for personnel travel between floors and emergency exit. • An elevator will be utilized to provide personnel access and small equipment removal between floors.
Dryer Facility: Chemical and DAF Area (Lower Level)	• Equipment to be removed and transferred utilizing roll-up door within room. • Stairs and access doors for personnel travel between floors and emergency exit. • An elevator will be utilized to provide personnel access and small equipment removal between floors.
Dryer Facility: Conveyors (Intermediate Level)	• Floor access opening to be utilized for equipment removal to 1st floor of facility. • Stairs and access doors for personnel travel between floors and emergency exit. • Proper spacing around conveyors will be provided for access and maintenance. • An elevator will be utilized to provide personnel access and small equipment removal between floors.
Dryer Facility: Centrifuge Area (Upper Level)	• Access opening in floor to be utilized for equipment removal to 1st floor of facility. • Stairs and access doors for personnel travel between floors and emergency exit. • An elevator will be utilized to provide personnel access and small equipment removal between floors.
Dryer Facility: Electrical Room (Lower Level)	• The ground room will house the main site substation. Access to this room requires a 10' H x 10' W coiling door with electrical operator. The coiling door material needs to be corrosion resistant and have insulation between the inner and outer faces. In addition, the room will have two man-doors that open outward from the room equipped with panic exit hardware.

Table 13-4. Key Access Approaches for New and Modified Areas

Facility	Access Approaches
Dryer Facility: Electrical Room (Intermediate/Upper Levels)	• The room will have two man-doors that open outwardly equipped with panic hardware. One hatch on the floor will be needed to hoist electrical gear to the second and third floor electrical rooms. Other solutions will be explored if the floor hatch is not suitable.
High Pressure Effluent Building: Main Pump Room	• A bridge crane will be provided for periodic removal of vertical turbine pumps, associated motors, strainers, and other major equipment. • Skylights will be provided for periodic removal or replacement of vertical turbine pumps via an exterior crane. • The room will have two exterior man doors and one 10' H x 10' W roll-up door with electrical operator. • Two sets of stairs will be provided for access to the sodium hypochlorite chemical secondary containment area.
High Pressure Effluent Building: Electrical Room	• Equipment will be removed through a double door located on the north side of the proposed HPE Building. A platform will be located where the double doors are on the electrical room to allow equipment to be temporarily staged prior to removal.

Section 14

Site Demolition

In order to construct the proposed improvements, portions of the existing facilities will need to be demolished and/or retrofitted as part of the overall construction activities. This section provides a general list of the proposed structures and facilities requiring demolition as well as a basic description of the scope of demolition. Detailed descriptions and/or justification of demolition activities may be included in subsequent sections of this PER – where necessary to describe the associated improvements.

14.1 Planned Process Area Demolition

Major demolition efforts associated with the proposed improvements are summarized in the following sections.

14.1.1 Existing Headworks Area Improvements

Demolition in the existing Headworks area will consist primarily of process mechanical equipment and piping systems associated with the existing Grit Removal Tanks and adjacent tunnels. Note that all plant service piping (air, water, drain, etc.) will be removed within the existing tunnels to the nearest branch connection to eliminate dead end/stagnant conditions.

- Removal of all piping and equipment associated with each of the four existing Grit Removal Tanks including grit pumps and piping, air and odor control piping. grit augers, grit dewatering equipment and associated electrical and control systems.
- Removal of the covers and associated control gates and channels associated with Grit Removal Tanks 3 & 4 (that will be repurposed for the new screens)
- Removal of the influent flume for the Hendersonville force main including all instrumentation not to be reused for proposed larger flume
- Partial demolition of paving and buried piping / duct work adjacent to the existing headworks structure.

Figure 14-1. Existing Grit Tank Tunnel and Upper Level Photos

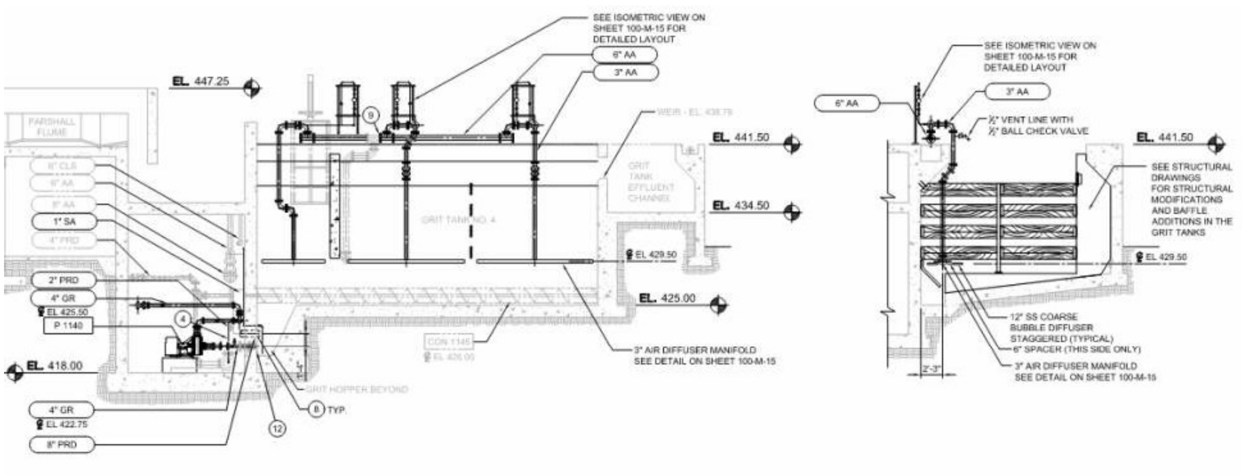

Figure 14-2. Typical Section of Existing Grit Tanks and Tunnel

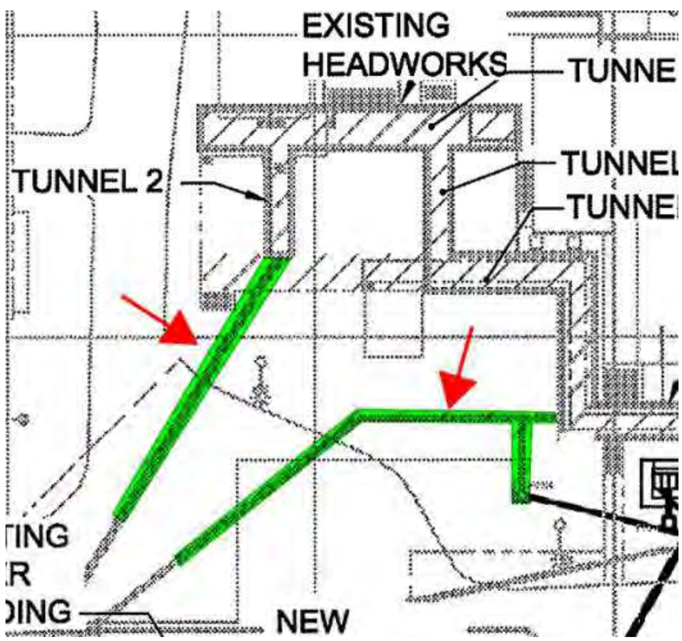

Figure 14-3. Underground Duct Bank Demolition

14.1.2 Existing Biofilter Area Improvements

Demolition in the existing biofilter area will include demolition and replacement of existing duct and could include removing and replacing one or more of the existing odor control fans as well as replacement of some items in the biofilter system, including solenoid valves and gauges. The existing Odor System Control Panel (Panel 9600), located in the Odor System Control Building, will be removed and replaced.

14.1.3 Existing Blower Building Electrical Improvements

The existing MV electrical switchgear, MV MCC, and related equipment in the existing Blower Building will be removed and replaced based on the facility design improvements. The existing utility outdoor substation will be demolished as well once the new substation in the new biosolids building is in service and ties to the distribution network as noted in the electrical section of this document. See

Figure 14-4 for photographs of the existing gear. All gear to be demolished will be shown on the design documents.

Figure 14-4. MV Switchgear Demolition

14.1.4 Existing High Pressure Effluent System Area Improvements

The existing HPE pumps and strainers will be removed, including housekeeping pads and associated cable and conduit. HPE piping and valves in the immediate area of the existing HPE pump station will also be removed. The wet well itself will remain intact and in-service. After the completion of this project, the existing HPE and Spray Water wet well will be solely dedicated to the spray water system.


Figure 14-5. Existing HPE Pumps (L) and Strainers (R) to be demolished.

14.1.5 Existing Filter Building and DSST Area Improvements

Demolition in this area is related to the installation of the new RDTs, modifications to the existing DSSTs, and removal of other abandoned equipment to free space inside the existing building. Major demolition items include the following:

- GBT equipment, piping, conveyors, ducts, and all other ancillary mechanical and electrical components will be demolished and removed from the GBT room to make room for the new RDTs
- Portions of foul air ductwork to be demolished and removed inside and outside the Filter Building and in the vicinity of the DSSTs.
- All BFP equipment, piping, ducts, hoods, access platforms, and ancillary mechanical and electrical components to be demolished and removed from BFP room (no building demolition in this room).
- The existing polymer storage tanks, mixing systems, dosing equipment and associated mechanical and electrical components will be demolished and removed from the chemical area for replacement with new systems. Removal of existing polymer storage tanks will be further evaluated during detailed design.
- The existing tank mixing system components inside the existing DSSTs and the adjacent pump gallery will be demolished including the pumps and associated piping inside the gallery. Select portions of piping inside the tank will remain for tank cleaning and maintenance purposes.
- Minor structural demolition will be performed in the above areas to remove equipment pads, supports, containment curbs, etc. to accommodate the new equipment and eliminate safety/access hazards.
- The existing sludge load out area on the north side of the building will be completely removed.

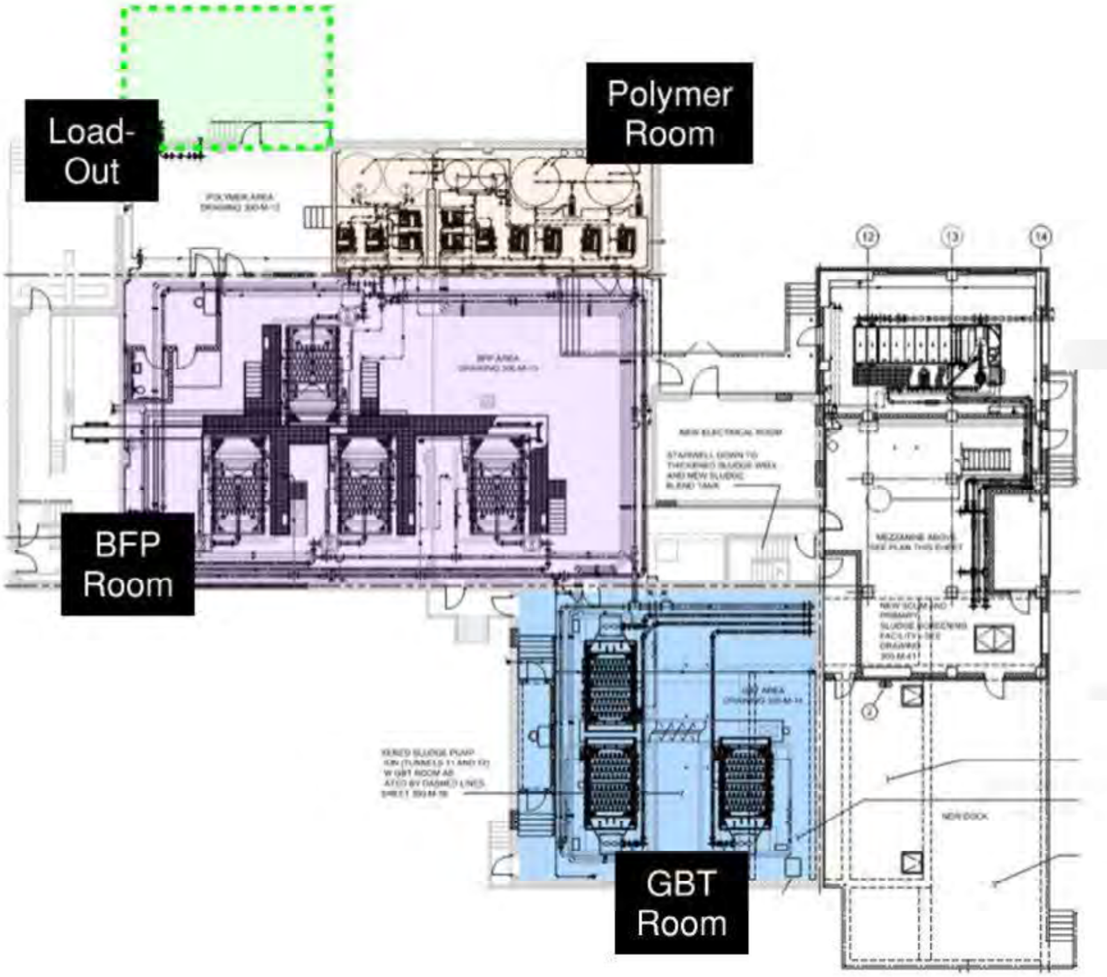

Figure 14-6. Overall Plan View of Existing Filter Building

Figure 14-7. Existing BGT Room (Left) and BFP Room (Right) Photos

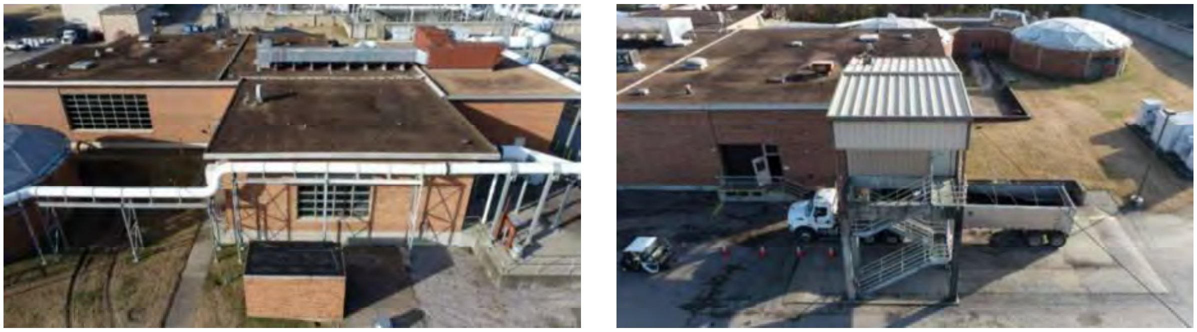

Figure 14-8. Exterior Filter Building Photos Showing Foul Air Ducts and Sludge Load-Out Area.

14.1.6 Existing Digester Area Improvements

No major demolition work will be required in this area.

14.1.7 Site Demolition

Major site demolition activities are summaries below:

- **Site Security Fence**: The existing site security fence and gate will be demolished and removed along the west and north edges of the plant site, from the current entry gate to the Maintenance Building.
- **Drying Beds in West Lot**: The drying beds located in the lot west of Edenwold Road Connector will be demolished and removed.
- **Edenwold Connector Road**: Portions of Edenwold Road Connector and plant entry pavement will be demolished and removed

14.1.8 Other Structures

In addition to the demolition associated with the proposed improvements, the following additional demolition will be performed at the site:

- **Existing Chlorination/Dechlorination Building:** The existing building will be abandoned upon completion of the new UV Disinfection project including removal of all major chlorination and dechlorination storage and feed systems. Under this project the remainder of the superstructure and all remaining mechanical and electrical systems will be removed down to the existing operating floor slab elevation. Where appropriate for safety, handrail will be provided along the perimeter of the operating floor slab (in particular, the north side which will remain elevated above grade.
- **Security Booth:** Located at the existing plant entrance, this building will be demolished including adjacent covered parking area for construction of the new Sludge Dryer Facility.

Figure 14-9. Chlorination Building (L) and Security Guard Booth (R) to be demolished

14.2 Hazardous Materials Investigations

Given the age of the existing Chlorination /Dechlorination Building, a regulated materials survey will be conducted to determine specific requirements for demolition and associated material handling/disposal/reuse. The field investigation to be performed during the Preliminary Design Phase will catalog suspect asbestos-containing materials (ACM), lead-containing paint (LCP), potential universal waste, and visual inventory of petroleum products and chemicals.

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Section 15

Flood Protection & Resiliency

As described in Section 1, a new flood wall will be constructed as part of the current Flood Mitigation Improvements Project (21-SC-0226). The new flood wall will provide flood protection for the entire treatment plant site to an elevation of 439.00 (NAVD 88) which corresponds to the 500-year flood elevation plus 2 feet. The anticipated construction schedule for the flood wall project shows completion ahead of the proposed construction schedule for this project. As such, all proposed improvements to be constructed under this project will be protected by the new floodwall, requiring no other specific mitigation measures.

Nonetheless, the BC Team conducted a review of the proposed improvement areas to identify additional, feasible flood protection measures that can be incorporated into the design for improved resiliency. A summary of the measures to be take in each of the major project improvement areas is provided in Table 15-1.

Table 15-1. Additional Flood Resiliency Measures by Process Area

Process Area	Flood Resiliency Considerations
Headworks Area	• All new electrical equipment will be placed in a new electrical room on the upper level of the Solids Processing Building which has a finished floor elevation of approximately 448.00'. • All headworks related equipment will be removed from the tunnels and the existing MCCs located there will be relocated to the new Solids Processing Building electrical room. • The motors for the new screens will be at an approximate elevation of 450.00'. • For remaining equipment (grit pumps, screenings washing equipment, etc.) which will be set below elevation 429, consideration will be given for additional protective measures such as immersible and/or spare motors.
Biofilter Area	• The operating elevations in the area of the existing odor control fans is approximately 439.5 ft and the control panel is at 436.4 ft. • A review of this area indicates that it is not practical to raise the fans or electrical equipment; however, these systems are not critical for plant operations and therefore represent limited risk to the facility.
Blower Building	• The operating elevation inside the building where the existing switchgear is located is approximately 437.5'. • A review of this area indicates that it is not practical to raise the floor or relocate the equipment for additional resiliency; therefore, no additional measures will be taken in this area.
Disinfection and Plant Water Area	• The proposed operating floor elevation at the new HPE Building is approximately 431.85'. • All new electrical equipment will be placed in a new elevated electrical room inside the building with a floor elevation of 439.0'. • The motors for the new vertical turbine pumps will be raised as high as practical without impeding access and maintainability. This item will be coordinated with the pump manufacturers as the design progresses. • For remaining equipment (chemical pumps, strainers, etc.) which will be set below elevation 439.0', consideration will be given for additional protective measures such as immersible and/or spare motors.
Filter Building Area	• The operating elevation inside the existing GBT and Polymer areas is approximately 431.0'. • The operating elevation inside the existing DSST tunnel/headhouse area is approximately 414.0'. • A review of this area indicates that it is not practical to raise the equipment or electrical equipment; however, consideration will be given for additional protective measures such as immersible and/or spare motors.
Digester and Waste Gas Burner Area	• The current elevation of the concrete pad at the waste gas burner (flare) is 436.5'.

Table 15-1. Additional Flood Resiliency Measures by Process Area

Process Area	Flood Resiliency Considerations
Biosolids Drying Building Area	• The finished floor elevation for the new building will be set close to elevation 439.0 such that all first-floor equipment (counting the additional height provided by equipment pads) will be protected. • For equipment (pumps, etc.) to be located in the proposed basement area, additional design considerations to increase flood resiliency will be given as the design progresses.

Refer to Section 1 for additional discussion on the new flood wall and Section 6 for discussion on other floodway considerations for the site.

Section 16

Permitting

The following table presents a list of the anticipated permits and approvals necessary for construction of the project:

Table 16-1. Anticipated Permits

Permit	Description	
Grading Permit	• MWS Development Services	• Coordination and submittals to MWS Development Services for review and comment will be required as part of the Grading Permit Application process, including submittals and coordination with MWS Stormwater
Building Permits	• Metro Department of Codes and Building Safety	• Building permits will be required for any of the occupied spaces (Security Booth, Offices/Control Room in BDF) and the Codes Department will determine ancillary requirements for improvements within the public right-of-way
Railroad Approval	• CSX Railroad	• Coordination and submittals to CSX Railroad for review and comment on proposed improvements along north edge of Project will be necessary to obtain approval for work within railroad property setback easement
Subdivision Application	• Metro Planning	• Abandonment and dedication of right-of-way for relocation of Edenwold Connector Road. Additional coordination with Metro Public Works / TDOT will be necessary as part of the subdivision application process. Additional outside approvals would be provided and coordinated through Planning as part of the application review process.
Air Permit	• Metro Health Division of Air Pollution Control	• Coordination and submittals to Metro Health Division of Air Pollution Control will be required for new point source loads associated with the BDF, RTOs, and new waste gas burner
NPDES Permit	• TDEC Division of Water Resources	• Coordination and submittals to TDEC Division of Water Resources will be required for updating the current NPDES permit for the DCWRF to include the new process units
Water Connection	• Madison Suburban Utility District	• Coordination and application for a new/updated water service connection will be required to serve the improvements
Natural Gas Connection	• Piedmont Natural Gas	• Coordination and application for a new service connection will be required to serve the improvements
Electrical Service	• Nashville Electric Service	• Coordination and application for a new service drop and increased service capacity contract will be necessary to serve the improvements
Phone / Fiber	• AT&T	• Coordination and application for an updated service connection will be necessary to serve the improvements

Coordination and submittals to the lead entities/agencies listed above will be required for review, comment, and ultimately support or approval of the various permit applications, applications for service, and/or construction documents.

Section 17

Opinion of Probable Construction Cost

17.1 Class of Estimate

In accordance with the Association for the Advancement of Cost Engineering International (AACE) criteria, this is a Class 4 estimate. A Class 4 estimate is defined as a Planning Level or Design Technical Feasibility Estimate. Typically, engineering is from 1 to 15 percent complete. Class 4 estimates are used to prepare planning level cost scopes or to evaluate alternatives in design conditions and form the base work for the Class 3 Project Budget or Funding Estimate.

Expected accuracy for Class 4 estimates typically range from -30 to +50 percent, depending on the technological complexity of the project, appropriate reference information and the inclusion of an appropriate contingency determination. In unusual circumstances, ranges could exceed those shown.

17.2 Estimating Methodology

This estimate was prepared using quantity take-offs, vendor quotes and equipment pricing furnished either by the project team or by the estimator. The estimate includes direct labor costs and anticipated productivity adjustments to labor and equipment. Where possible, estimates for work anticipated to be performed by specialty subcontractors have been identified.

Construction labor crew and equipment hours were calculated from production rates contained in documents and electronic databases published by R.S. Means, Mechanical Contractors Association (MCA), National Electrical Contractors Association (NECA), and Rental Rate Blue Book for Construction Equipment (Blue Book).

A basis of estimate report is provided in Appendix D that details other estimating assumptions.

17.3 Opinion of Probable Construction Cost

Table 17-1 summarizes the construction costs for the proposed upgrades organized generally by major process area or discipline as appropriate.

Table 17-1. Preliminary Opinion of Probable Construction Costs

Project Component	Construction Cost
Headworks Improvements	$24,320,000
Sludge Thickening improvements (GBT Replacement)	$8,570,000
Digested Sludge Storage Improvements	$3,690,000
Waste Gas Improvements	$650,000
New Biosolids Drying Facility	$79,670,000
New High Pressure Effluent Building	$5,370,000

Table 17-1. Preliminary Opinion of Probable Construction Costs	
Project Component	**Construction Cost**
Odor Control Improvements	$3,280,000
Plant Electrical Improvements	$11,560,000
Ex. Chlorination Building Demolition	$450,000
Ex. Filter Building Demolition (BFP related systems)	$260,000
Edenwold Connector Road Relocation	$1,020,000
Plant Sitework	$4,200,000
Total Project Cost	$143,040,000

Key assumptions associated with each category above are as follows:

- **Headworks**: Includes all work in the vicinity of the new Headworks facility including all flow measurement, screening, and grit related improvements and associated modifications to the existing Headwork structures.
- **Sludge Thickening**: Includes all work related to replacing the existing GBTs with new RDTs including modifications to the existing polymer feed systems and a placeholder for temporary sludge thickening equipment rental (pending further evaluation during detailed design)
- **Digested Sludge Storage**: Included modifications to the existing DSST mixing systems and piping as defined herein.
- **Biosolids Drying Facility**: Includes all work in and around the new sludge drying facility including elements such as RTOs, gas conditioning, and associated electrical systems (including new plant switchgear) to be located in that facility.
- **High Pressure Effluent Building**: Includes all work associated with upgrades to the existing plant water systems (high pressure and spray water) including the new HPE Building and modifications to the existing chlorine contact tanks.
- **Odor Control**: Includes all new primary ductwork and associated modifications (outside of individual process areas) and modifications to existing equipment in the existing biofilter area.
- **Plant Electrical**: Includes major switchgear and related improvements in the existing Blower building and other site electrical modifications outside the individual process areas.
- **Ex Chlorination Building Demo**: Includes demolition of the existing building down to the existing operating floor slab and assumes all work shown in the existing UV improvements project is completed.
- **Filter Building Demo**: Includes demo of the existing BFP and associated systems including the sludge loadout area.
- **Edenwold Connector Road**: Includes all sitework associated with relocation of the existing road including existing utility modifications.
- **Plant Sitework**: Includes all general site work, stormwater, yard piping modifications and relocation of the existing guard shed.

Section 18

Limitations

This document was prepared solely for Metro Water Services in accordance with professional standards at the time the services were performed and in accordance with the contract between Metro Water Services and Brown and Caldwell dated November 7, 2019. This document is governed by the specific scope of work authorized by Metro Water Services; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by Charlotte Water and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

APPLICATION FOR TDEC DWR-ARP NON COLLABORATIVE STATE WATER INFRASTRUCTURE GRANTS PROGRAM

METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY

DocuSigned by:

Scott Potter

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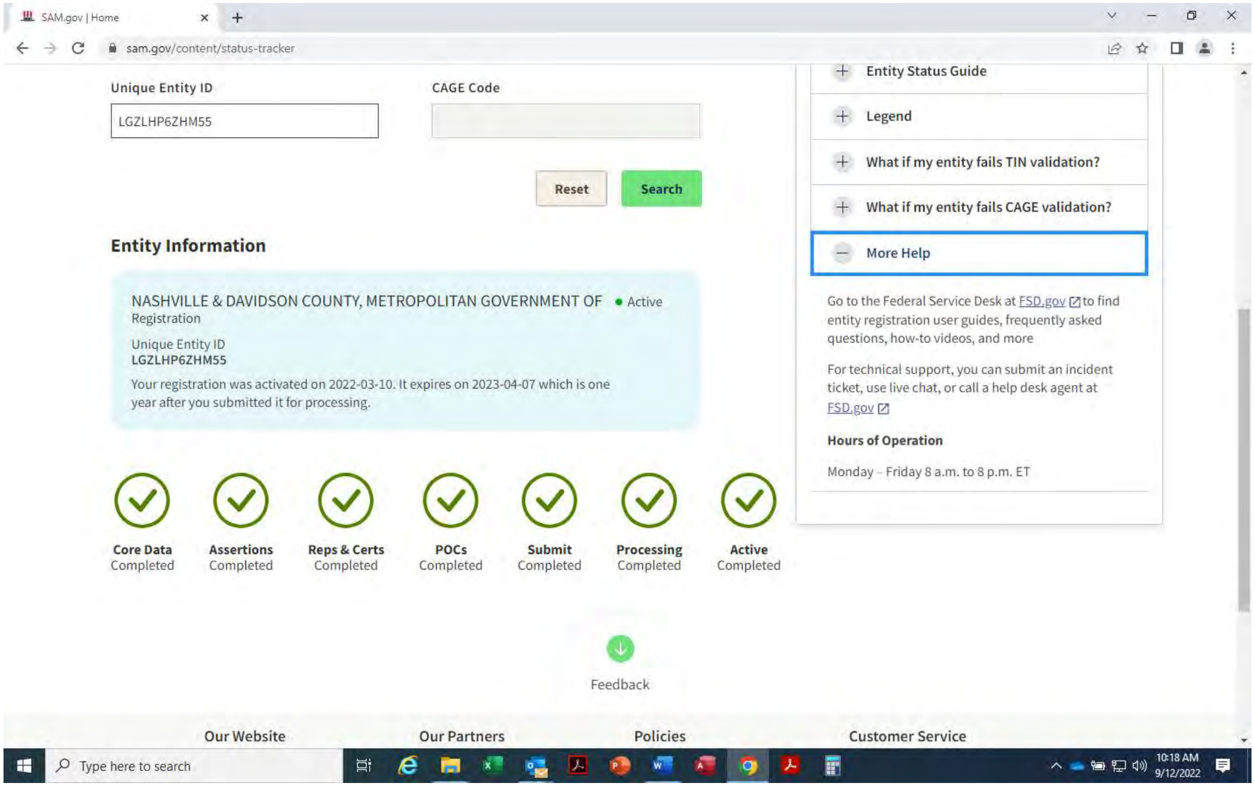
10/6/2022

Scott Potter, Director

Department of Water and Sewerage Services

Date


SAM.gov | Home
sam.gov/content/status-tracker
Unique Entity ID
LGZLHP6ZHM55
CAGE Code
Reset
Search
Entity Information
NASHVILLE & DAVIDSON COUNTY, METROPOLITAN GOVERNMENT OF
Active Registration
Unique Entity ID
LGZLHP6ZHM55
Your registration was activated on 2022-03-10. It expires on 2023-04-07 which is one year after you submitted it for processing.
Core Data Completed
Assertions Completed
Reps & Certs Completed
POCs Completed
Submit Completed
Processing Completed
Active Completed
Entity Status Guide
Legend
What if my entity fails TIN validation?
What if my entity fails CAGE validation?
More Help
Go to the Federal Service Desk at FSD.gov to find entity registration user guides, frequently asked questions, how-to videos, and more
For technical support, you can submit an incident ticket, use live chat, or call a help desk agent at FSD.gov
Hours of Operation
Monday – Friday 8 a.m. to 8 p.m. ET
Feedback
Our Website
Our Partners
Policies
Customer Service
Type here to search
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9/12/2022

ORIGINAL

METROPOLITAN COUNTY COUNCIL

Resolution No. ______________

A resolution approving an application for the DWR-ARP Non Collaborative Grants State Water Infrastructure Program Grant from the Tennessee Department of Environment and Conservation to The Metropolitan Government of Nashville and Davidson County, acting by and through the Metropolitan Nashville Water and Sewerage Services Department, to modernize and upgrade the Dry Creek Water Reclamation Facility.

Introduced ______________________

Amended ______________________

Adopted ______________________

Approved ______________________

By ______________________

Metropolitan Mayor