STATE OF UTAH
DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
SALT LAKE CITY, UTAH

UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM (UPDES) PERMITS

Minor Industrial Permit No. **UT0026131**

In compliance with provisions of the Utah *Water Quality Act, Title 19, Chapter 5, Utah Code Annotated ("UCA") 1953, as amended* (the *"Act"*),

Sand Hollow Ground Water Treatment Plant

is hereby authorized to discharge from its groundwater treatment facility to receiving waters named **Sand Hollow Reservoir**,

in accordance with specific limitations, outfalls, and other conditions set forth herein.

This permit shall become effective on March 1, 2021

This permit expires at midnight on February 28, 2026.

Signed this 9th day of February, 2021.

Erica Brown Gaddis, PhD
Director

DWQ-2020-024659

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I. DISCHARGE LIMITATIONS AND REPORTING REQUIREMENTS

A. Description of Discharge Points. The authorization to discharge wastewater provided under this part is limited to those outfalls specifically designated below as discharge locations. Discharges at any location not authorized under a UPDES permit are violations of the *Act* and may be subject to penalties under the *Act*. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge may be subject to criminal penalties as provided under the *Act*.

Outfall Number(s)	Location of Discharge Outfall(s)
001	Located at latitude 37° 06' 52.0" N and longitude 113° 23' 18.0" W Intermittent discharge of decant water from drying beds to an 8" pipe Sand Hollow Reservoir to the Northeast of the facility.

B. Narrative Standard. It shall be unlawful, and a violation of this permit, for the permittee to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor or taste, or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by a bioassay or other tests performed in accordance with standard procedures.

C. Specific Limitations and Self-Monitoring Requirements.

1. Effective Immediately, and lasting through the life of this permit, there shall be no acute or chronic toxicity in Outfall(s) 001 as determined by test procedures in DWQ's Permitting and Enforcement Guidance Document for Whole Effluent Toxicity Control, dated February 2018.

2.
   a. Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfall 001. Such discharges shall be limited and monitored by the permittee as specified below:

Parameter	Effluent Limitations [a]			
	Maximum Monthly Avg.	Maximum Weekly Avg.	Daily Minimum	Daily Maximum
Total Flow (GPD)	-	-	--	3,600
TSS, mg/L	25	35	--	--
BOD_5, mg/L	25	35	--	
Dissolved Oxygen, mg/L	--	--	5.0	--
TRC, mg/L	--	--	--	0.280
E. coli, No./100mL	126	157	--	--
Oil & Grease, mg/L	--	--	--	10.0
pH, Standard Units	--	--	6.5	9
TDS, tons/day [g]	--	--	--	1.0
TDS, mg/L [g]	--	--	--	1,200

Self-Monitoring and Reporting Requirements [a]			
Parameter	Frequency	Sample Type	Units
Total Flow [b,c]	Continuous	Recorder	GPD
TSS	Monthly	Grab	mg/L
BOD_5	Monthly	Grab	mg/L
E. coli	Monthly	Grab	No./100mL
pH	Monthly	Grab	SU
DO	Monthly	Grab	mg/L
TRC	Daily	Grab	mg/L
Oil & Grease [d]	When Sheen Observed	Grab	mg/L
Arsenic [e]	Monthly	Grab	mg/L
Manganese [e]	Monthly	Grab	mg/L
Iron [e]	Monthly	Grab	mg/L
TDS [f,g]	Monthly	Composite	tons/day
TDS [f,g]	Monthly	Composite	mg/L
Metals [h]	1 X in Permit Cycle	Composite	mg/L

Metals to be Monitored		
Parameter	Sample Type	Units
Total Arsenic	Composite	mg/L
Total Cadmium	Composite	mg/L
Total Chromium	Composite	mg/L
Total Copper	Composite	mg/L
Total Cyanide	Grab	mg/L
Total Lead	Composite	mg/L
Total Mercury	Grab/Composite	mg/L
Total Nickel	Composite	mg/L
Total Selenium	Composite	mg/L
Total Silver	Composite	mg/L
Total Zinc	Composite	mg/L

Table References

a. See Definitions, Part VII, for definition of terms.

b. Flow measurements of influent/effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.

c. If the rate of discharge is controlled, the rate and duration of discharge shall be reported.

d. Oil & Grease sampled when sheen is present or visible. If no sheen is present or visible, report NA.

e. Arsenic, Iron, Manganese are currently monitoring only. Monitoring is required for these parameters because they were identified as a pollutant of concern by the applicant. Data collected will be used to determine if a future limit is required, if more data is needed, or if there is no need for continued monitoring.

f. If the facility is unable to collect a composite sample, then a grab should be taken.

g. The facility has both concentration and mass limits for Total Dissolved Solids (TDS). The Virgin River Watershed has an approved TMDL for TDS. TDS mass limitations are based on Colorado Basin Salinity Control Forum and concentration based limits are based on the approved TMDL for the Virgin River Watershed and reflects the standard.

h. Metals sampling shall occur 1 time during the 5-year permit cycle.

End Table References

1. Compliance Schedule

   a. There is no Compliance Schedule included in this permit or Compliance Schedule Language.

B. Reporting of Monitoring Results.

   1. Reporting of Wastewater Monitoring Results Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1)* or by NetDMR, post-marked or entered into NetDMR no later than the 28th day of the month following the completed reporting period. The first report is due on April 28, 2021. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports including whole effluent toxicity (WET) test reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part VII.G)*, and submitted by NetDMR, or to the Division of Water Quality at the following address:

* Starting January 1, 2017 monitoring results must be submitted using NetDMR unless the permittee has successfully petitioned for an exception.

Department of Environmental Quality
Division of Water Quality
PO Box 144870
Salt Lake City, Utah 84114-4870

II. INDUSTRIAL PRETREATMENT PROGRAM

A. Discharge to POTW. Any wastewaters discharged to the sanitary sewer, either as a direct discharge or as a hauled waste, are subject to Federal, State and local pretreatment regulations. Pursuant to Section 307 of The Water Quality Act of 1987, the permittee shall comply with all applicable federal General Pretreatment Regulations promulgated at 40 CFR 403, the State Pretreatment Requirements at UAC R317-8-8, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the wastewaters. At a minimum the discharge, into a POTW, must met the requirements of Part II.C. of the permit.

B. Hazardous Waste Notification. The permittee must notify the POTW, the EPA Regional Waste Management Director, and the State hazardous waste authorities, in writing, if they discharge any substance into a POTW which if otherwise disposed of would be considered a hazardous waste under 40 CFR 261. This notification must include the name of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).

C. General and Specific Prohibitions.

1. General Prohibitions. The permittee may not introduce into a POTW any pollutant(s) which cause Pass Through or Interference. These general prohibitions and the specific prohibitions in paragraph 2. of this section apply to the introducing pollutants into a POTW whether or not the permittee is subject to other National Pretreatment Standards or any national, State, or local Pretreatment Requirements.

2. Specific Prohibitions. The following pollutants shall not be introduced into a POTW:

a. Pollutants which create a fire or explosion hazard in the publicly owned treatment works (POTW), including, but not limited to, wastestreams with a closed cup flashpoint of less than 140˚F (60˚C);

b. Pollutants, which will cause corrosive structural damage to the POTW, but in no case, discharges with a pH lower than 5.0;

c. Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference;

d. Any pollutant, including oxygen demanding pollutants (BOD, etc.), released in a discharge at such volume or strength as to cause interference in the POTW;

e. Heat in amounts, which will inhibit biological activity in the POTW, resulting in interference, but in no case, heat in such quantities that the influent to the sewage treatment works exceeds 104˚F (40˚C));

f. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

g. Pollutants, which result in the presence of toxic gases, vapor, or fumes within the POTW in a quantity that may cause worker health or safety problems;

h. Any trucked or hauled pollutants, except at discharge points designated by the POTW; or

i. Any pollutant that causes pass through or interference at the POTW.

j. Any specific pollutant which exceeds any local limitation established by the POTW.

D. Categorical Standards. In addition to the general and specific limitations expressed in *Part II. C.* of this section, applicable National Categorical Pretreatment Standards must be met by all industrial users discharging into a POTW. These standards are published in the federal regulations at *40 CFR 405 through 471*.

E. Definitions. For this section the following definitions shall apply:

3. *Indirect Discharge* means the introduction of pollutants into a publicly-owned treatment works (POTW) from any non-domestic source regulated under section 307 (b), (c) or (d) of the CWA.

4. *Interference* means a discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

   a. Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and

   b. Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

5. *Pass Through means* a Discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

6. *Publicly Owned Treatment Works* or *POTW* means a treatment works as defined by section 212 of the CWA, which is owned by a State or municipality (as defined by section 502(4) of the CWA). This definition includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a POTW Treatment Plant. The term also means the municipality as defined in section 502(4) of the CWA, which has jurisdiction over the Indirect Discharges to and the discharges from such a treatment works.

7. *Significant industrial user (SIU)* is defined as an industrial user discharging to a POTW that satisfies any of the following:

   a. Has a process wastewater flow of 25,000 gallons or more per average work day;

b. Has a flow greater than five percent of the flow carried by the municipal system receiving the waste;
c. Is subject to Categorical Pretreatment Standards, or

d. Has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement.

8. *User or Industrial User (IU)* means a source of Indirect Discharge.

III. BIOSOLIDS REQUIREMENTS

The State of Utah has adopted the 40 CFR 503 federal regulations for the disposal of sewage sludge (biosolids) by reference. However, since this facility is a drinking water plant, there is not any regular biosolids production. Therefore 40 CFR 503 does not apply at this time. In the future, if the sludge needs to be removed from the drying beds and is disposed in some way; the Division of Water Quality must be contacted prior to the removal of the sludge to ensure that all applicable state and federal regulations are met.

IV. MONITORING, RECORDING & GENERAL REPORTING REQUIREMENTS

A. Representative Sampling. Samples taken in compliance with the monitoring requirements established under *Part I* shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge. Samples of biosolids shall be collected at a location representative of the quality of biosolids immediately prior to the use-disposal practice.

B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under *Utah Administrative Code ("UAC") R317-2-10 and 40CFR Part 503*, unless other test procedures have been specified in this permit.

C. Penalties for Tampering. The *Act* provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

E. Additional Monitoring by the Permittee. If the permittee monitors any parameter more frequently than required by this permit, using test procedures approved under *UAC R317-2-10* and *40 CFR 503* or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or the Biosolids Report Form. Such increased frequency shall also be indicated. Only those parameters required by the permit need to be reported.

F. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

G. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least five years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. A copy of this UPDES permit must be maintained on site during the duration of activity at the permitted location

H. Twenty-four Hour Notice of Noncompliance Reporting.

1. The permittee shall (orally) report any noncompliance including transportation accidents, spills, and uncontrolled runoff from biosolids transfer or land application sites which may seriously endanger health or environment, as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of circumstances. The

report shall be made to the Division of Water Quality, (801) 536-4300, or 24-hour answering service (801) 536-4123.

2. The following occurrences of noncompliance shall be reported by telephone (801) 536-4300 as soon as possible but no later than 24 hours from the time the permittee becomes aware of the circumstances:

    a. Any noncompliance which may endanger health or the environment;

    b. Any unanticipated bypass, which exceeds any effluent limitation in the permit (See *Part V.G, Bypass of Treatment Facilities.)*;

    c. Any upset which exceeds any effluent limitation in the permit (See *Part V.H*, *Upset Conditions*.);

    d. Violation of a daily discharge limitation for any of the pollutants listed in the permit; or,

    e. Violation of any of the Table 3 metals limits, the pathogen limits, the vector attraction reduction limits or the management practices for biosolids that have been sold or given away.

3. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

    a. A description of the noncompliance and its cause;

    b. The period of noncompliance, including exact dates and times;

    c. The estimated time noncompliance is expected to continue if it has not been corrected;

    d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and,

    e. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period.

4. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Division of Water Quality, (801) 536-4300.

5. Reports shall be submitted to the addresses in *Part I.D*, *Reporting of Monitoring Results*.

I. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for *Part I.D* are submitted. The reports shall contain the information listed in *Part IV.H.3*

J. Inspection and Entry The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, including but not limited to, biosolids treatment, collection, storage facilities or area, transport vehicles and containers, and land application sites;

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the *Act*, any substances or parameters at any location, including, but not limited to, digested biosolids before dewatering, dewatered biosolids, biosolids transfer or staging areas, any ground or surface waters at the land application sites or biosolids, soils, or vegetation on the land application sites; and,

5. The permittee shall make the necessary arrangements with the landowner or leaseholder to obtain permission or clearance, the Director, or authorized representative, upon the presentation of credentials and other documents as may be required by law, will be permitted to enter without delay for the purposes of performing their responsibilities.

V. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity, which may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions. The *Act* provides that any person who violates a permit condition implementing provisions of the *Act* is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions or the Act is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under *UCA 19-5-115(2)* a second time shall be punished by a fine not exceeding $50,000 per day. Except as provided at *Part V.G*, *Bypass of Treatment Facilities* and *Part V.H*, *Upset Conditions*, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit, which has a reasonable likelihood of adversely affecting human health or the environment. The permittee shall also take all reasonable steps to minimize or prevent any land application in violation of this permit.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Removed Substances. Collected screening, grit, solids, sludge, or other pollutants removed in the course of treatment shall be disposed of in such a manner so as to prevent any pollutant from entering any waters of the state or creating a health hazard. Sludge/digester supernatant and filter backwash shall not directly enter either the final effluent or waters of the state by any other direct route.

G. Bypass of Treatment Facilities.

1. Bypass Not Exceeding Limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to paragraph 2 and 3 of this section.

2. Prohibition of Bypass.

   a. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

      (1) Bypass was unavoidable to prevent loss of human life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance, and

      (3) The permittee submitted notices as required under *section V.G.3*.

   b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in *sections V.G.2.a (1), (2) and (3)*.

3. Notice.

   a. *Anticipated bypass*. Except as provided above in *section V.G.2* and below in *section V.G.3.b*, if the permittee knows in advance of the need for a bypass, it shall submit prior notice, at least ninety days before the date of bypass. The prior notice shall include the following unless otherwise waived by the Director:

      (1) Evaluation of alternative to bypass, including cost-benefit analysis containing an assessment of anticipated resource damages:

      (2) A specific bypass plan describing the work to be performed including scheduled dates and times. The permittee must notify the Director in advance of any changes to the bypass schedule;

      (3) Description of specific measures to be taken to minimize environmental and public health impacts;

      (4) A notification plan sufficient to alert all downstream users, the public and others reasonably expected to be impacted by the bypass;

      (5) A water quality assessment plan to include sufficient monitoring of the receiving water before, during and following the bypass to enable evaluation of public health risks and environmental impacts; and,

      (6) Any additional information requested by the Director.

   b. *Emergency Bypass*. Where ninety days advance notice is not possible, the permittee must notify the Director, and the Director of the Department of Natural Resources, as soon as it becomes aware of the need to bypass and provide to the Director the information in *section V.G.3.a.(1) through (6)* to the extent practicable.

c. *Unanticipated bypass*. The permittee shall submit notice of an unanticipated bypass to the Director as required under *Part IV.H*, Twenty Four Hour Reporting. The permittee shall also immediately notify the Director of the Department of Natural Resources, the public and downstream users and shall implement measures to minimize impacts to public health and environment to the extent practicable.

H. Upset Conditions.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of paragraph 2 of this section are met. Director's administrative determination regarding a claim of upset cannot be judiciously challenged by the permittee until such time as an action is initiated for noncompliance.

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated;

   c. The permittee submitted notice of the upset as required under *Part IV.H*, *Twenty-four Hour Notice of Noncompliance Reporting*; and,

   d. The permittee complied with any remedial measures required under *Part V.D*, *Duty to Mitigate*.

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

VI. GENERAL REQUIREMENTS

A. Planned Changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of parameters discharged or pollutant sold or given away. This notification applies to pollutants, which are not subject to effluent limitations in the permit. In addition, if there are any planned substantial changes to the permittee's existing sludge facilities or their manner of operation or to current sludge management practices of storage and disposal, the permittee shall give notice to the Director of any planned changes at least 30 days prior to their implementation.

B. Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity, which may result in noncompliance with permit requirements.

C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit.

E. Duty to Provide Information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

F. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director, and,

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. A duly authorized representative may thus be either a named individual or any individual occupying a named position.

3. Changes to authorization. If an authorization under *paragraph VI.G.2* is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of *paragraph VI.G.2.* must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Penalties for Falsification of Reports. The *Act* provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000.00 per violation, or by imprisonment for not more than six months per violation, or by both.

I. Availability of Reports. Except for data determined to be confidential under *UAC R317-8-3.2*, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of Director. As required by the *Act*, permit applications, permits and effluent data shall not be considered confidential.

J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the permittee of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under the *Act*.

K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. Severability. The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 20 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittee's containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph *2* above.

N. State or Federal Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by *UCA 19-5-117* and *Section 510* of the *Act* or any applicable Federal or State transportation regulations, such as but not limited to the Department of Transportation regulations.

O. Water Quality - Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. Water Quality Standards for the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.

2. A final wasteload allocation is developed and approved by the State and/or EPA for incorporation in this permit.

3. Revisions to the current CWA § 208 areawide treatment management plans or promulgations/revisions to TMDLs (40 CFR 130.7) approved by the EPA and adopted by DWQ which calls for different effluent limitations than contained in this permit.

P. Biosolids – Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate biosolids limitations (and compliance schedule, if necessary), management practices, other appropriate requirements to protect public health and the environment, or if there have been substantial changes (or such changes are planned) in biosolids use or disposal practices; applicable management practices or numerical limitations for pollutants in biosolids have been promulgated which are more stringent than the requirements in this permit; and/or it has been determined that the permittees biosolids use or land application practices do not comply with existing applicable state of federal regulations.

Q. Toxicity Limitation - Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include WET testing, a WET limitation, a compliance schedule, a compliance date, additional or modified numerical limitations, or any other conditions related to the control of toxicants if toxicity is detected during the life of this permit.

VII. DEFINITIONS

A. Wastewater.

1. The "7-day (and weekly) average", other than for *E. coli* bacteria, fecal coliform bacteria, and total coliform bacteria, is the arithmetic average of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. Geometric means shall be calculated for *E. coli* bacteria, fecal coliform bacteria, and total coliform bacteria. The 7-day and weekly averages are applicable only to those effluent characteristics for which there are 7-day average effluent limitations. The calendar week, which begins on Sunday and ends on Saturday, shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for that calendar week shall be included in the data for the month that contains Saturday.

2. The "30-day (and monthly) average," other than for *E. coli* bacteria, fecal coliform bacteria and total coliform bacteria, is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. Geometric means shall be calculated for *E. coli* bacteria, fecal coliform bacteria and total coliform bacteria. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.

3. "Act," means the *Utah Water Quality Act*.

4. "Acute toxicity" occurs when 50 percent or more mortality is observed for either test species at any effluent concentration (lethal concentration or "LC_{50}").

5. "Bypass," means the diversion of waste streams from any portion of a treatment facility.

6. "Chronic toxicity" occurs when the $IC_{25} < 1.8\%$ effluent. The 1.8% effluent is the concentration of the effluent in the receiving water, at the end of the mixing zone expressed as per cent effluent.

7. "IC_{25}" is the concentration of toxicant (given in % effluent) that would cause a 25% reduction in mean young per female, or a 25% reduction in overall growth for the test population.

8. "Composite Samples" shall be flow proportioned. The composite sample shall, as a minimum, contain at least four (4) samples collected over the compositing period. Unless otherwise specified, the time between the collection of the first sample and the last sample shall not be less than six (6) hours nor more than 24 hours. Acceptable methods for preparation of composite samples are as follows:

   a. Constant time interval between samples, sample volume proportional to flow rate at time of sampling;

   b. Constant time interval between samples, sample volume proportional to total flow (volume) since last sample. For the first sample, the flow rate at the time the sample was collected may be used;

c. Constant sample volume, time interval between samples proportional to flow (i.e., sample taken every "X" gallons of flow); and,

d. Continuous sample volume, with sample collection rate proportional to flow rate.

9. "CWA" means *The Federal Water Pollution Control Act*, as amended, by *The Clean Water Act of 1987*.

10. "Daily Maximum" (Daily Max.) is the maximum value allowable in any single sample or instantaneous measurement.

11. "EPA," means the United States Environmental Protection Agency.

12. "Director," means Director of the Division of Water Quality.

13. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

14. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.

15. "Severe Property Damage," means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

16. "Upset," means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

FACT SHEET AND STATEMENT OF BASIS
SAND HOLLOW GROUNDWATER TREATMENT PLANT
NEW PERMIT: DISCHARGE
UPDES PERMIT NUMBER: UT0026131
MINOR INDUSTRIAL

FACILITY CONTACTS

Person Name:	Corey Cram
Position:	Associate General Manager of Project Development
Phone Number:	(435) 673-3617
Person Name:	David Jessop
Position:	Operator
Phone Number:	(435) 673-3617
Facility Name:	Sand Hollow Groundwater Treatment Plant
Mailing and Facility Address:	533 East Waterworks Drive St. George, Utah 84770
Actual Address:	Sand Hollow Road, Washington County

DESCRIPTION OF FACILITY

The Sand Hollow Groundwater Treatment Plant will be a newly constructed drinking water facility designed to primarily treat arsenic and manganese in raw groundwater. Arsenic and other contaminants will be removed through filter media. The main treatment process involves pre-oxidation with chlorine, coagulation (ferric chloride), and pressure filtration with sand and anthracite media and air scour capabilities, followed by post-chlorination. Backwash flows will be pumped to a backwash clarifier. Water within the clarifier will be decanted and returned to the front of the plant. Periodically, the sludge in the tank bottom will be removed through a blowdown process and will be pumped to the drying beds for further processing. Water within the drying beds will be removed through evaporation. However, in the event that the water production exceeds the evaporation rate, decanted water will discharge to the west dam drain to Sand Hollow Reservoir. Dried Sludge will be removed and hauled to a local landfill. The discharge is not anticipated to be year-round, but only during periods of low evaporation and high water production.

DISCHARGE

DESCRIPTION OF DISCHARGE

Sand Hollow Groundwater Treatment Plant is a groundwater treatment facility that maintains a UPDES permit in the event that a discharge of drying bed decant water is necessary.

Outfall Number	Location of Discharge Outfall(s)
001	Located at latitude 37° 06' 52.0" N and longitude 113° 23' 18.0" W Intermittent discharge of decant drying water from drying beds through an 8" pipe to Sand Hollow Reservoir to the Northeast of the facility.

RECEIVING WATERS AND STREAM CLASSIFICATION
If a discharge were to occur, it would be pumped into then west dam drain to Sand Hollow Reservoir, which is a Class 1C, 2A, 3B, and 4 according to *Utah Administrative Code (UAC) R317-2-13*:

Class 1C -- Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water

Class 2A -- Protected for frequent primary contact recreation where there is a high likelihood of ingestion of water or a high degree of bodily contact with the water. Examples include, but are not limited to, swimming, rafting, kayaking, diving, and water skiing.

Class 3B -- Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.

Class 4 -- Protected for agricultural uses including irrigation of crops and stock watering.

BASIS FOR EFFLUENT LIMITATIONS
Limitations on total suspended solids (TSS), biochemical oxygen demand (BOD5), E. coli, and pH are based on current Utah Secondary Treatment Standards, UAC R317-1-3.2. Limitations on dissolved oxygen (DO) and total residual chlorine (TRC) were based on the wasteload analysis (WLA). The oil and grease is based on best professional judgment (BPJ). Attached is a WLA for this discharge into Sand Hollow Reservoir.

Total Dissolved Solids (TDS) limitations are based upon Utah Water Quality Standards for concentration values and the Colorado River Basin Salinity Control Forum (CRBSCF) for mass loading values when applicable as authorized in UAC R317-2-4. In accordance with the CRBSCF the effluent will be limited to a maximum discharge of 1 ton per day. The Virgin River Watershed has an approved TMDL for TDS. Sand Hollow Reservoir is included in the approved TMDL for the Virgin River Watershed. The TMDL calls for a 24% reduction in TDS loading, but does not assign allocations to facilities. Since no allocations were identified in the TMDL, the facility will be required to meet the standard for TDS, which is 1,200 mg/L.

Since this is a new UPDES permit and the discharge will use assimilative capacity of the receiving water, a Level II Antidegradation review (ADR) was required. The level II ADR was public noticed from January 5, 2021, to February 5, 2021, as part of this permit. The permittee is expected to be able to comply with these limitations. It has been determined that this discharge will not cause a violation of water quality standards. The permit limitations are:

Parameter	Effluent Limitations [a]			
	Maximum Monthly Avg.	Maximum Weekly Avg.	Daily Minimum	Daily Maximum
Total Flow (GPD)	-	-	--	3,600
TSS, mg/L	25	35	--	--
BOD_5, mg/L	25	35	--	
Dissolved Oxygen, mg/L	--	--	5.0	--
TRC, mg/L	--	--	--	0.280
E. coli, No./100mL	126	157	--	--
Oil & Grease, mg/L	--	--	--	10.0
pH, Standard Units	--	--	6.5	9
TDS, tons/day [g]	--	--	--	1.0
TDS, mg/L [g]	--	--	--	1,200

Reasonable Potential Analysis
Since January 1, 2016, DWQ has conducted reasonable potential analysis (RP) on all new and renewal applications received after that date. RP for this permit was not conducted following DWQ's September 10, 2015 Reasonable Potential Analysis Guidance (RP Guidance) because there is inadequate data for use in a RP. As a result, monitoring for metals will be included in this permit. The monitoring will help establish a record of presence or absence of each pollutant. Monitoring for metals will be required 1 time during this permit cycle. To ensure that the metals sampling requirement is met during the permit cycle, the facility should consider collecting the samples as soon as they begin to discharge.

SELF-MONITORING AND REPORTING REQUIREMENTS
The permit will require reports to be submitted monthly and annually, as applicable, on Discharge Monitoring Report (DMR) forms due 28 days after the end of the monitoring period. Effective January 1, 2017, monitoring results must be submitted using NetDMR unless the permittee has successfully petitioned for an exception. Lab sheets for biomonitoring must be attached to the biomonitoring DMR. Lab sheets for metals and toxic organics must be attached to the DMRs.

The applicant identified Arsenic, TSS, Iron, and Manganese as pollutants of concern. Since this facility currently doesn't discharge, the concentrations of the parameters of concern (POC) in the effluent are not known. Monitoring only for Arsenic, Iron, and Manganese were included in this permit to determine if a future limit will be required. Based on the results the facility may receive limits, continue monitoring only, or have the monitoring requirements removed. At this time no limit for Arsenic, Manganese, and Iron were included.

Self-monitoring and reporting requirements are listed below:

Self-Monitoring and Reporting Requirements [a]			
Parameter	Frequency	Sample Type	Units
Total Flow [b,c]	Continuous	Recorder	GPD
TSS	Monthly	Grab	mg/L
BOD_5	Monthly	Grab	mg/L
E. coli	Monthly	Grab	No./100mL
pH	Monthly	Grab	SU
DO	Monthly	Grab	mg/L
TRC	Daily	Grab	mg/L
Oil & Grease [d]	When Sheen Observed	Grab	mg/L
Arsenic [e]	Monthly	Grab	mg/L
Manganese [e]	Monthly	Grab	mg/L
Iron [e]	Monthly	Grab	mg/L
TDS [f,g]	Monthly	Composite	tons/day
TDS [f,g]	Monthly	Composite	mg/L
Metals [h]	1 X in Permit Cycle	Composite	mg/L

Metals to be Monitored		
Parameter	Sample Type	Units
Total Arsenic	Composite	mg/L
Total Cadmium	Composite	mg/L
Total Chromium	Composite	mg/L
Total Copper	Composite	mg/L
Total Cyanide	Grab	mg/L
Total Lead	Composite	mg/L
Total Mercury	Grab/Composite	mg/L
Total Nickel	Composite	mg/L
Total Selenium	Composite	mg/L
Total Silver	Composite	mg/L
Total Zinc	Composite	mg/L

<u>Table References</u>

a. See Definitions, Part VII, for definition of terms.

b. Flow measurements of influent/effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.

c. If the rate of discharge is controlled, the rate and duration of discharge shall be reported.

d. Oil & Grease sampled when sheen is present or visible. If no sheen is present or visible, report NA.

e. Arsenic, Iron, Manganese are currently monitoring only. Monitoring is required for these parameters because they were identified as a pollutant of concern by the applicant. Data collected will be used to determine if a future limit is required, if more data is needed, or if there is no need for continued monitoring.

f. If the facility is unable to collect a composite sample, then a grab should be taken.

a. The facility has both concentration and mass limits for Total Dissolved Solids (TDS). The Virgin River Watershed has an approved TMDL for TDS. TDS mass limitations are based on Colorado Basin Salinity Control Forum and concentration based limits are based on the approved TMDL for the Virgin River Watershed and reflects the standard.

b. Metals sampling shall occur 1 time during the 5-year permit cycle.

End Table References

PRETREATMENT REQUIREMENTS

Any wastewater discharged to the sanitary sewer, either as a direct discharge or as a hauled waste, is subject to Federal, State and local pretreatment regulations. Pursuant to Section 307 of the CWA, the permittee shall comply with all applicable Federal Pretreatment Regulations promulgated at 40 CFR Part 403, the State Pretreatment Requirements at UAC R317-8-8, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the wastewaters.

In addition, in accordance with 40 CFR Part 403.12(p)(1), the permittee must notify the POTW, the EPA Regional Waste Management Director, and the State hazardous waste authorities, in writing, if the permittee discharges any substance into a POTW which if otherwise disposed of would be considered a hazardous waste under 40 CFR Part 261. This notification must include the name of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).

BIOSOLIDS

The State of Utah has adopted the 40 CFR 503 federal regulations for the disposal of sewage sludge (biosolids) by reference. However, since this facility is a drinking water plant, there is not any regular biosolids production. Therefore 40 CFR 503 does not apply at this time. In the future, if the sludge needs to be removed from the drying beds and is disposed in some way; the Division of Water Quality must be contacted prior to the removal of the sludge to ensure that all applicable state and federal regulations are

BIOMONITORING REQUIREMENTS

A nationwide effort to control toxic discharges where effluent toxicity is an existing or potential concern is regulated in accordance with the Utah Pollutant Discharge Elimination System Permit and Enforcement Guidance Document for Whole Effluent Toxicity Control (biomonitoring), dated February 2018. Authority to require effluent biomonitoring is provided in Permit Conditions, UAC R317-8-4.2, Permit Provisions, UAC R317-8-5.3 and Water Quality Standards, UAC R317-2-5 and R317 -2-7.2.

The permittee is a minor industrial facility that will be discharging an infrequent amount of effluent which will be significantly diluted by Sand Hollow Reservoir. Additionally, based on the frequency and quantity of flow, it is not likely that the facility will be able to conduct sampling that would meet WET testing requirements, as outlined in the State of Utah Permitting and Enforcement Guidance Document for WET Control. As such, there will be no numerical WET limitations or WET monitoring requirements in this permit. However, the permit will contain a toxicity limitation re-opener provision that allows for modification of the permit should additional information indicate the presence of toxicity in the discharge.

PERMIT DURATION

It is recommended that this permit be effective for a duration of five (5) years.

Drafted by
Leanna Littler, Discharge
Daniel Griffin, Biosolids
Jennifer Robinson, Pretreatment
Lonnie Shull, Biomonitoring
Suzan Tahir, Wasteload Analysis
Amy Dickey, TMDL
Utah Division of Water Quality, (801) 536-4300

PUBLIC NOTICE

Began: January 5, 2021
Ended: February 5, 2021

Comments will be received at: 195 North 1950 West
PO Box 144870
Salt Lake City, UT 84114-4870

The Public Noticed of the draft permit was published on the Department website.

During the public comment period provided under R317-8-6.5, any interested person may submit written comments on the draft permit and may request a public hearing, if no hearing has already been scheduled. A request for a public hearing shall be in writing and shall state the nature of the issues proposed to be raised in the hearing. All comments will be considered in making the final decision and shall be answered as provided in R317-8-6.12.

ADDENDUM TO FSSOB

During finalization of the Permit certain dates, spelling edits and minor language corrections were completed. The FSSOB facility description section was updated to clarify that the facility will supply drinking water. Due to the nature of these changes they were not considered Major and the permit is not required to be re Public Noticed.

Responsiveness Summary

No comments were received.

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ATTACHMENT 1

Wasteload Analysis

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Utah Division of Water Quality
Statement of Basis
ADDENDUM
Wasteload Analysis and Antidegradation Level I Review

Date: **November 17, 2020**

Prepared by: **Suzan Tahir**
Standards and Technical Services

Facility: **Sand Hollow Groundwater Treatment Plant**
UPDES No. UT0026131

Receiving water: **Sand Hollow Reservoir (1C, 2A, 3B, 4)**

This addendum summarizes the wasteload analysis that was performed to determine water quality based effluent limits (WQBEL) for this discharge. Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses (UAC R317-2-8). Projected concentrations are compared to numeric water quality standards to determine acceptability. The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions determined by staff of the Division of Water Quality.

<u>Discharge</u>
The design flow of the facility is 0.0036 MGD.

<u>Receiving Water</u>
Per UAC R317-2-13.12(z), the designated beneficial uses of the Sand Hollow Reservoir are 1C, 2A, 3B and 4.

- *Class 1C - Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water*

- *Class 2A -- Protected for frequent primary contact recreation where there is a high likelihood of ingestion of water or a high degree of bodily contact with the water. Examples include, but are not limited to, swimming, rafting, kayaking, diving, and water skiing.*

- *Class 3B - Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.*

- *Class 4 - Protected for agricultural uses including irrigation of crops and stock watering.*

Flow

Typically, the critical flow for the wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). The proposed new plant will be discharging to Sand Hollow Reservoir, therefore seasonal critical values were not calculated for this waste load analysis and the design flow was used instead.

Ambient receiving water quality was characterized using DWQ monitoring station #5951000 (Sand Hollow Reservoir 001) for the period 2000-2020.

There was no DWQ monitoring station for the discharge point (new facility), therefore the discharge was characterized using very limited data provided in the Gunlock and Sand Hollow Water Treatment Preliminary Design Report prepared by Alpha Engineering and Carollo in 2018 (Alpha Engineering & Carollo, 2018).

Total Maximum Daily Load (TMDL)

According to the Utah's 2016 303(d) Water Quality Assessment Report, the receiving water for the discharge, Sand Hollow Reservoir (UT-L-15010008-025_00) supports all assessed uses.

Mixing Zone

The maximum allowable mixing zone is 15 minutes of travel time for acute conditions, not to exceed 50% of stream width, and for chronic conditions is 2500 ft, per UAC R317-2-5. Water quality standards must be met at the end of the mixing zone.

Based on the results of the mixing zone modeling, plume width was 100 % of the river at 2500 feet. 100 % of the seasonal critical low flow was used to calculate chronic limits. Acute limits were calculated using 50% of the seasonal critical low flow.

Parameters of Concern

Potential parameters of concern were identified as arsenic, total suspended solids, iron and manganese.

WET Limits

The percent of effluent in the receiving water in a fully mixed condition, and acute and chronic dilution in a not fully mixed condition are calculated in the WLA in order to generate WET limits. The LC_{50} (lethal concentration, 50%) percent effluent for acute toxicity and the IC_{25} (inhibition concentration, 25%) percent effluent for chronic toxicity, as determined by the WET test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC_{50} is typically 100% effluent and does not need to be determined by the WLA.

IC25 WET limits for Outfall 001 should be based on 1.18% effluent (Table 1).

Table 1.WET Limits for IC25

Outfall	**Percent Effluent**
Outfall 001	1.18%

Wasteload Allocation Methods

Effluent limits were determined for conservative constituents using a simple mass balance mixing analysis (UDWQ 2012). The mass balance analysis is summarized in the Wasteload Addendums.

The water quality standard for chronic ammonia toxicity is dependent on temperature and pH, and the water quality standard for acute ammonia toxicity is dependent on pH. The AMMTOX Model developed by University of Colorado and adapted by Utah DWQ and EPA Region VIII was used to determine ammonia effluent limits (Lewis et al. 2002). The analysis is summarized in the Wasteload Addendum.

Models and supporting documentation are available for review upon request.

Antidegradation Level I Review

The objective of the Level I ADR is to ensure the protection of existing uses, defined as the beneficial uses attained in the receiving water on or after November 28, 1975. No evidence is known that the existing uses deviate from the designated beneficial uses for the receiving water. Therefore, the beneficial uses will be protected if the discharge remains below the WQBELs presented in this wasteload.

A Level II Antidegradation Review (ADR) was submitted and is not required.

Documents:

WLA Document*: Sand Hollow Groundwater Treatment Plant_WLA_11-17-2020.docx*
Wasteload Analysis and Addendums: *Sand Hollow GWTP_WLA_11-17-2020.xlsm*

References:

Utah Division of Water Quality. 2012. *Utah Wasteload Analysis Procedures Version 1.0.*

Alpha Engineering , & Carollo. (2018). *Technical Memorandum 1 Gunlock & Sand Hollow Water Treatment Preliminary Design Report.* St. George.

WASTELOAD ANALYSIS [WLA]
Addendum: Statement of Basis
SUMMARY

Discharging Facility:	**Sand Hollow Groundwater Treatment Plant**		
UPDES No:	0026131		
Current Flow:	0.0036	MGD	Design Flow
Design Flow	0.0036	MGD	

Receiving Water:	**Sand Hollow Reservoir**	
Lake Classification:	1C, 2A, 3B, 4	
TDS (mg/l)	521.75	Average
Hardness (mg/l)	283.00	Average
pH	8.20	Average
Temp (C)	16.67	Average

Selected Effluent Limit Summary:				**WQ Standard:**
Flow, MGD:	0.0036	MGD	Design Flow	
BOD, mg/l:	25.0	All Season	5	Indicator
Dissolved Oxygen, mg/l:	5.00	All Season	5.50	30 Day Average
TNH3, Acute, mg/l:	14.90	All Season	Varies	Function of pH and Temperature
TDS, mg/l:	1200.00	All Season	1200	Receiving water is impaired for TDS
Zinc, ug/l	3853.52	All Season	Varies	Function of Hardness
Copper, ug/l	458.03	All Season	Varies	Function of Hardness

Modeling Parameters:

Acute Dilution Ratio	14.74	to 1
Chronic Dilution Ratio:	84.21	to 1

Wasteload Analysis - Total Maximum Daily Load (Lake TMDL)

11/23/2020 15:27

Facility: **Sand Hollow Groundwater Treatment Plant** **UPDES No: UT- 0026131**
Discharging to: **Sand Hollow Reservoir**

I. Introduction

Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on lake water quality. The wasteload analysis does not take into account downstream designated uses [R317-2-8, UAC]. Projected concentrations are compared to numeric water quality standards to determine acceptability. The anti-degradation policy and procedures are also considered. The primary water quality parameters of concern may include metals (as a function of hardness), total dissolved solids (TDS), total residual chlorine (TRC), unionized ammonia (as a function of pH and temperature, measured and evaluated interms of total ammonia), and dissolved oxygen.

Mathematical water quality modeling is employed to determine water quality response to point source discharges. Models aid in the effort of anticipating water quality at future effluent flows at critical environmental conditions (e.g., high temperature, high pH, etc).

The numeric criteria in this wasteload analysis may be modified by narrative criteria and other conditions as determined by staff of the Division of Water Quality.

II. Receiving Water and Lake / Reservoir Classification

Sand Hollow Reservoir 1C, 2A, 3B, 4

III. Numeric Water Quality Standards for Protection of Aquatic Wildlife

			pH	Temp
Total Ammonia (TNH3)		Function of Temperature and pH		
	1.39	mg/l as N (4 Day Average)	8.17	19.4
	6.04	mg/l as N (1 Hour Average)	8.17	19.2
Chronic Total Residual Chlorine (TRC)	0.011	mg/l (4 Day Average)		
	0.019	mg/l (1 Hour Average)		
Chronic Dissolved Oxygen (DO)	5.50	mg/l (30 Day Average)		
	4.00	mg/l (7Day Average)		
	3.00	mg/l (1 Day Average		
Maximum Total Dissolved Solids [Class 4 Ag]	1200	mg/l		
Maximum Boron [Class 4 Ag]	750	mg/l		

Acute and Chronic Heavy Metals (Dissolved)

Parameter	4 Day Average (Chronic) Standard Concentration		1 Hour Average (Acute) Standard Concentration	
Aluminum	87.000	ug/l	750	ug/l
Antimony		ug/l		ug/l
Arsenic	190.000	ug/l	360.00	ug/l
Asbestos		ug/l		ug/l
Barium		ug/l	1000.00	ug/l
Beryllium		ug/l		ug/l
Cadmium	0.559	ug/l	5.79	ug/l
Chromium III	192.031	ug/l	4017.66	ug/l
ChromiumVI	11.000	ug/l	16.00	ug/l
Copper	21.522	ug/l	35.19	ug/l
Cyanide	5.200	ug/l	22.00	ug/l
Iron		ug/l	1000.00	ug/l
Lead	11.054	ug/l	283.65	ug/l
Mercury	0.012	ug/l	2.40	ug/l
Nickel	201.87	ug/l	1073.42	ug/l
Selenium	5.000	ug/l	20.00	ug/l
Silver		ug/l	20.36	ug/l
Thallium				
Zinc	274.477	ug/l	274.48	ug/l

Based upon a Hardness of 265.99 mg/l as CaCO3 Based upon 266.96 mg/l as CaCO3

Organics [Pesticides]

Parameter	4 Day Average (Chronic) Standard Concentration	1 Hour Average (Acute) Standard Concentration

Aldrin		1.500	ug/l
Chlordane	0.0043 ug/l	1.200	ug/l
DDT, DDE	0.001 ug/l	0.550	ug/l
Dieldrin	0.0056 ug/l	0.240	ug/l
Endosulfan, a & b	0.056 ug/l	0.110	ug/l
Endrin	0.036 ug/l	0.086	ug/l
Guthion			
Heptachlor & H. epoxide	0.0038 ug/l	0.260	ug/l
Lindane	0.08 ug/l	1.000	ug/l
Methoxychlor		0.030	ug/l
Mirex		0.001	ug/l
Parathion	0.0130 ug/l	0.066	ug/l
PCB's	0.014 ug/l		
Pentachlorophenol	15.00 ug/l	19.000	ug/l
Toxephene	0.0002 ug/l	0.730	ug/l

IV. Numeric Water Quality Standards for Protection of Agriculture

	1 Hour Average (Acute) Standard Concentration	
TDS	1200	mg/l
Arsenic	100	ug/l
Boron	750	ug/l
Cadmium	10	ug/l
Chromium	100	ug/l
Copper	200	ug/l
Lead	100	ug/l
Selenium	50	ug/l

V. Numeric Water Quality Standards for Protection of Human Health (Class 1C Waters)

Metals	1 Hour Average (Acute) Standard Concentration	
Arsenic	10	ug/l
Barium	1000	ug/l
Cadmium	10	ug/l
Chromium	50	ug/l
Lead	15	ug/l
Mercury	2	ug/l
Selenium	50	ug/l
Silver	50	ug/l
Fluoride (3)	1400	ug/l
to	2400	ug/l
Nitrates as N	10000	ug/l
Chlorophenoxy Herbicides		
2,4-D	0	ug/l
2,4,5-TP	0	ug/l
Methoxychlor	0	ug/l

VI. Numeric Water Quality Standards the Protection of Human Health from Water & Fish Consumption [Toxics]

	Maximum Conc., ug/l - Acute Standards	
	Class 1C	Class 3A, 3B, 3C, 3D
	[2 Liters/Day for 70 Kg Person over 70 Yr.	[6.5 g for 70 Kg Person over 70 Y
Antimony	5.6 ug/l	640 ug/l

Arsenic	A		A	
Beryllium	C		C	
Cadmium	C		C	
Chromium III	C		C	
Chromium VI	C		C	
Copper	1,300	ug/l		
Lead	C		C	
Mercury	A		A	
Nickel	100	ug/l	4,600	ug/l
Selenium	A		4,200	ug/l
Silver				
Thallium	0.24	ug/l	6.3	ug/l
Zinc	7400	ug/l	26,000	ug/l
Cyanide	140	ug/l	220,000	ug/l
Asbestos	7.00E+06	Fibers/L		
2,3,7,8-TCDD Dioxin	5.0 E-9	ug/l	5.1 E-9	ug/l
Acrolein	190	ug/l	290	ug/l
Acrylonitrile	0.051	ug/l	0.25	ug/l
Alachlor	2	ug/l		
Benzene	2.2	ug/l	51 B	ug/l
Bromoform	4.3	ug/l	140.00	ug/l
Carbofuran	40			
Carbon Tetrachloride	0.23	ug/l	1.60	ug/l
Chlorobenzene	100	ug/l	21,000	ug/l
Chlorodibromomethane	0.4	ug/l	13.00	ug/l
Chloroethane				
2-Chloroethylvinyl Ether				
Chloroform	5.7	ug/l	470.00	ug/l
Dalapon	200	ug/l		
Di(2ethylhexl)adipate	400	ug/l		
Dichlorobromopropane	0.2			
Dichlorobromomethane	0.55	ug/l	17.00	ug/l
1,1-Dichloroethane				
1,2-Dichloroethane	0.38	ug/l	37.00	ug/l
1,1-Dichloroethylene	7	ug/l	3.20	ug/l
Dichloroethylene (cis-1,2)	70			
Dinoseb	7			
Diquat	20			
1,2-Dichloropropane	0.5	ug/l	15.00	ug/l
1,3-Dichloropropene	0.34	ug/l	1,700	ug/l
Endothall	100			
Ethylbenzene	530	ug/l	29,000	ug/l
Ethyldibromide	0.05	ug/l		
Glyphosate	700	ug/l		
Haloacetic acids	60	ug/l E		
Methyl Bromide	47	ug/l	1,500	ug/l
Methyl Chloride		F	F	
Methylene Chloride	4.6	ug/l	590.00	ug/l
Ocamyl (vidate)	200	ug/l		
Picloram	500	ug/l		
Simazine	4	ug/l		
Styrene	100	ug/l		
1,1,2,2-Tetrachloroethane	0.17	ug/l	4.00	ug/l
Tetrachloroethylene	0.69	ug/l	3.30	ug/l

Toluene	1000 ug/l		200,000	ug/l
1,2 -Trans-Dichloroethylene	100 ug/l		140,000	ug/l
1,1,1-Trichloroethane	200 ug/l		F	
1,1,2-Trichloroethane	0.59 ug/l		16.00	ug/l
Trichloroethylene	2.5 ug/l		30.00	ug/l
Vinyl Chloride	0.025 ug/l		530.00	ug/l
Xylenes	10000 ug/l			
2-Chlorophenol	81 ug/l		150	ug/l
2,4-Dichlorophenol	77 ug/l		290	ug/l
2,4-Dimethylphenol	380 ug/l		850	ug/l
2-Methyl-4,6-Dinitrophenol	13 ug/l		280	ug/l
2,4-Dinitrophenol	69 ug/l		5,300	ug/l
2-Nitrophenol				
4-Nitrophenol				
3-Methyl-4-Chlorophenol				
Penetachlorophenol	0.27 ug/l		3.00	ug/l
Phenol	21000 ug/l		1,700,000	ug/l
2,4,6-Trichlorophenol	1.4 ug/l		2.40	ug/l
Acenaphthene	670 ug/l		990	ug/l
Acenaphthylene	ug/l			ug/l
Anthracene	8300 ug/l		40,000	ug/l
Benzidine	0.000086 ug/l	B	0.00	ug/l
BenzoaAnthracene	0.0038 ug/l		0.02	ug/l
BenzoaPyrene	0.0038 ug/l		0.02	ug/l
BenzobFluoranthene	0.0038 ug/l		0.02	ug/l
BenzoghiPerylene	ug/l			
BenzokFluoranthene	0.0038 ug/l		0.02	ug/l
Bis2-ChloroethoxyMethane	ug/l			
Bis2-ChloroethylEther	0.03 ug/l		0.53	ug/l
Bis2-Chloroisopropy1Ether	1400 ug/l		65,000	ug/l
Bis2-EthylbexylPhthalate	1.2 ug/l		2.20	ug/l
4-Bromophenyl Phenyl Ether	ug/l			
Butylbenzyl Phthalate	1500 ug/l		1,900	ug/l
2-Chloronaphthalene	1000 ug/l		1,600	ug/l
4-Chlorophenyl Phenyl Ether	ug/l			
Chrysene	0.0038 ug/l		0.02	ug/l
Dibenzoa, hAnthracene	0.0038 ug/l		0.02	ug/l
1,2-Dichlorobenzene	420 ug/l		17,000	ug/l
1,3-Dichlorobenzene	320 ug/l		960	ug/l
1,4-Dichlorobenzene	63 ug/l		2,600	ug/l
3,3-Dichlorobenzidine	0.021 ug/l		0.03	ug/l
Diethyl Phthalate	17000 ug/l		44,000	ug/l
Dimethyl Phthalate	270000 ug/l		1,100,000	ug/l
Di-n-Butyl Phthalate	2000 ug/l		4,500	ug/l
2,4-Dinitrotoluene	0.11 ug/l		3.40	ug/l
2,6-Dinitrotoluene	ug/l			
Di-n-Octyl Phthalate	ug/l			
1,2-Diphenylhydrazine	0.036 ug/l		0.20	ug/l
Fluoranthene	130 ug/l		140.00	ug/l
Fluorene	1100 ug/l		5,300	ug/l
Hexachlorobenzene	0.00028 ug/l		0.00029 B	ug/l
Hexachlorobutedine	0.44 ug/l		18.00	ug/l
Hexachloroethane	1.4 ug/l		3.30	ug/l
Hexachlorocyclopentadiene	40 ug/l		17,000	ug/l
Ideno 1,2,3-cdPyrene	0.0038 ug/l		0.02	ug/l

Isophorone	35 ug/l	B	960.00 ug/l
Naphthalene			
Nitrobenzene	17 ug/l		690 ug/l
N-Nitrosodimethylamine	0.00069 ug/l		3.00 ug/l
N-Nitrosodi-n-Propylamine	0.005 ug/l		0.51 ug/l
N-Nitrosodiphenylamine	3.3 ug/l		6.00 ug/l
Phenanthrene			
Pyrene	830 ug/l		4,000 ug/l
1,2,4-Trichlorobenzene	260 ug/l		940 ug/l
Aldrin	0.000049 ug/l		0.000050 ug/l
alpha-BHC	0.0026 ug/l		0.00 ug/l
beta-BHC	0.0091 ug/l		0.02 ug/l
gamma-BHC (Lindane)	0.2 ug/l		0.06 ug/l
delta-BHC			
Chlordane	0.0008 ug/l		0.00 ug/l
4,4-DDT	0.00022 ug/l		0.00 ug/l
4,4-DDE	0.00022 ug/l		0.00 ug/l
4,4-DDD	0.00031 ug/l		0.00 ug/l
Dieldrin	0.000052 ug/l	B	0.000054 ug/l
alpha-Endosulfan	62 ug/l		89 ug/l
beta-Endosulfan	62 ug/l		89 ug/l
Endosulfan Sulfate	62 ug/l		89 ug/l
Endrin	0.059 ug/l		0.81 ug/l
Endrin Aldehyde	0.29 ug/l		0.30 ug/l
Heptachlor	0.000079 ug/l	B	0.000079 ug/l
Heptachlor Epoxide	0.000039 ug/l	B	0.000039 ug/l
Polychlorinated Biphenyls	0.000064 ug/l	B,D	0.000064 ug/l
Toxaphene	0.00028 ug/l		0.00028 ug/l

There are additional standards that apply to this receiving water, but were not considered in this modeling/waste load allocation analysis.

VII. Mathematical Modeling of Water Quality Quality

Model configuration was accomplished utilizing standard modeling procedures. Data points were plotted and coefficients adjusted as required to match observed data as closely as possible.

The modeling approach used in this analysis included one or a combination of the following models.

(1) The Utah River Model, Utah Division of Water Quality, 1992. Based upon STREAMDO IV (Region VIII) and Supplemental Ammonia Toxicity Models; EPA Region VIII, Sept. 1990 and

QUAL2E (EPA, Athens, GA).

(2) Utah Ammonia/Chlorine Model, Utah Division of Water Quality, 1992.

(3) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al. Harper Collins Publisher, Inc. 1987, pp. 644.

Coefficients used in the model were based, in part, upon the following references:

(1) Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens Georgia. EPA/600/3-85/040 June 1985.

(2) Principles of Surface Water Quality Modeling and Control. Robert V. Thomann, et.al. Harper Collins Publisher, Inc. 1987, pp. 644.

The Utah Reservoir and Lake Model is a simple round jet model which was received from EPA Region 8. It assumes a discharge expands into the receiving water as a 1/2 cone from the point of discharge with the appropriate dilution.

The dilution ratios for this wasteload analysis are as follows:

Acute Dilution Ratio:	**14.7 to 1**
Chronic Dilution Ration:	**84.2 to 1**

VIII. Modeling Information

The required information for the model may include the following information for both the lake and effluent conditions:

Temperature, Deg. C.	Total Residual Chlorine (TRC), mg/l
pH	Total NH3-N, mg/l
BOD5, mg/l	Total Dissolved Solids (TDS), mg/l
Metals, ug/l	Toxic Organics of Concern, ug/l
D.O. mg/l	

Other Conditions

In addition to the lake and effluent conditions, the models require a variety of physical and biological coefficients and other technical information. In the process of actually establishing the permit limits for an effluent, values are used based upon the available data, model calibration, literature values, site visits and best professional judgement.

Model Inputs

Lake Information	Temp. Deg. C	pH	T-NH3 mg/l as N	BOD mg/l	DO mg/l	TRC mg/l	TDS mg/l	Metals ug/l
	19.4	8.2	0.00	N/A	N/A	0.00	521.8	0.0

	Season	Flow, MGD	Temp.
Discharge Information	All Seasons	0.0	16.7

IX. Effluent Limitations based upon Water Quality Standards

Effluent Limitation for Flow

All Seasons			
Not to Exceed:	0.00	MGD	Daily Average
	0.01	cfs	Daily Average

WET Requirements As determined by Permits & Compliance Branch

Effluent Limitation for Biological Oxygen Demand (BOD)

	Concentration	
30 Day Average	25.0	mg/l as BOD5
30 Day Average	20.0	mg/l as CBOD5

Effluent Limitation for Dissolved Oxygen (DO)

	Concentration 1 Day Average (Acute)	
30 Day Average	5.00	mg/l

Effluent Limitation for Total Ammonia

	4 Day Average [Chronic] Concentration		**Load**	
All Seasons	202.94	mg/l as N	6.1	lbs/day
	1 Hour Average [Acute] Concentration		**Load**	
	14.9	mg/l as N	0.4	lbs/day

Effluent Limitation for Total Residual Chlorine

	4 Day Average [Chronic] Concentration		**Load**	
All Seasons	0.926	mg/l	0.0	lbs/day
	1 Hour Average [Acute] Concentration		**Load**	
	0.280	mg/l	0.0	lbs/day

Effluent Limitations for Metals

4 Day Average (Chronic)		**1 Hour Average (Acute)**	
Concentration	**Load**	**Concentration**	**Load**

Aluminum	6083.76	ug/l*	0.1	lbs/day	10847.14	ug/l	0.2	lbs/day
Arsenic	12495.48	ug/l	0.2	lbs/day	4987.95	ug/l*	0.1	lbs/day
Barium					14736.30	ug/l	0.3	lbs/day
Cadmium	24.20	ug/l*	0.0	lbs/day	74.27	ug/l	0.0	lbs/day
Chromium III	7749.27	ug/l*	0.2	lbs/day	17748.02	ug/l	0.3	lbs/day
ChromiumVI	801.47	ug/l	0.0	lbs/day	215.18	ug/l*	0.0	lbs/day
Copper	1488.53	ug/l	0.0	lbs/day	458.03	ug/l*	0.0	lbs/day
Cyanide	76.63				324.20			
Iron					320.20	ug/l	0.0	lbs/day
Lead	558.98	ug/l*	0.0	lbs/day	2713.55	ug/l	0.1	lbs/day
Mercury	0.01	ug/l*	0.000	lbs/day	35.20	ug/l	0.0	lbs/day
Nickel	9769.91	ug/l*	0.2	lbs/day	15793.89	ug/l	0.3	lbs/day
Selenium	337.43	ug/l	0.0	lbs/day	262.91	ug/l*	0.0	lbs/day
Silver					249.75	ug/l	0.0	lbs/day
Zinc	138521.02	ug/l	2.7	lbs/day	3853.52	ug/l*	0.1	

* Most stringent between Chronic & Acute Effluent Limitations

Effluent Limitations for Organics [Pesticides]

	4 Day Average				1 Hour Average			
Pesticide	**Concentration**		**Load**		**Concentration**		**Load**	
Aldrin					22.1044	ug/l	0.000	lbs/day
Chlordane	0.3621	ug/l*	0.000	lbs/day	17.6836	ug/l	0.000	lbs/day
DDT, DDE	0.0842	ug/l*	0.000	lbs/day	8.1050	ug/l	0.000	lbs/day
Dieldrin	0.4716	ug/l*	0.000	lbs/day	3.5367	ug/l	0.000	lbs/day
Endosulfan	4.7156	ug/l	0.000	lbs/day	1.6210	ug/l*	0.000	lbs/day
Endrin	3.0315	ug/l	0.000	lbs/day	1.2673	ug/l*	0.000	lbs/day
Guthion					0.0000	ug/l	0.000	lbs/day
Heptachlor	0.3200	ug/l*	0.000	lbs/day	3.8314	ug/l	0.000	lbs/day
Lindane	6.7366	ug/l*	0.000	lbs/day	14.7363	ug/l	0.000	lbs/day
Methoxychlor					0.4421	ug/l	0.000	lbs/day
Mirex					0.0147	ug/l	0.000	lbs/day
Parathion					0.9726	ug/l	0.000	lbs/day
PCB's	1.1789	ug/l	0.000	lbs/day	0.0000	ug/l*	0.000	lbs/day
Pentachlorophenol	1263.1110	ug/l	0.025	lbs/day	279.9896	ug/l*	0.005	lbs/day
Toxephene	0.0168	ug/l*	0.000	lbs/day	10.7575	ug/l	0.000	lbs/day

Effluent Limitations for Protection of Human Health (Class 1C Waters)

	1 Hour Average (Acute) Standard			
Metals	**Concentration**		**Load**	
Arsenic	0.00	ug/l	0.00	lbs/day
Barium	0.00	ug/l	0.00	lbs/day
Cadmium	0.00	ug/l	0.00	lbs/day
Chromium	0.00	ug/l	0.00	lbs/day
Lead	0.00	ug/l	0.00	lbs/day
Mercury	0.00	ug/l	0.00	lbs/day
Selenium	0.00	ug/l	0.00	lbs/day
Silver	0.00	ug/l	0.00	lbs/day
Fluoride	0.00	ug/l	0.00	lbs/day

to	0.00 ug/l	0.00 lbs/day
Nitrates as N	0.00 ug/l	0.00 lbs/day
Pesticides		
2,4-D	0.00 ug/l	0.00 lbs/day
2,4,5-TP	0.00 ug/l	0.00 lbs/day
Methoxychlor	0.00 ug/l	0.00 lbs/day

Effluent Limitations for Protection of Human Health [Toxics Rule]
Based upon Water Quality Standards (Most stringent of 1C or 3A & 3B as appropriate.)

	Maximum Conc., ug/l - Acute Standards			
	Class 1C		Class 3A, 3B	
Toxics Rule Parameters	[2 Liters/Day for 70 Kg Person over 70 Yr.		[6.5 g for 70 Kg Person over 70 Yr. Period]	
Antimony	0.00 ug/l	0.00 lbs/day	82.52 ug/l	0.0 lbs/day
Arsenic				
Beryllium				
Cadmium				
Chromium III				
Chromium VI				
Copper	0.00 ug/l	0.00 lbs/day	19157.18 ug/l	0.4 lbs/day
Lead				
Mercury		lbs/day	1473.63 ug/l	0.0 lbs/day
Nickel	0.00 ug/l	0.00 lbs/day		
Selenium			109048.58 ug/l	2.1 lbs/day
Silver			2063.08 ug/l	0.0 lbs/day
Thallium	0.00 ug/l	0.00 lbs/day		
Zinc	0.00 ug/l	0.00 lbs/day	2799.90 ug/l	0.1 lbs/day
Cyanide	0.00 ug/l	0.00 lbs/day	0.75 ug/l	0.0 lbs/day
Asbestos	0.00 ug/l	0.00E+00 lbs/day	63.37 ug/l	0.0 lbs/day
0	0.00 ug/l	0.00 lbs/day		
2,3,7,8-TCDD Dioxin	0.00 ug/l	0.00 lbs/day	1473.63 ug/l	0.0 lbs/day
Acrolein	0.00 ug/l	0.00 lbs/day	5.89 ug/l	0.0 lbs/day
Acrylonitrile	0.00 ug/l	0.00 lbs/day		
Benzene	0.00 ug/l	0.00 lbs/day		
Bromoform	0.00 ug/l	0.00 lbs/day	84.00 ug/l	0.0 lbs/day
Carbon Tetrachloride	0.00 ug/l	0.00 lbs/day		
Chlorobenzene	0.00 ug/l	0.00 lbs/day		
Chlorodibromomethane	0.00 ug/l	0.00 lbs/day	5.60 ug/l	0.0 lbs/day
Chloroethane	0.00 ug/l	0.00 lbs/day	103.15 ug/l	0.0 lbs/day
2-Chloroethylvinyl Ether	0.00 ug/l	0.00 lbs/day	7.37 ug/l	0.0 lbs/day
Chloroform	0.00 ug/l	0.00 lbs/day	5.01 ug/l	0.0 lbs/day
Dichlorobromomethane	0.00 ug/l	0.00 lbs/day	692.61 ug/l	0.0 lbs/day
1,1-Dichloroethane	0.00 ug/l	0.00 lbs/day		
1,2-Dichloroethane	0.00 ug/l	0.00 lbs/day	67.79 ug/l	0.0 lbs/day
1,1-Dichloroethylene	0.00 ug/l	0.00 lbs/day	2.51 ug/l	0.0 lbs/day
1,2-Dichloropropane	0.00 ug/l	0.00 lbs/day	14736.30 ug/l	0.3 lbs/day
1,3-Dichloropropene	0.00 ug/l	0.00 lbs/day	8.69 ug/l	0.0 lbs/day
Ethylbenzene	0.00 ug/l	0.00 lbs/day	36.84 ug/l	0.0 lbs/day
Methyl Bromide	0.00 ug/l	0.00 lbs/day	0.37 ug/l	0.0 lbs/day
Methyl Chloride	0.00 ug/l	0.00 lbs/day	1193.64 ug/l	0.0 lbs/day
Methylene Chloride	0.00 ug/l	0.00 lbs/day	1134.69 ug/l	0.0 lbs/day
1,1,2,2-Tetrachloroethane	0.00 ug/l	0.00 lbs/day	5599.79 ug/l	0.1 lbs/day
Tetrachloroethylene	0.00 ug/l	0.00 lbs/day	191.57 ug/l	0.0 lbs/day

Toluene	0.00 ug/l	0.00 lbs/day		
1,2 -Trans-Dichloroethylene	0.00 ug/l	0.00 lbs/day		
1,1,1-Trichloroethane	0.00 ug/l	0.00 lbs/day	3.98 ug/l	0.0 lbs/day
1,1,2-Trichloroethane	0.00 ug/l	0.00 lbs/day	309462.20 ug/l	6.0 lbs/day
Trichloroethylene	0.00 ug/l	0.00 lbs/day	20.63 ug/l	0.0 lbs/day
Vinyl Chloride	0.00 ug/l	0.00 lbs/day	9873.32 ug/l	0.2 lbs/day
2-Chlorophenol	0.00 ug/l	0.00 lbs/day		
2,4-Dichlorophenol	0.00 ug/l	0.00 lbs/day	122311.25 ug/l	2.4 lbs/day
2,4-Dimethylphenol	0.00 ug/l	0.00 lbs/day		
2-Methyl-4,6-Dinitrophenol	0.00 ug/l	0.00 lbs/day	0.06 ug/l	0.0 lbs/day
2,4-Dinitrophenol	0.00 ug/l	0.00 lbs/day	0.06 ug/l	0.0 lbs/day
2-Nitrophenol	0.00 ug/l	0.00 lbs/day	0.06 ug/l	0.0 lbs/day
4-Nitrophenol	0.0000 ug/l	0.0000 lbs/day		
3-Methyl-4-Chlorophenol	0.0000 ug/l	0.0000 lbs/day	0.06 ug/l	0.000 lbs/day
Penetachlorophenol	0.0000 ug/l	0.0000 lbs/day		
Phenol	0.0000 ug/l	0.00E+00 lbs/day	0.44 ug/l	0.000 lbs/day
2,4,6-Trichlorophenol	0.0000 ug/l	0.0000 lbs/day	20630.81 ug/l	0.400 lbs/day
Acenaphthene	0.00 ug/l	0.00 lbs/day		
Acenaphthylene	0.00 ug/l	0.00 lbs/day	22104.44 ug/l	0.4 lbs/day
Anthracene	0.00 ug/l	0.00 lbs/day	14736.30 ug/l	0.3 lbs/day
Benzidine	0.00 ug/l	0.00 lbs/day		
BenzoaAnthracene	0.00 ug/l	0.00 lbs/day	0.06 ug/l	0.0 lbs/day
BenzoaPyrene	0.00 ug/l	0.00 lbs/day	0.1 ug/l	0.0 lbs/day
BenzobFluoranthene	0.00 ug/l	0.00 lbs/day	6189.24 ug/l	0.1 lbs/day
BenzoghiPerylene	0.00 ug/l	0.00 lbs/day	4715.61 ug/l	0.1 lbs/day
BenzokFluoranthene				
Bis2-ChloroethoxyMethane				
Bis2-ChloroethylEther	0.0000 ug/l	0.00000 lbs/day	2.51E+05 ug/l	4.86E+00 lbs/day
Bis2-Chloroisopropy1Ether	0.0000 ug/l	0.00E+00 lbs/day	3.98E+06 ug/l	7.72E+01 lbs/day
Bis2-EthylbexylPhthalate	0.0000 ug/l	0.00000 lbs/day	######### ug/l	0.57189 lbs/day
4-Bromophenyl Phenyl Ether	0.0000 ug/l	0.00000 lbs/day	1.62099 ug/l	0.00003 lbs/day
Butylbenzyl Phthalate	0.0000 ug/l	0.00E+00 lbs/day		
2-Chloronaphthalene	0.0000 ug/l	0.00000 lbs/day		
4-Chlorophenyl Phenyl Ether	0.0000 ug/l	0.00000 lbs/day	0.53051 ug/l	0.00001 lbs/day
Chrysene	0.0000 ug/l	0.00000 lbs/day	######### ug/l	0.03717 lbs/day
Dibenzoa, hAnthracene	0.0000 ug/l	0.00000 lbs/day	######### ug/l	0.31454 lbs/day
1,2-Dichlorobenzene	0.0000 ug/l	0.00000 lbs/day	0.00413 ug/l	0.00000 lbs/day
1,3-Dichlorobenzene	0.0000 ug/l	0.00000 lbs/day	6.48397 ug/l	0.00013 lbs/day
1,4-Dichlorobenzene	0.0000 ug/l	0.00000 lbs/day	20.63081 ug/l	0.00040 lbs/day
3,3-Dichlorobenzidine				
Diethyl Phthalate				
Dimethyl Phthalate				
Di-n-Butyl Phthalate	0.00000 ug/l	0.00000 lbs/day		
2,4-Dinitrotoluene	0.00000 ug/l	0.00000 lbs/day	######### ug/l	0.004861 lbs/day
2,6-Dinitrotoluene	0.00000 ug/l	0.00000 lbs/day	0.010168 ug/l	0.000000 lbs/day
Di-n-Octyl Phthalate	0.00000 ug/l	0.00000 lbs/day	0.073681 ug/l	0.000001 lbs/day
1,2-Diphenylhydrazine	0.00000 ug/l	0.00000 lbs/day	48.629774 ug/l	0.000944 lbs/day
Fluoranthene	0.00000 ug/l	0.00000 lbs/day		
Fluorene	0.00000 ug/l	0.00000 lbs/day	1.22E+04 ug/l	2.37E-01 lbs/day
Hexachlorobenzene				
Hexachlorobutedine				
Hexachloroethane	0.00 ug/l	0.00 lbs/day		
Hexachlorocyclopentadiene				
Ideno 1,2,3-cdPyrene				
Isophorone	0.00 ug/l	0.00 lbs/day		

Naphthalene								
Nitrobenzene								
N-Nitrosodimethylamine	0.00	ug/l	0.00	lbs/day				
N-Nitrosodi-n-Propylamine	0.00	ug/l	0.00	lbs/day	0.00	ug/l	0.0	lbs/day
N-Nitrosodiphenylamine	0.00E+00	ug/l	0.00E+00	lbs/day				
Phenanthrene	0.00	ug/l	0.00	lbs/day	913.65	ug/l	0.0	lbs/day
Pyrene	0.00	ug/l	0.00	lbs/day				
1,2,4-Trichlorobenzene					913.65	ug/l	0.0	lbs/day
Aldrin					0.87	ug/l	0.0	lbs/day
alpha-BHC	0.00000000	ug/l	0.000000	lbs/day				
beta-BHC	0.00000000	ug/l	0.000000	lbs/day				
gamma-BHC (Lindane)	0.00000000	ug/l	0.000000	lbs/day				
delta-BHC			0.000000	lbs/day				
Chlordane	0.00000000	ug/l	0.000000	lbs/day				
4,4-DDT	0.00000000	ug/l	0.000000	lbs/day				
4,4-DDE	0.00000000	ug/l	0.000000	lbs/day				
4,4-DDD	0.00000000	ug/l	0.000000	lbs/day				
Dieldrin			0.000000	lbs/day				
alpha-Endosulfan	0.00	ug/l	0.000	lbs/day				
beta-Endosulfan	0.00	ug/l	0.000	lbs/day				
Endosulfan Sulfate	0.00	ug/l	0.000	lbs/day				
Endrin	0.00000000	ug/l	0.000	lbs/day				
Endrin Aldehyde	0.00000000	ug/l	0.000	lbs/day				
Heptachlor				lbs/day				
Heptachlor Epoxide				lbs/day				
Polychlorinated Biphenyls				lbs/day				
0	0.00000000	ug/l	0.000000	lbs/day				
Toxaphene	0.00000000	ug/l	0.000000	lbs/day				
Specific Parameter: TDS	0	ug/l	0.000000	lbs/day	1698.76	mg/l	0.0	tons / day

Effluent Limitations for the Protection of Agriculture

	1 Hour Average (Acute) Standard Concentration		Load	
Arsenic	1473.63	ug/l	0.03	lbs / day
Boron	11052.22	ug/l	0.21	lbs / day
Cadmium	147.36	ug/l	0.00	lbs / day
Chromium	1473.63	ug/l	0.03	lbs / day
Copper	736.81	ug/l	0.01	lbs / day
Lead	1473.63	ug/l	0.03	lbs / day
Selenium	736.81	ug/l	0.01	lbs / day

Metals Effluent Limitations for Protection of All Beneficial Uses Based upon Water Quality Standards and Toxics Rules

	Class 4 Acute Agricultural ug/l	Class 3 Acute Aquatic Wildlife ug/l	Acute Toxics Drinking Water Source ug/l	Acute Toxics Wildlife ug/l	1C Acute Health Criteria ug/l	Acute Most Stringent ug/l	Class 3 Chronic Aquatic Wildlife ug/l
Aluminum		10847.14				10847.14	6083.76
Antimony			0.00			0.00	
Arsenic	1473.63	4987.95			10.00	10.00	12495.48
Asbestos							
Barium		14736.30			1000.00	1000.00	
Boron							
Cadmium	147.36	74.27			0.00	0.00	24.20
Chromium (III)		17748.0			50.00	50.00	7749.27
Chromium (VI)	1473.63	215.18				215.18	801.47
Copper	736.81	458.03				458.03	1488.53
Cyanide		324.20		0.00		0.00	76.63
Iron		320.20				320.20	
Lead	1473.63	2713.55			15.00	15.00	558.98
Mercury		35.2023			0.00	0.00	0.0120
Nickel		15793.89		0.00		0.00	9769.91
Selenium	736.81	262.91			50.00	50.00	337.43
Silver		249.75			0.00	0.00	
Thallium				0.00		0.00	
Zinc		3853.52				3853.52	138521.02

Summary Effluent Limitations for Metals [Wasteload Allocation, TMDL]

	Acute		Chronic	
	ug/l	lbs/day	ug/l	lbs/day
Aluminum	10847.14	0.3	6083.76	0.2
Antimony				
Arsenic	10.00	0.0	12495.48	0.4
Asbestos				
Cadmium	0.00	0.0	24.20	0.0
Chromium (III)	50.00	0.0	7749.27	0.2
Chromium (VI)	215.18	0.0	801.47	0.0
Copper	458.03	0.0	1488.53	0.0
Cyanide	0.00	0.0	76.63	0.0
Iron	320.20	0.0		
Lead	15.00	0.0	558.98	0.0
Mercury	0.00	0.0	0.01	0.0
Nickel	0.00	0.0	9769.91	0.3
Selenium	50.00	0.0	337.43	0.0
Silver	0.00	0.0		
Zinc	3853.52	0.1	138521.02	4.2

Effluent Indicators / Targets for Pollution Indicators

Water quality targets for pollution Indicators will be met with an effluent limit as follows:

	Indicator / Target mg/l		Target mg/l	lbs/day
Gross Beta (pCi/l)	50.0	pCi/L		
BOD	5.0		73.68	33442.39
Nitrates as N	4.0		58.95	26753.91
Total Phosphorus as P	0.05		0.74	334.42
Total Suspended Solids	90.0		1326.27	601963.07

Other Effluent Limitations are based upon R317-1.

X. Antidegradation Considerations

The Utah Antidegradation Policy allows for degradation of existing quality where it is determined that such lowering of water quality is necessary to accommodate important economic or social development in the area in which the waters are protected [R317-2-3]. It has been determined that development in the area in which the waters are protected [R317-2-3]. It has been determined that certain chemical parameters introduced by this discharge will cause an increase of the concentration of said parameters in the receiving waters. Under no conditions will the increase in concentration be allowed to interfer with existing water users.

Category III waters fall under special rules for the determination of effluent limits. These rules allow more stringent effluent limitations based upon additional factors, including: "blue-ribbon" fisheries, special recreation areas, and drinking water sources.

XI. Colorado River Salinity Forum Considerations

Discharges in the Colorado River Basin are required to have their discharge at a TDS loading of less than 1.00 tons/day unless shown that this is not attainable. Refer to the Forum's Guidelines for additional information.
This doesn’t apply to facilities that do not discharge to the Colorado River Basin.

The permit writers may utilize other information to adjust these limits and/or to determine other limits based upon best available technology and other considerations.

XII. Summary Comments

The mathematical modeling and best professional judgement indicate that violations of receiving wataer benefical uses with their associated water quality standards, including important downstream segments, will not occur for the evaluated parameters of concern as discussed above if the effluent limitations indicated above are met.

The permit writers may utilize other information to adjust these limits or to determine other limite based upon best available technology and other considerations. Under no circumstances however, may those alterations allow for the violation of water quality standards by the permitee.

XIII. Notice of UPDES Requirement

This Addendum to the Statement of Basis does not authorize any entity or party to discharge to the waters of the State of Utah. That authority is granted through a UPDES permit issued by the Utah

Division of Water Quality. The numbers presented here may be changed as a function of other factors. Dischargers are strongly urged to contact the Permits Section for further information.

XIV. Notice of Availability of Information

All model numerical inputs, intermediate calculations, outputs and graphs are available for discussion, inspection and copy at the Division of Water Quality.

Prepared by:
Suzan Tahir
Utah Division of Water Quality
801-536-4341

Sand Hollow GWTP-WLA-11-17-2020

DWQ-2020-026055

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Division of Water Quality (DWQ)
UPDES Program

UPDES Industrial Permit Application

Part X. Antidegradation Review

The objective of antidegradation rules and policies is to protect existing high quality waters and set forth a process for determining where and how much degradation is allowable for socially and/or economically important reasons. In accordance with Utah Administrative Code (UAC R317-2-3), an antidegradation review (ADR) is a permit requirement for any project that will increase the level of pollutants in waters of the state. The rule outlines requirements for both Level I and Level II ADRs, as well as public comment procedures. This review form is intended to assist the applicant and Division of Water Quality (DWQ) staff in complying with the rule but is not a substitute for the complete rule in R317-2-3.5. Additional details can be found in the *Utah Antidegradation Implementation Guidance* and relevant sections of the guidance are cited in this review form.

ADRs should be among the first steps of an application for a UPDES permit because the review helps establish treatment expectations. The level of effort and amount of information required for the ADR depends on the nature of the project and the characteristics of the receiving water. To avoid unnecessary delays in permit issuance, DWQ recommends that the process be initiated at least one year prior to the date a final approved permit is required.

DWQ will determine if the project will impair beneficial uses (Level I ADR) using information provided by the applicant and whether a Level II ADR is required. The applicant is responsible for conducting the Level II ADR. For the permit to be approved, the Level II ADR must document that all feasible measures have been undertaken to minimize pollution for socially, environmentally or economically beneficial projects resulting in an increase in pollution to waters of the state.

For permit requiring a Level II ADR, this antidegradation form must be completed and approved by DWQ before any UPDEs permit can be issued. Typically, the ADR form is completed in an iterative manner in consultation with DWQ. The applicant should first complete the statement of social, environmental and economic importance (SEEI) in Section C and determine the parameters of concern (POC) in Section D. Once the POCs' are agreed upon by DWQ, the alternatives analysis and selection of preferred alternative Section E can be conducted based on minimizing degradation resulting from discharge of the POCs. Once the applicant and DWQ agree upon the preferred alternative, the review is considered complete, and the form is submitted to DWQ.

What are the designated uses of the receiving water (R317-2-6)?

- ☒ Domestic Water Supply
- ☒ Recreation
- ☒ Aquatic Life
- ☒ Agricultural Water Supply
- ☐ Great Salt Lake

Antidegradation Category 1, 2 or 3 of receiving water (R317-2-3.2, -3.3, and -3.4): Category 3

UPDES Industrial Permit Application

Part X. Antidegradation Review *continued*

Effluent flow reviewed: *typically, this should be the maximum daily discharge at the design capacity of the facility. Exceptions should be noted.*

Max Daily Discharge = 3,600 GPD.

What is the application for? (Check all that apply)

- ☒ A UPDES permit for a new facility, project, or outfall.
- ☐ A UPDES permit renewal with an expansion of modification of an existing wastewater treatment works.
- ☐ A UPDES permit renewal requiring limits for a pollutant not covered by the previous permit and/or an increase to existing permit limits.
- ☐ A UPDES permit renewal with no charges in facility operations.

Section B. Is a Level II ADR required?

This section of the form is intended to help applicants determine if a Level II ADR is required for specific permitted activities. In addition, the Executive Secretary may require a Level II ADR for an activity with the potential for major impact on the quality of waters of the state (R317-2-3.5a.1).

B1. The UPDES permit is new <u>or</u> is being renewed and the proposed effluent concentration and loading limits are higher than the concentration and loading limits in the previous permit and any previous antidegradation review(s).

☒ YES – (Proceed to B3 of the Form)
☐ NO – No Level II ADR is required and there is <u>no need to proceed further with the review questions. Continue to the Certification Statement and Signature page.</u>

B2. Will any pollutants use assimilative capacity of the receiving water, i.e. do the pollutant concentrations in the effluent exceed those in the receiving waters at critical conditions? For most pollutants, effluent concentrations that are higher than the ambient concentrations require an antidegradation review? For a few pollutants such as dissolved oxygen, and antidegradation review is required if the effluent concentrations are less than the ambient concentrations in the receiving water. (Section 3.3.3 of Implementation Guidance)

☐ YES – (Proceed to B4 of the Form)
☒ NO – No Level II ADR is required and there is <u>no need to proceed further with the review questions. Continue to the Certification Statement and Signature page.</u>

UPDES Industrial Permit Application

Part X. Antidegradation Review *continued*

B3. Are water quality impacts of the proposed project temporary and limited (Section 3.3.4 of Implementation Guidance)? Proposed projects that will have temporary and limited effects on water quality can be exempted form a Lev le II ADR.

☐ YES – Identify the reason used to justify this determination if B4.1 and proceed to Section G. No Level II ADR is required.

☒ NO – A Level II ADR is required (Proceed to Section C)

B3.1 Complete this question only if the applicant is requesting a Level II review exclusion for temporary and limited projects (See R317-2-3.5(b)(3) and R317-2-3.5(b)(4)). For projects requesting a temporary and limited exclusion please indicate the factor(s) used to justify this determination (check all that apply and provide details as appropriate) (Section 3.3.4 of Implementation Guidance):

☐ Water quality impacts will be temporary and related exclusively to sediment or turbidity and fish spawning will not be impaired.

Factors to be considered in determining whether water quality impacts will be temporary and limited:

a) The length of time during which water quality will be lowered:	
b) The perfect change in ambient concentrations of pollutants:	
c) Pollutants affected:	
d) Likelihood for long-term water quality benefits:	
e) Potential for any residual long-term influences on existing uses:	
f) Impairment of fish spawning, survival and development of aquatic fauna excluding fish removal efforts:	
Additional justification, as needed:	

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Division of Water Quality (DWQ) UPDES Program

UPDES Industrial Permit Application

Part X. Antidegradation Review ***continued***

Level II ADR

Section C, D, E, and F of the form constitute the Level II ADR Review. The applicant must provide as much detail as necessary for DWQ to perform the antidegradation review. Questions are provided for the convenience of applicants; however, for more complex permits it may be more effective to provide the required information in a separate report. Applicants that prefer a separate report should record the report name here and proceed to Section G of the form.

Option Report Name: ______________________

Section C. Is the degradation from the project socially and economically necessary to accommodate important social or economic development in the area in which the waters are located? *The applicant must provide as much detail as necessary for DWQ to concur that the project is socially and economically necessary when answering the questions in the section. More information is available in Section 6.2 of the Implementation Guidance.*

C1. Describe the social and economic benefits that would be realized through the proposed project, including the number and nature of jobs created and anticipated tax revenues.

Washington County Water Conservancy District (WCWCO) owns and operates West Oam Springs pump station, Water System #27073. The West Oam Springs source has high manganese (Mn) levels that have previously created colored water events in the distribution system. These events forced WCWCO to suspend discharge to the distribution system yet continue to pump from the wet well. All of the West Dam Springs water is currently being pumped to Sand Hollow Reservoir. The source also has arsenic (As) levels near the regulated limit of 10 µg/L requiring As treatment as well. Additionally, WCWCO would like the capability to blend and treat water from the nearby Sand Hollow well field. Most of the wells have elevated As levels that require blending or treatment for culinary use. The new water treatment facility will supply clean drinking water to the WCWCO's customers. This is especially pertinent to help relieve drinking water supply strains with the rising population.

C2. Describe any environmental benefits to be realized through implementation of the proposed project.

Not applicable.

C3. Describe any social and economic losses that may result from the project, including impacts to recreation or commercial development.

None.

C4. Summarize any supporting information from the affected communities on preserving assimilative capacity to support future growth and development.

There will be limited impact to the Sand Hollow Reservoir. Only a small, additional flow into the Reservoir is anticipated from Decant Water from the new sludge drying beds. The drying beds will settle out most particles and contaminants. Additionally, the Decant water would not flow year-round, but only during period of low evaporation and high water production. It is only in place if evaporation was not sufficient to remove enough water from the drying beds, and would not be normal operation.

UPDES Industrial Permit Application

Part X. Antidegradation Review ***continued***

C5. Please describe any structures or equipment associated with the project that will be placed within or adjacent to the receiving water.

An entirely new treatment building will be constructed for this project. The main treatment process involves pre-oxidation with chlorine, coagulation (ferric chloride) and pressure filtration with sand and anthracite media and air scour capabilities, followed by post-chlorination. Backwash waste flows will be pumped to a backwash clarifier. Water within the clarifier will be decanted and returned to the front of the plant. Periodically, the sludge in the tank bottom will be removed through a blowdown process and will be pumped to the drying beds for further processing. Water within the drying beds will be removed through evaporation. However, in the event that the water production exceeds the evaporation rate, decanted water will be sent to the West Dam drains, which is pumped to the Sand Hollow Reservoir. Dried sludge will be removed and hauled to a local landfill.

C6. Will the discharge potentially impact a drinking water source, e.g., Class 1C waters? Depending upon the locations of the discharge and its proximity to downstream drinking water diversions, additional treatment or more stringent effluent limits or additional monitoring, beyond that which may otherwise be required to meet minimum technology standards or in stream water quality standards, may be required by the Director in order to adequately protect public health and the environment (R317-2-3.5 d.).

☐ YES
☒ NO

Section D. Identify and rank (from increasing to decreasing potential threat to designated uses) the parameters of concern. *Parameters of concern are parameters in the effluent at concentrations greater than ambient concentrations in the receiving water. The applicant is responsible for identifying parameter concentrations in the effluent and DWQ will provide parameter concentrations for the receiving water. More information is available in Section 3.3.3 of the Implementation Guidance.*

Parameters of Concern:

Rank	Pollutant	Ambient Concentration	Effluent Concentration
1.	Arsenic	Not Available (NA)	NA
2.	TSS	NA	NA
3.	Iron	NA	NA
4.	Manganese	NA	NA
5.			

Part X. Antidegradation Review *continued*

Pollutants Evaluated that are not Considered Parameters of Concern:

Pollutant	Ambient Concentration	Effluent Concentration	Justification
1.	Nitrate	NA	NA
2.	Phosphorus	NA	NA
3.			
4.			
5.			

Section E. Alternative Analysis Requirements of Level II Antidegradation Review. *Level II ADRs require the applicant to determine whether there are feasible less-degrading alternatives to the proposed project. More information is available in Section 5.5 and 5.6 of the Implementation Guidance.*

E1. The UPDES permit is being renewed without any changes to flow or concentrations. Alternative treatment and discharge options including changes to operations and maintenance were considered and compared to the current processes. NO economically feasible treatment or discharge alternatives were identified that were not previously considered for any previous antigradation review(s).

☐ YES – (Proceed to Section F)

☒ NO or Does Not Apply (Proceed to E2)

E2. Attach as an appendix to this form a report that describes that following factors for all alternative treatment options (see 1) a technical descriptions of the treatment process, including construction costs and continued operation and maintenance expenses, 2) the mass and concentration of discharge constituents, and 3) a description of the reliability of the system, including the frequency where recurring operation and maintenance may lead to temporary increases in discharged pollutants. Most of this information is typically available from a Facility Plan, if available.

Report Name: Gunlock & Sand Hollow Water Treatment Preliminary Design Report

E3. Describe the proposed method and cost of the baseline treatment alternative. The baseline treatment alternative is the minimum treatment required to meet water quality based effluent limits (WQBEL) as determined by the preliminary or final wasteload analysis (WLC) and any secondary or categorical effluent limits.

The treatment method is as described in section C5. Water within the drying beds will be removed through evaporation. However, in the event that the water production exceeds the evaporation rate, decanted water will be sent to the West Dam drains, which eventually runs to the Sand Hollow Reservoir. Dried sludge will be removed and hauled to a local landfill.

The cost of the treatment is coupled within the $9.4 million dollar construction project.

UPDES Industrial Permit Application

Part X. Antidegradation Review *continued*

E4. Were any of the following alternatives feasible and affordable?

Alternative	Feasible	Reason Not Feasible/Affordable
Pollutant Trading	☐ YES ☒ NO	Not Applicable
Water Recycling/Reuse	☒ YES ☐ NO	Intention
Land Application	☐ YES ☒ NO	Not Applicable
Connection to Other Facilities	☐ YES ☒ NO	Not Applicable
Upgrade to Existing Facility	☐ YES ☒ NO	Not Applicable
Total Containment	☒ YES ☐ NO	Intention
Improved O&M of Existing Systems	☐ YES ☒ NO	Not Applicable
Seasonal or Controlled Discharge	☒ YES ☐ NO	Optional
New Construction	☒ YES ☐ NO	Currently under construction
No Discharge	☒ YES ☐ NO	Intention

E5. From the applicant's perspective, what is the preferred treatment option?

The preferred treatment option is what has been designed, i.e., recycle decanted water to the front of the plant and then contain all remaining backwash waste water in the sludge drying beds. The removal of the water would be primarily through evaporation; however, a small flow may need to be decanted and discharged to avoid overburdening the drying beds.

UPDES Industrial Permit Application

Part X. Antidegradation Review ***continued***

E6. Is the preferred option also the least polluting feasible alternative?

☒ YES ☐ NO

If No, what were less degrading feasible alternative(s)?

If No, provide a summary of the justification for not selecting the least polluting feasible alternative and if appropriate, provide a more detailed justification as an attachment.

Section F. Optional Information

F1. Does the applicant want to conduct optional public review(s) in addition to the mandatory public review? Level II ADRs are public noticed for a thirty day comment period. More information is available in Section 3.7.1 of the Implementation Guidance.

☐ YES ☒ NO

F2. Does the project include an optional mitigation plan to compensate for the proposed water quality degradation?

☐ YES ☒ NO

Report Name: ______________________________

UTAH DEPARTMENT *of* ENVIRONMENTAL QUALITY
WATER QUALITY

Division of Water Quality (DWQ) UPDES Program

UPDES Industrial Permit Application

Part XI. Certification Statement and Signature

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with system designed to assure that quailed personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment of knowing violations.

Corey Cram	[signature]	Assoc. Gm Mgr	4-18-20
PRINT Signatory Authority	**Signature**	**Title**	**Date**

The Division of Water Quality may request addition information.

Important: The UPDES Permit Application will not be considered complete unless you answer every question. If an item does not apply to you, enter "Not Applicable" to show that you considered the question.

The UPDES Permit Application, must be signed as follows:

1) For a corporation, a responsible corporate officer shall sign the NOT, a responsible corporate officer means:
   a. A President, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation; or
   b. The manager of one or more manufacturing, production, or operating facilities, if
      i. The manager is authorized to make management decisions that govern the operation of the regulated facility, including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental statutes and regulations:
      ii. The manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and
      iii. Authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
2) For a partnership of sole proprietorship, the general partner or the proprietor, respectively; or
3) For a municipality, state or other public agency, either a principal executive officer or ranking elected official shall sign the application; in this subsection, a principal executive officer of any agency means;
   a. The chief executive officer of the agency; or
   b. A senior executive officer having responsibility for the overall operations of a principal geographic unit or division of the agency.

Where to File the UPDES Permit Application form:

Please submit the original form with a signature in ink to the below address. Remember to retrain a copy for your records.

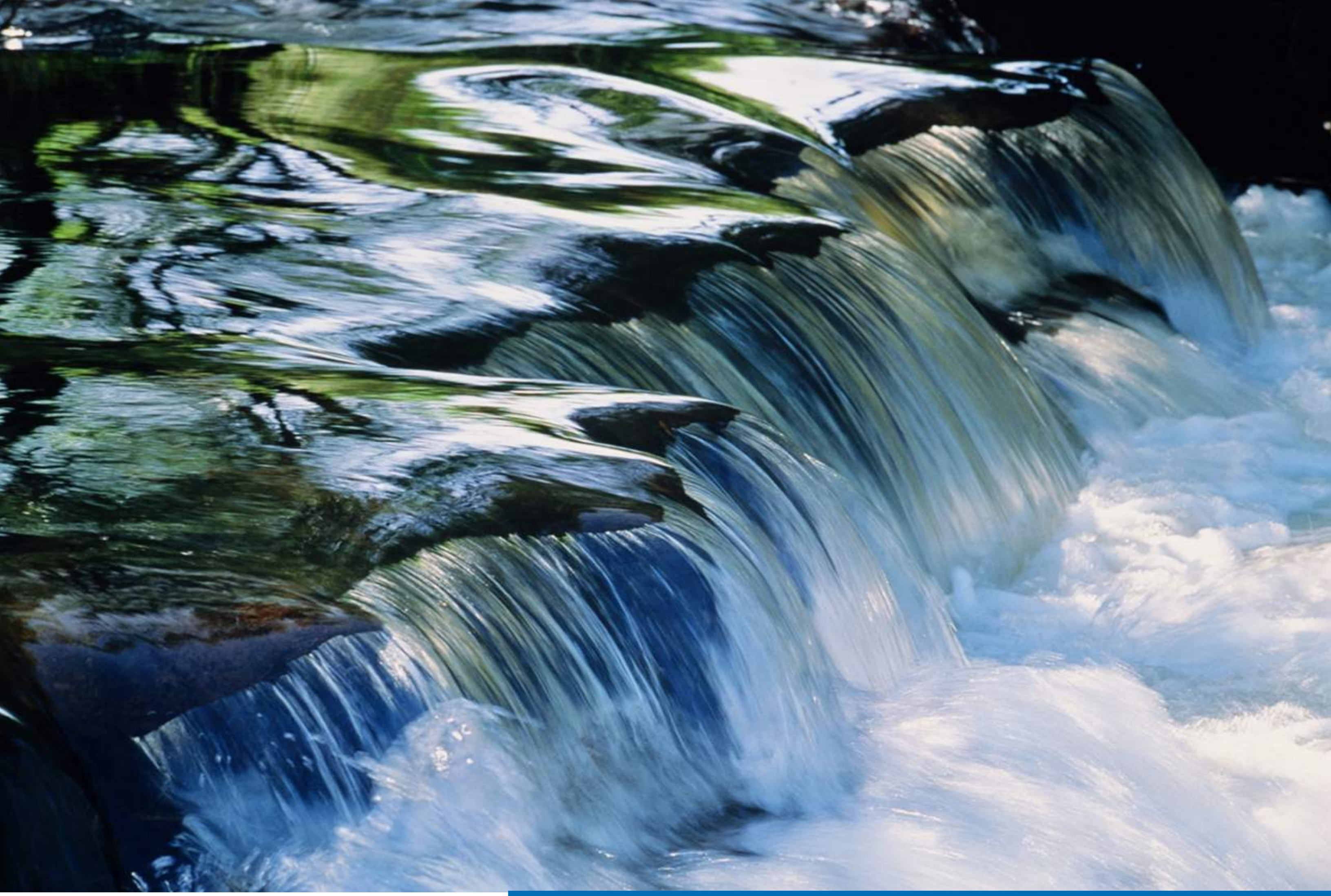
UPDES sent by mail:

Division of Water Quality
195 North 1950 West
PO Box 144870
Salt Lake City, UT 84114-4870

OFFICE USE ONLY

Date received: ____/____/____ **Received by:** ____________ **Document No:** ____________

via: ☐ Email ☐ Fax ☐ Webportal ☐ Mail ☐ Hand Delivery



City of St. George
Gunlock Water Treatment Facility Design &
Washington County Water Conservancy District
Sand Hollow Groundwater Treatment Plant
Design

WASHINGTON COUNTY
WATER CONSERVANCY DISTRICT

Technical Memorandum 1
GUNLOCK & SAND HOLLOW WATER TREATMENT PRELIMINARY DESIGN REPORT

FINAL | December 2018

ALPHA ENGINEERING

carollo

City of St. George
Gunlock Water Treatment Facility Design
&
Washington County Water Conservancy District
Sand Hollow Groundwater Treatment Plant Design

Technical Memorandum 1
GUNLOCK & SAND HOLLOW WATER TREATMENT PRELIMINARY DESIGN REPORT

FINAL | December 2018

Digitally signed by Gordon D. Thelin
Date: 2018.12.11 15:17:58-07'00'

REGISTERED PROFESSIONAL ENGINEER
No. 4860846-2202
GORDON D. THELIN
STATE OF UTAH

Contents

Appendices

Tables

Figures

Abbreviations

µg/L	micrograms per liter
A	amperes
AACEI	Association for the Advancement of Cost Engineering International
AC	asphalt concrete
Alpha	Alpha Engineering
As	arsenic
As(V)	arsenate
As(III)	arsenite
BLM	Bureau of Land Management
BW	backwash
BWW	backwash waste
C/F	coagulation/filtration
Carollo	Carollo Engineers, Inc.
cfs	cubic feet per second
City	City of St. George
District	Washington County Water Conservancy District
EPA	United States Environmental Protection Agency
ES	effective size
gpm	gallons per minute
gpm/sf	gallons per minute per square foot
GWTP	Groundwater Treatment Plant
hp	horsepower
HVAC	heating, ventilation, and air conditioning
kVA	kilovolt-amperes
lbs/d	pounds per day
lbs/sf	pounds per square foot
lbs/yr	pounds per year
M	million
MCC	motor control center
MCL	maximum contaminant level
MG	million gallon
mg/L	milligrams per liter

mgd	million gallons per day
mm	millimeter
Mn	manganese
NEC	National Electrical Code
NTU	Nephelometric Turbidity Unit
O&M	Operations and Maintenance
OSHG	onsite sodium hypochlorite generating system
P&ID	process and instrumentation diagrams
PLC	Programmable Logic Controller
PP	power panel
ppb	parts per billion
ppm	parts per minute
psi	pounds per square inch
RTU	remote terminal unit
SCADA	Supervisory Control and Data Acquisition
scfm/sf	standard cubic feet per minute per square foot
SHRP	Sand Hollow Regional Pipeline
TM	technical memorandum
V	volt
VFD	variable frequency drive
WCWCD	Washington County Water Conservancy District
WTF	water treatment facility

Technical Memorandum 1

Gunlock & Sand Hollow Water Treatment Preliminary Design Report

1.1 Purpose

The purpose of this predesign report is to present the results of the predesign effort to evaluate the current hydraulic conditions of the existing Gunlock and Sand Hollow well fields, outline a potential site layout for a new arsenic water treatment facility at both sites, and recommend a treatment layout to carry forward into design. The preliminary findings are summarized in this report and prepared to facilitate review and further discussion with the City of St. George and Washington County Water Conservancy District, the two Owners of the treatment facilities.

1.2 Background

1.2.1 Gunlock

The Gunlock well field, located 15 miles northwest of the City of Saint George (City), consists of 11 wells that supply drinking water for the City and surrounding area. The City owns and operates these wells, ranging in capacity from approximately 500 to 1,600 gallons per minute (gpm). Water rights dating back to 1961 allow the Gunlock well field to produce a total flow of 18 cubic feet per second (cfs) or 13,031.4 acre-feet. The total hydraulic capacity of the existing 18-inch and 20-inch conveyance lines is 19.7 cfs.

The ground water from the Gunlock well field has arsenic (As) concentrations higher than the United States Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 10 micrograms per liter (µg/L), but otherwise is of high quality with no other constituents that require treatment for current drinking water standards.

Demand in the distribution system on the west side of the City stresses the hydraulic capacity of the Washington County Water Conservancy District (District) regional pipeline that supplies this area, since a portion of the Gunlock well field capacity is unavailable due to arsenic concerns. Implementing arsenic treatment for the Gunlock well field water supply would significantly reduce the hydraulic stresses on the St. George west side water system and would provide a reliable, long-term water supply for this area.

A new 6 million gallon per day (mgd) coagulation/filtration (C/F) pressure vessel facility located at the Upper Bureau of Land Management (BLM) site was recommended in a previous technical memorandum (TM) to treat water from the upper wells, namely wells 5, 7, 8, 9, 10 and 11 in the Gunlock well field. The treatment plant will have sufficient capacity for arsenic removal from the upper wells with the ability to blend in water from the lower wells in the future. The total capacity of the upper wells is approximately 7 mgd. The initial 6 mgd treatment plant will be equipped with a 3-mgd bypass to accommodate some of the well flow bypassing the treatment plant, if warranted, while still meeting the As standard.

The initial design will accommodate space for future treatment expansion to 12 mgd on the Upper BLM site in case future regulations or water quality create the need to treat the City's entire Gunlock well field water supply. A pipeline from the lower wells will be constructed at some future point to supply the additional 6 MGD to the future water treatment facility expansion.

1.2.2 Sand Hollow

Washington County Water Conservancy District (WCWCD) owns and operates West Dam Springs, a pump station located near the toe of the Sand Hollow Reservoir's west dam. The collective production rate of the three pumps at the pump station ranges from 1,500 gpm to 2,100 gpm, depending on the water elevation in Sand Hollow Reservoir. West Dam Springs consists of a gravel-pack collection trench running parallel to the west dam that collects groundwater in a concrete wet well that originally pumped water from the wet well to the Dixie Springs 2 million gallon (MG) tank and to other locations within the distribution system. The West Dam Springs source has high manganese (Mn) levels that have previously created colored water events in the distribution system. These events forced WCWCD to suspend discharge to the distribution system yet continue to pump from the wet well. All of the West Dam Springs water is currently being pumped to Sand Hollow Reservoir. The West Dam Springs source requires Mn treatment before it can be used again for culinary water supply. The source also has arsenic levels near the regulated limit of 10 µg/L requiring As treatment as well.

A new 3 mgd C/F pressure vessel facility, located near West Dam Springs, is recommended to treat all the water from West Dam Springs, with the capability to blend and treat water from the nearby Sand Hollow well field. The existing Sand Hollow wells range from 300 to 1,500 gpm; most of the wells have elevated As levels that require blending or treatment for culinary use. In addition, WCWCD is currently developing five additional wells (Wells 10, 11, 12, 13 and 15) in the Sand Hollow area that will range in production between 500 and 2,000 gpm. The District has requested that the Sand Hollow wells be chlorinated before the water is sent to the distribution system; therefore, the new treatment plant's chlorine system will be sized to chlorinate the treated West Dam Springs water (approximately 3 mgd) and the Sand Hollow well field water (approximately 8 mgd). The plant will be designed to accommodate additional flows from the future wells, with a buildout capacity of 6 mgd. The West Dam Springs water and Sand Hollow well field water will be blended in the new Sand Hollow Regional Pipeline (SHRP) which will originate at the treatment plant and will send blended flows to a new 4 to 5 MG storage tank. A small portion of treated, unchlorinated water will also be bypassed from entering the SHRP and sent to the Dixie Springs 2 MG storage tank. Existing West Dam Springs pumps and Sand Hollow well pumps will pump against an additional head of approximately 15 pounds per square inch (psi) associated with the pressure vessels and sand separators. This will either slightly reduce their capacity or require the pump's variable frequency drives (VFD) to operate at a higher speed.

1.3 General Site Conditions

1.3.1 Gunlock

The Gunlock site was evaluated and selected as part of a preliminary engineering study performed for both the WCWCD and the City of St. George by Carollo Engineers, Inc. (Carollo) and Alpha Engineering (Alpha) in April of 2015. In that study, the Upper BLM site was selected as the site for the new arsenic treatment facility. This site is located along the east side of Gunlock Road between Well 7 and Well 8. This area is sufficiently large to accommodate current and future water treatment facilities. It is adjacent to the pipeline from the upper wells, which flows south to the interconnection with the lower wells and ultimately to the Gunlock Tank. Existing well pumps will pump against an additional head of approximately 9 psi associated with the pressure vessels. This will slightly reduce the well's capacity. The City is planning on upgrading the existing wells with larger pumps and VFDs.

1.3.1.1 Well Characteristics

Gunlock well field layout is shown in Figure 1.1 and represents the existing conditions at the well field including water and power infrastructure.

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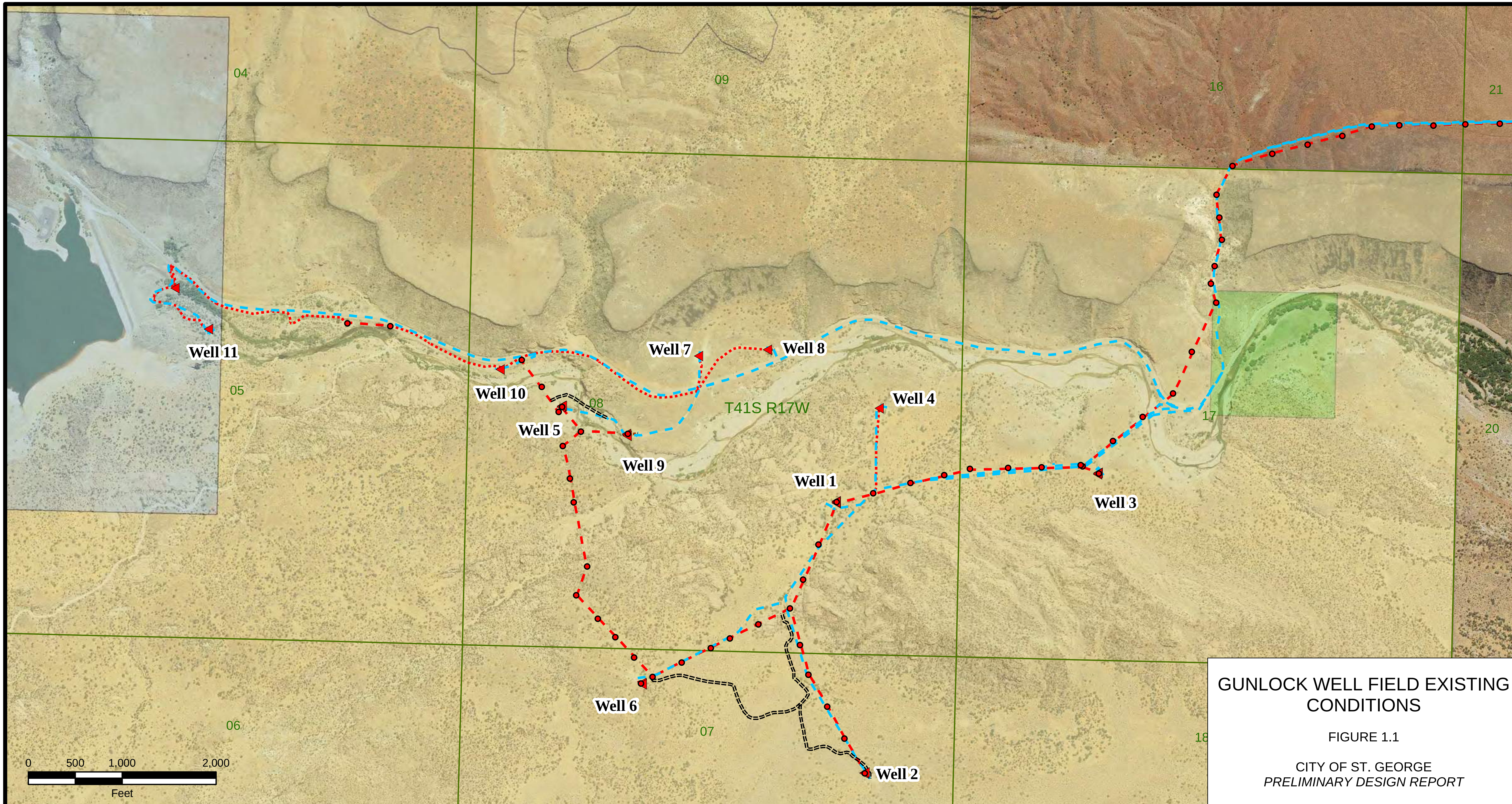

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- Existing Switch
- Existing Power Pole
- Existing Transformer
- Existing Access Road
- Existing Water Line
- Existing OHP Primary
- Existing OHP Secondary
- Existing UGP Primary
- Existing UGP Secondary
- Federal Land
- Private Land
- State Land
- PLSS Section Lines
- PLSS Township Lines

Gunlock Well Field Existing Conditions

Figure 1.1

Spatial Reference:	Utah State Plane NAD 83, feet
Drawn By:	JRH
Scale:	1" = 1,000'
Date:	May 2, 2016

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The following tables (Table 1.1 and Table 1.2) show the water quality of the Gunlock well field.

Table 1.1 Arsenic Values for the Gunlock Well Field

Analyte	Sample Date	Well Field										
		Lower						Upper				
		1	2	3	4	5	6	7	8	9	10	11
Arsenic (µg/L)	2010-2011	27	9.7	20	26	18	16	17	18	24	18	7.0
	9/08/2015	26	9.7	21	22	20	-	20	19	24	15	7.1
	11/24/2015	26	9.5	22	20	20	-	16	18	22	13	6.8

Table 1.2 Gunlock Well Field Historical Water Quality Data

Parameter	Units	Value	Basis
Total Arsenic	ppb	25.4	Calculated composite average based on water quality data (2000)
Arsenic V	%	>99	Based on well testing analysis performed 9/03 on wells 3-5
Arsenic III	%	ND	Based on well testing analysis performed 9/03 on wells 3-5
Iron	mg/L	0.1	Average of Gunlock Well Nos. 1-9 (92'-03')
Calcium	mg/L	71.4	Average of Gunlock Well Nos. 1-9 (92'-03')
Magnesium	mg/L	14.9	Average of Gunlock Well Nos. 1-9 (92'-03')
Manganese	mg/L	<0.01	Average of Gunlock Well Nos. 1-9 (92'-03')
Sodium	mg/L	14.5	Average of Gunlock Well Nos. 1-9 (92'-03')
Sulfate	mg/L	74	Average of Gunlock Well Nos. 1-9 (92'-03')
Nitrate-N	mg/L	0.4	Average of Gunlock Well Nos. 1-9 (92'-03')
Total Silica	mg/L	21.5	Based on well testing analysis performed 9/03 on wells 3-5
Dissolved	%	>99	Based on well testing analysis performed 9/03 on wells 3-5
TOC	mg/L	0.6	Based on well testing analysis performed 9/03 on wells 3-5
Total Phosphorous-P	mg/L	0.05	Based on well testing analysis performed 9/03 on wells 3-5
Alkalinity[1]	mg/L	186	Average of Gunlock Well Nos. 1-9 (92'-03')
Fluoride	mg/L	0.3	Average of Gunlock Well Nos. 1-9 (92'-03')
Chloride	mg/L	15.8	Average of Gunlock Well Nos. 1-9 (92'-03')
Barium	mg/L	0.11	Average of Gunlock Well Nos. 1-9 (92'-03')
pH	-	7.5	Average of Gunlock Well Nos. 1-9 (92'-03')
Turbidity	NTU	0.44	Average of Gunlock Well Nos. 1-9 (92'-03')
TDS	mg/L	361	Average of Gunlock Well Nos. 1-9 (92'-03')
Conductivity	umhos/cm	976	Average of Gunlock Well Nos. 1-9 (92'-03')
Temperature	°F	55-65	Water temperature tested on Gunlock Wells Nos. 1-11 (10/03)

Notes:
(1) Expressed as $CaCO_3$.

1.3.1.2 Distribution Pipeline Conditions

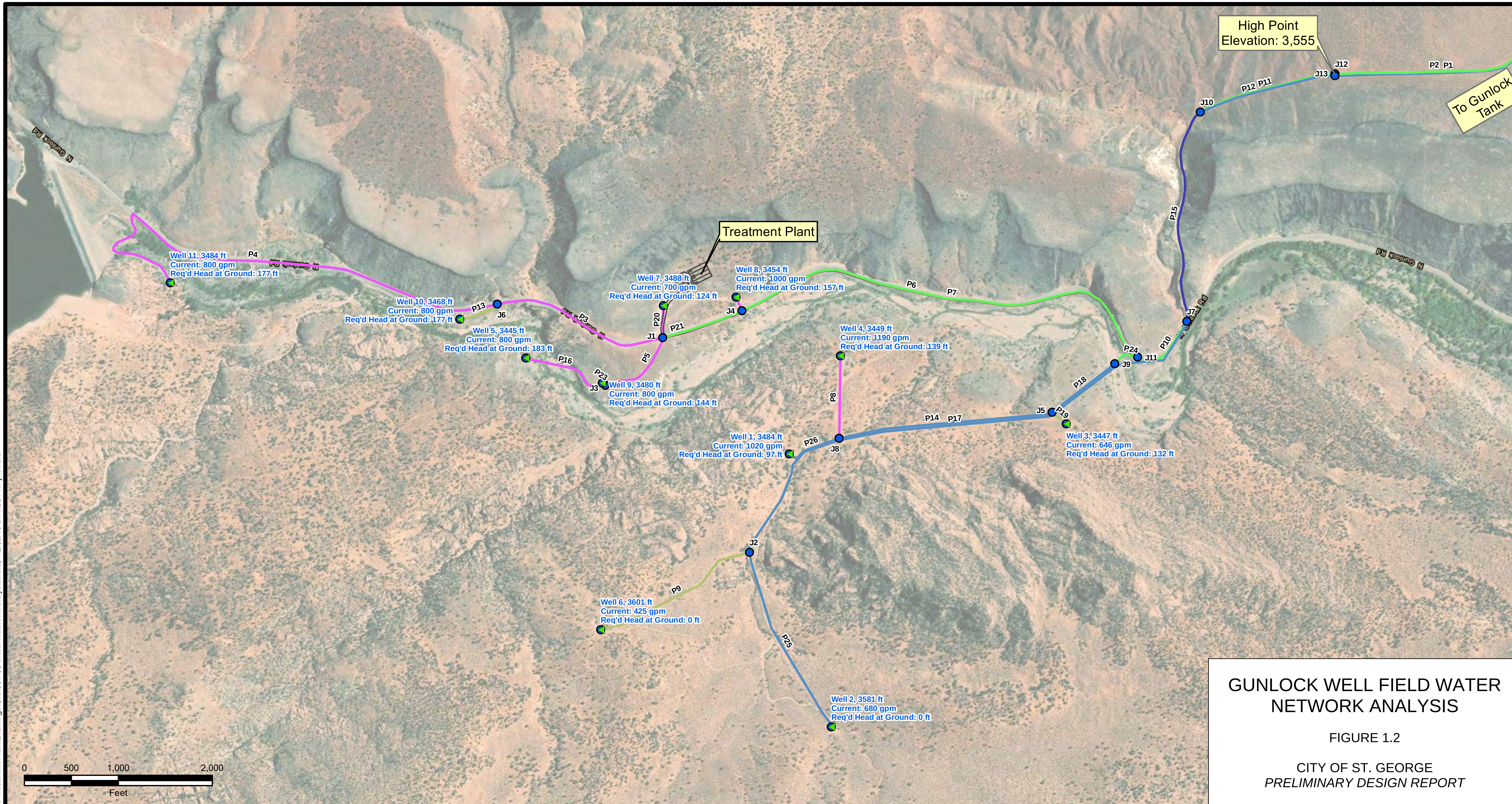
The existing 20-inch pipeline in Gunlock Road will be tapped into with a 24-inch pipe to feed the new Gunlock Water Treatment Facility (WTF). A new 24-inch pipe will return the treated water from the WTF to the existing line. Isolation valves will also be provided to direct the upper well water to the WTF and to isolate the WTF from the existing well field, if necessary. Wells 5, 7, 8, 9, 10, and 11 have a total design capacity of 4,900 gpm of which about 4,200 gpm will be sent through the treatment plant. These wells will be retrofitted by the City to provide the needed flows and head needed to reach the Gunlock Tank. Wells 1, 2, 3, 4, and 6 will mix with the treated water at the existing distribution interconnect tee. A water network analysis for the Gunlock Upper Wells is shown in Figure 1.2, which shows the ground surface elevation of the well, the existing pipe diameters, the current design pumping rate, and the required head at the ground surface to convey flow to the high point of the existing pipeline. This information provides the City with head conditions at the well with the new WTF in place and will aid the City in retrofitting the wells. Additional tables containing this information are included in the appendices of this report.

The multi-cell pressure vessel configuration uses 2,100 gpm from the filter effluent pipe to backwash one of the four cells from one filter vessel at a time. This eliminates the need for a backwash supply tank or pump station. The system is configured so that three cells can filter the design flow of 2,100 gpm, and their filtered water can backwash the fourth cell. Thus, when the WTF is operating at 2,100 gpm or higher, whether through one filter vessel or two, no supplemental water is needed from the distribution system. If the WTF is operating at less than 2,100 gpm, supplemental water from the filter effluent piping is required for backwash. This supplemental water is automatically available from the downstream transmission piping provided that the total well production entering the pipe to the Gunlock tank (either from the upper wells through the WTF, or from the lower directly into the pipe) exceeds 2,100 gpm. Since there is a high point between the wells and the Gunlock tank that prevents backflow from the tank, the filter vessels can only be backwashed when the total flow from the groundwater wells exceeds 2,100 gpm.

1.3.1.3 Site Layout

The site will include an asphaltic concrete (AC) pavement entrance road from Gunlock Road and around the WTF, as depicted in Figure 1.3. A gravel base will be placed between the asphalt paving and drying beds for easier truck access.

Yard piping will include pipelines from the filters to a backwash waste tank with decant return piping to the building and sludge piping to the drying beds. There will also be overflow pipelines, drainage pipelines, and storm drainage culverts as needed. A wastewater holding tank, with associated piping, will also be designed for sanitary waste from the treatment facility. This tank will be maintained by the City removing contents periodically via a septic type pumping truck service. The building profile and setting will meet restrictions as outlined by the BLM in the Environmental Assessment.



GUNLOCK WELL FIELD WATER NETWORK ANALYSIS

FIGURE 1.2

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▲ Existing Well
● WaterGEMS Model Junction

Existing Pipe
- 8"
- 10"
- 14"
- 18"
- 20"
- 30"

Figure 1.2

Water Network Analysis

Gunlock Well Field

Spatial Reference:	Utah State Plane NAD 83, feet
Drawn By:	JRH
Scale:	1 inch = 1,000 feet
Date:	December 2018

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GUNLOCK WTF OVERALL SITE PLAN

FIGURE 1.3

CITY OF ST. GEORGE
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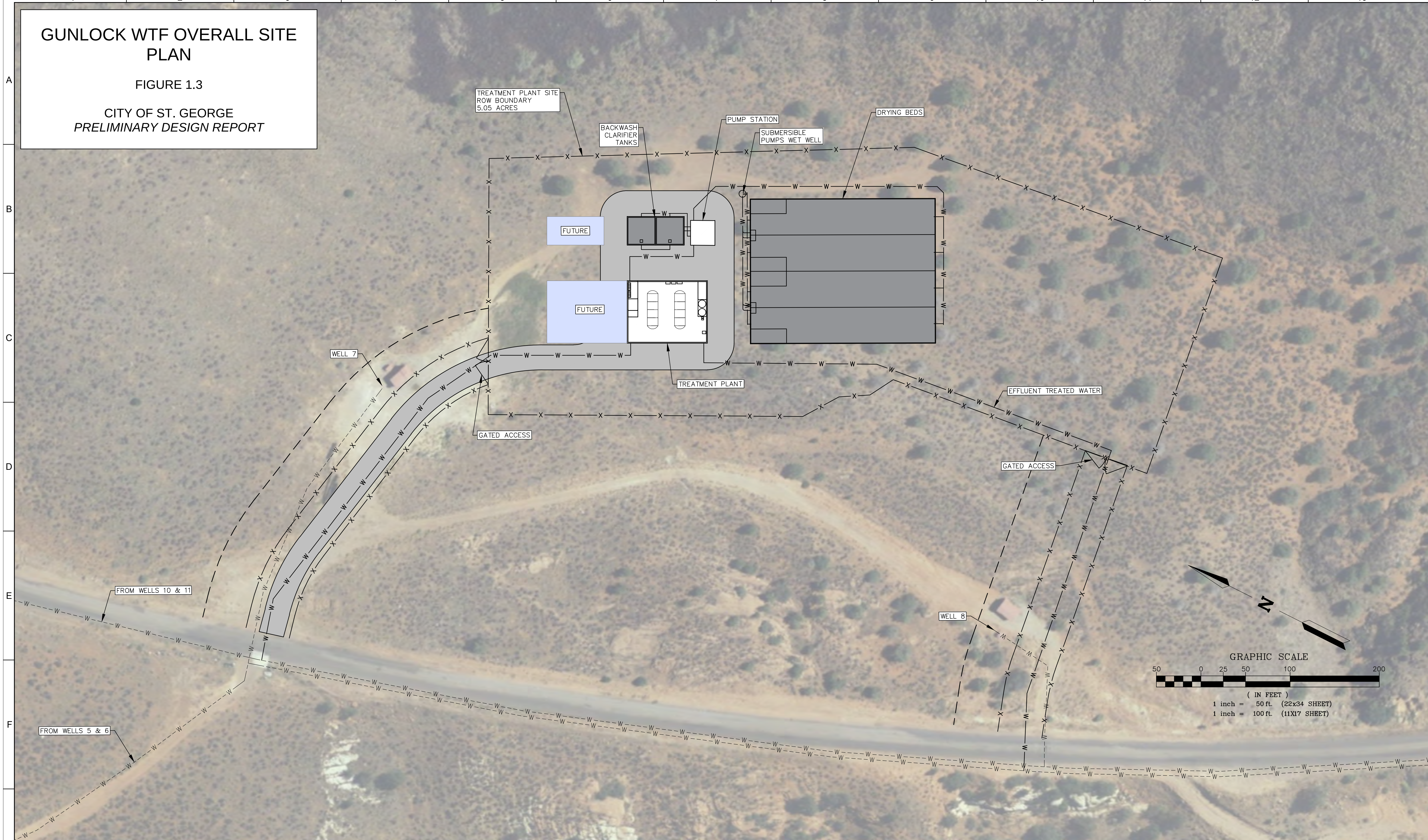

REV	DATE	BY	DESCRIPTION

DESIGNED JRH
DRAWN JRH
CHECKED TBG
DATE DECEMBER 2018

PRELIMINARY DESIGN SUBMITTAL
NOT FOR CONSTRUCTION

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St.George THE BRIGHTER SIDE

CITY OF ST. GEORGE
GUNLOCK WATER TREATMENT FACILITY DESIGN
GENERAL
OVERALL SITE PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
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1.3.2 Sand Hollow

The Sand Hollow Groundwater Treatment Plant (GWTP) site has been master planned to be located adjacent to the West Dam Springs pump station. The site is large enough to accommodate current and future water treatment facilities and is adjacent to the new Sand Hollow Regional Pipeline, which will collect groundwater from the Sand Hollow well field and the GWTP. The regional pipeline will convey groundwater to the new 4 to 5 MG Warner Valley storage tank south of the West Dam Springs area.

1.3.2.1 Well Characteristics

The Sand Hollow well field layout is shown in Figure 1.4 and represents the existing conditions at the well field.

Table 1.3 shows the capacity of the Sand Hollow well field and the water quality at each well, where wells 1, 10, 11, 12, 13, and 15 represent the future Sand Hollow wells.

Table 1.3 Sand Hollow Well Field Capacity

Well No.	Flow Rate (gpm)	Head (ft)	Avg. As (µg/L)	As Range (µg/L)	Comment
1	900	NA	8.5	1.1 - 10.7	Future Well
2	500	1,075	9.7	6.5 - 15.9	
4	205	NA	8.7	7.3 - 14.7	
5	205	NA	8.4	6.2 - 9.3	
6	237	NA	7.9	6.9 - 9.2	
8	500	390	8.9	6.4 - 21.3	
9	962	509	12.5	9.0 - 17.6	
10	2,000	NA	11	NA	Future Well
11	500	NA	10	NA	Future Well
12	1,000	NA	10	NA	Future Well
13	500	NA	10	NA	Future Well
15	500	NA	10	NA	Future Well
17	300	682	7.3	1 sample only	
18	825	395	11	1 sample only	
19	630	452	8.1	5.9 - 14	
20	800	336	14	1 sample only	
21	1,500	210	12.3	11.0 - 13.7	
22	420	202	8.2	1 sample only	
23	680	563	6.8	5.7 - 10.2	
West Dam Spring	2,100	NA	7.6	4.4 - 12.5	
Total	**15,264**				

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SAND HOLLOW WELLS AND PIPELINES
FIGURE 1.4
WCWCD
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SH05 (28)
205 GPM - Arsenic @ 8.4 ppb
SH06 (29)
237 GPM - Arsenic @ 7.9 ppb
SH07 (30)
SH30 (16)
SH17 (27)
300 GPM - Arsenic @ 7.3 ppb
SH11 (34)
SH13 (35)
West Dam Springs - SH14 (33)
2100 GPM - Arsenic @ 7.6 ppb
SH10 (23)
Arsenic Treatment Plant
SH26 (26)
SH29 (12)
SH12 (37)
SH24 (24)
SH16 (7)
SH15 (10)
SH08 (9)
500 GPM - Arsenic @ 8.9 ppb
Detail 2
Scale: 1" = 100' (22x34 Sheet)
See Detail 2 This Sheet
SH25 (25)
SH08 (9)
500 GPM - Arsenic @ 8.9 ppb
WCWCD SAND HOLLOW 1MG TANK (1 MG)
SH19 (11)
630 GPM - Arsenic @ 8.1 ppb
SH23 (13)
680 GPM - Arsenic @ 6.8 ppb
SH21 (2)
1500 GPM - Arsenic @ 12.3 ppb
Detail 1
1" = 50' (22x34) Sheet
SH09 (32)
962 GPM - Arsenic @ 12.5 ppb
SH20 (15)
800 GPM - Arsenic @ 14 ppb
SH18 (14)
825 GPM - Arsenic @ 11 ppb
SH21 (2)
1500 GPM - Arsenic @ 12.3 ppb
See Detail 1, This Sheet
WCWCD DIXIE SPRINGS 2MG TANK (2 MG)
SH01 (31)
900 GPM - Arsenic @ 8.5 ppb
SH27 (1)
0 300 600 1,200
Feet
SH22 (3)
420 GPM - Arsenic @ 8.2 ppb
SH04 (5)
205 GPM - Arsenic @ 8.7 ppb
SH03 (6)
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Wells - WCWCD No. (State No.)
Existing Wells
Proposed
Future Wells
Tanks
Proposed Water
Other
Air/Vac Valve
Butterfly Valve
Blow Off Valve
Gate Valve
Hydrant
PRV
Pump
Valve
Other
6"
8"
10"
12"
14"
16"
18"
20"
24"
30"
60"
1 of 1
Sand Hollow Wells & Pipelines Exhibit
Washington County Water Conservancy District
Spatial Reference: Utah State Plane NAD 83, feet
Drawn By: JRH
Scale: 1 inch = 600 feet
Date: November 2018

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Historical water quality, collected 2014 to 2015, is presented in Table 1.4.

Table 1.4 Sand Hollow Well Field Historical Water Quality Data (2014-2015)

Value	Alkalinity (mg/L[1])	pH	Conductivity (µS/cm)	TDS (mg/L)	Iron (mg/L)	Manganese (mg/L)
Min	156	7.80	811	551	0.028	0.036
Average	168	8.18	906	616	0.224	0.078
Max	180	8.4	929	632	1.32	0.294

Notes:
(1) Expressed as $CaCO_3$.

1.3.2.2 Distribution Conditions

The Sand Hollow well field consists of multiple wells nearby the new Sand Hollow GWTP. In particular, Wells 10, 11, 12, 13 and 15, which are in the process of being developed, will be part of the distribution system surrounding the GWTP. As described in Section 1.2.2, the West Dam Springs pumps will be the primary water supply (up to 2,100 gpm) to the pressure vessel included in this design. The existing 30-inch pipeline will be modified to connect West Dam Springs to the GWTP. In addition, the 30-inch pipeline coming from the existing and developing wells will route through the GWTP site and then connect to the 36-inch Sand Hollow Regional Pipeline (SHRP) where the well water will normally be conveyed. The well field pipe is routed through the GWTP site to allow a portion of it to be diverted through the GWTP for treatment if desired, and to provide a convenient point of chlorination to the well water after has combined with the treated water from the GWTP.

Under normal operating conditions, all of the West Dam Springs flow will be filtered at the GWTP and the water from the surrounding Sand Hollow well field will bypass the GWTP and flow to the SHRP. If the West Dam Springs flows are less than the 2,100 gpm filtration capacity (historical data shows it can go as low as 1,500 gpm), a portion of the well water can be diverted to the GWTP for treatment if desired up to a combined treatment capacity of 2,100 gpm. Under this condition, all of the Sand Hollow wells will have to overcome the additional headloss of filtration even though only some of that water is being treated. A portion of the filtered water (700 to 1,000 gpm) from the GWTP will be diverted and pumped to the Dixie Springs 2-MG tank, via the existing 30-inch pipe, for blending and chlorination at that location. Pumping is required because the hydraulic grade in the pipe to Dixie Springs tank is higher than the hydraulic grade of the SHRP. The remaining filtered water will combine with the bypassed well water for chlorination on the GWTP site and delivery to the SHRP and the Warner Valley storage tank.

The multi-cell pressure vessel configuration uses 2,100 gpm from the filter effluent pipe to backwash one of the four cells at a time, eliminating the need for a backwash supply tank or pump station. The system is configured so that three cells can filter the design flow of 2,100 gpm, and their filtered water can backwash the fourth cell. When operating at the full 2,100 gpm rated capacity, no supplemental water is needed from the distribution system. If the GWTP is operating at less than 2,100 gpm, supplemental water from the filter effluent piping is required for backwash. This supplemental water is automatically available from the well bypass provided that combined total flow of the GWTP flow and well bypass flow exceeds 2,100 gpm. This will be the case under all but the most unusual circumstances. If the combined flow is less than 2,100 gpm, a manual bypass around the pumps to the Dixie Springs tank is provided so that supplemental water can be provided from Dixie Springs. Supplemental water is not available from the SHRP because of a high point in the pipe between the GWTP and the Warner Valley storage tank.

1.3.2.3 Site Layout

The site will include an AC pavement entrance road from Sand Hollow Road and the reservoir access road and concrete paving around the GWTP. A gravel base will be placed between the concrete paving and drying beds for easier truck access. The treatment building, concrete drying beds, backwash tanks, security fencing, and gates are depicted in Figure 1.6.

Yard piping will include lines from the filters to a backwash tank with decant return piping to the building and sludge piping to the drying beds. There will also be overflow pipelines, drainage pipelines, and culverts as needed. Waste water from the treatment plant will connect to the existing 8-inch sewer line near the site.

SAND HOLLOW EXISTING WELLS NETWORK ANALYSIS

FIGURE 1.5

WCWCD
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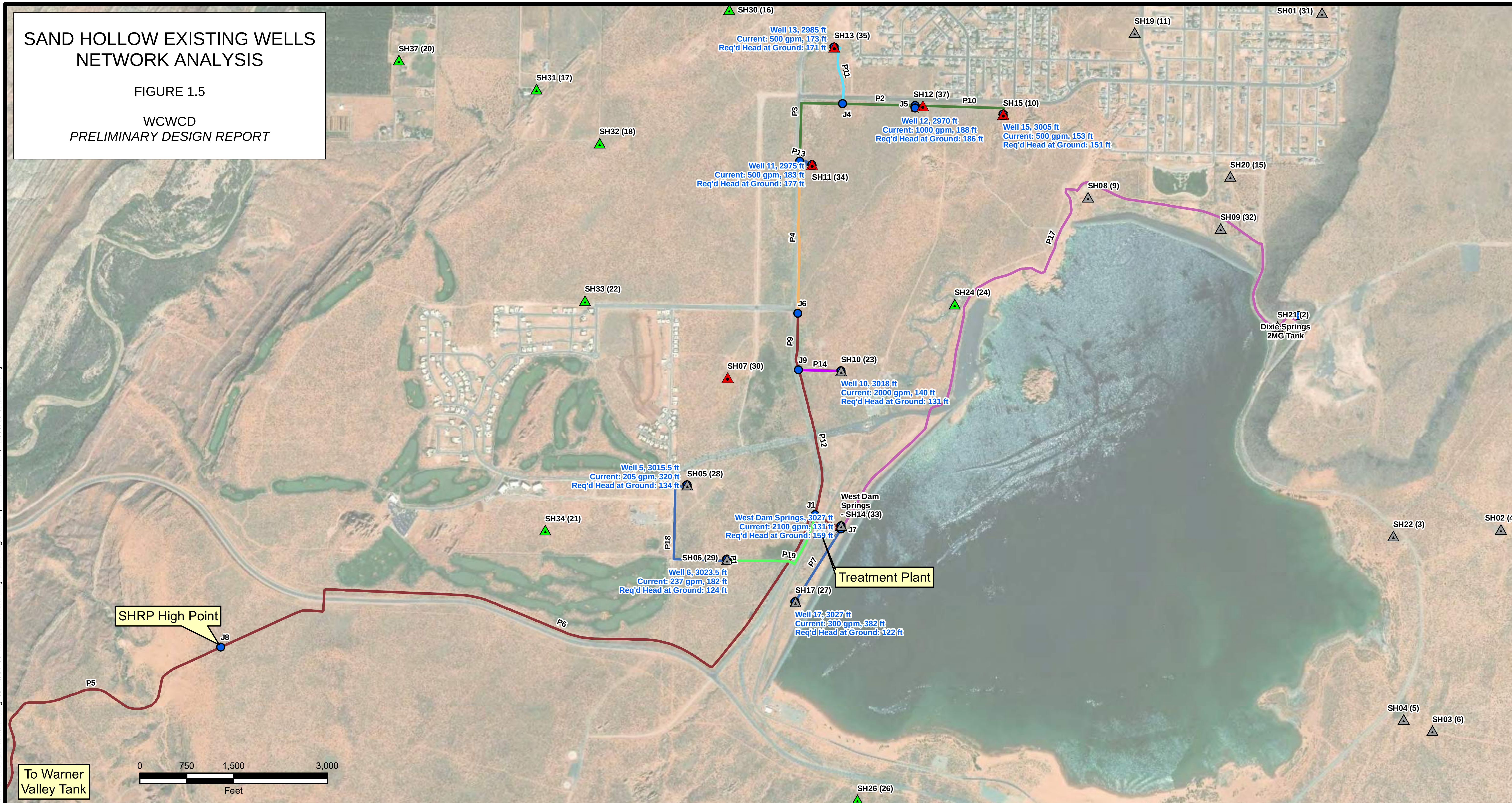

Wells - WCWCD No. (State No.)

- Existing Wells
- Proposed
- Future Wells
- WaterGEMS Model Junction

Pipe

- 8"
- 10"
- 12"
- 16"
- 18"
- 20"
- 24"
- 30"

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N

Figure 1.5

Existing and Proposed Wells Water Network Analysis
Sand Hollow Wells

Spatial Reference:	Utah State Plane NAD 83, feet
Drawn By:	JRH
Scale:	1 inch = 1,500 feet
Date:	December 2018

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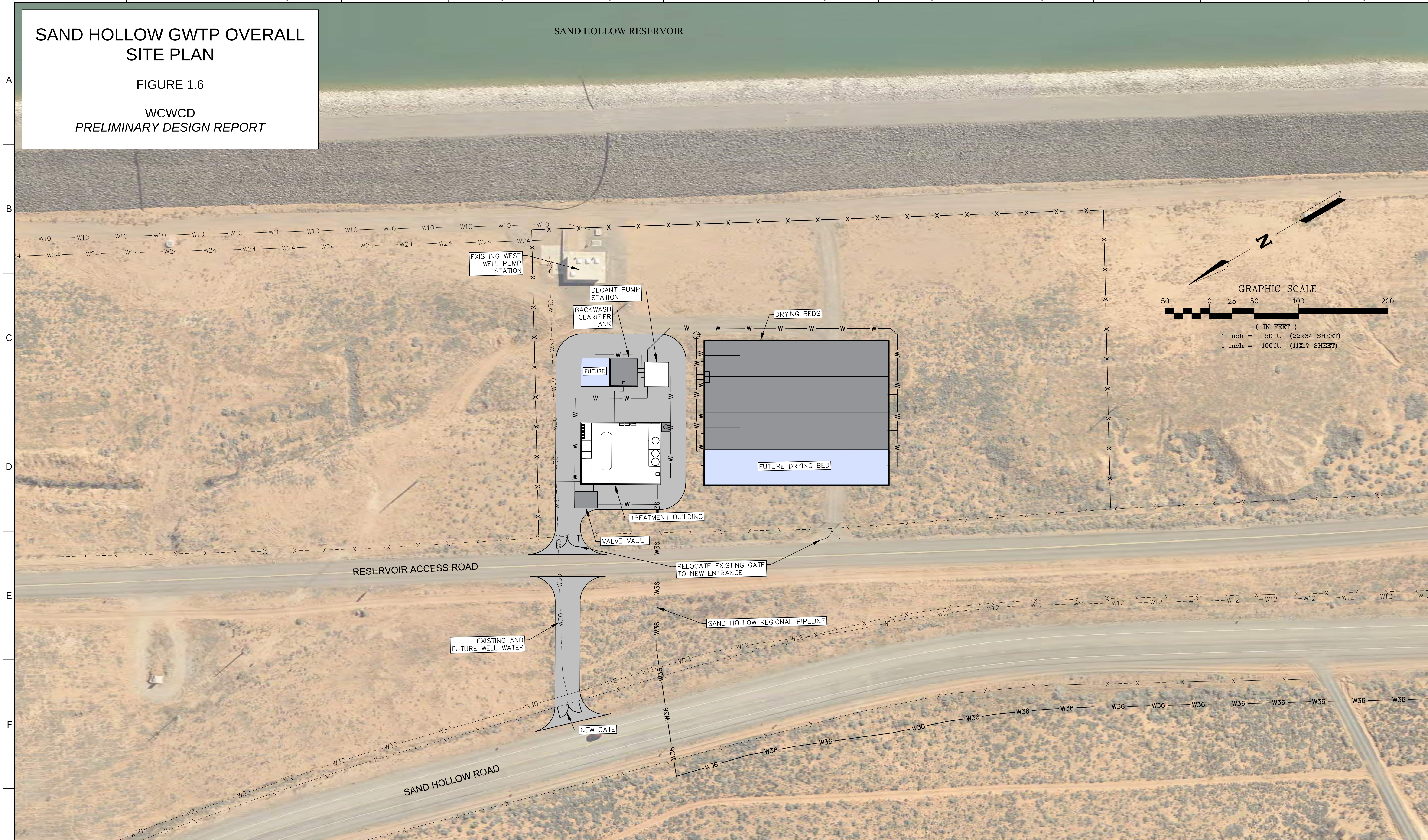
SAND HOLLOW GWTP OVERALL SITE PLAN

FIGURE 1.6

WCWCD
PRELIMINARY DESIGN REPORT



REV	DATE	BY	DESCRIPTION

DESIGNED JRH
DRAWN JRH
CHECKED TBG
DATE DECEMBER 2018

PRELIMINARY DESIGN SUBMITTAL
NOT FOR CONSTRUCTION

carollo
ALPHA ENGINEERING
WASHINGTON COUNTY WATER CONSERVANCY DISTRICT

WASHINGTON COUNTY WATER CONSERVANCY DISTRICT
SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN
GENERAL
OVERALL SITE EXHIBIT

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1.4 Water Treatment Design Criteria

1.4.1 Gunlock

1.4.1.1 Basis of Design

Figure 1.7 summarizes the general basis for design and equipment sizing for the Gunlock WTF. Subsequent sections provide an explanation and more detailed description for each design area. The basis of design presents two criteria. The first represents the current design and consists of two C/F pressure vessels treating up to 6 mgd of well water. The second represents the future buildout of the site which would incorporate a second pair of C/F pressure vessels and accompanying components and facilities.

The process flow diagram for the Gunlock WTF is shown in Figure 1.8, which outlays the general flow of treatment processes and equipment. The diagram represents schematically the flow path of raw groundwater through the treatment process and the proposed flow control and treatment equipment. Raw groundwater from the upper Gunlock well field enters the treatment plant in a 24-inch diameter pipe. A detailed description of each succeeding component through the treatment facility is presented below.

1.4.1.2 Bypass System

A bypass system is proposed for the WTF. A portion of the well water will be able to be routed from the incoming groundwater line around the vessels and recombined with treated water from the vessels to produce a blended water of treated and untreated groundwater still containing less than the arsenic maximum contaminant level (MCL). This blending option of treated, low-arsenic water with untreated well water will provide the capability to reduce treatment costs and extend the life of the filter media.

Generally, there is not a significant variation in groundwater quality. This allows for relatively consistent treatment wherein the process can be adjusted initially to achieve treatment objectives but then only requires monitoring and minor adjustments for a given flow rate. The proposed bypass system will be controlled by a flow control valve, which will automatically position to a particular flow or arsenic blend ratio. Multiple sample ports will be provided at different locations for sampling purposes. Raw water and treated water arsenic levels need to be measured to determine the flow split for the bypass water and treated water. There will be flow meters on the bypass line and effluent filter cells for determining flows once the valves have been adjusted.

The blending equation to determine the amount of raw water to bypass is shown in Equation 1 and Equation 2.

Equation 1 (General Equations):

$$(Q_{VL}) \times (As_{VL}) + (Q_{BY}) \times (As_{BY}) = (Q_{BL}) \times (As_{BL})$$

$$(Q_{VL}) + (Q_{BY}) = Q_{BL}$$

Where:

Q_{VL} = Flow rate for combined vessel effluent (gpm or mgd)

As_{VL} = Arsenic concentration for combined vessel effluent (µg/L)

Q_{BY} = Flow rate for bypass line (gpm or mgd)

As_{BY} = Arsenic concentration for bypass line (µg/L)

Q_{BL} = Flow rate for blended line going to the distribution system (gpm or mgd)

As_{BL} = Arsenic concentration goal for blended line going to the distribution system (µg/L)

Equation 2 (Calculation Bypass Flow Rate):

$$Q_{BY} = \frac{Q_{BL} \times (As_{BL} - As_{VL})}{(As_{BY}) \times \left(1 - {}^{As_{VL}}/_{As_{BY}}\right)}$$

If desired, all six Upper Gunlock wells could be run simultaneously at maximum capacity, producing up to 6,900 gpm, or 7 mgd. The estimated blended arsenic concentration for all six wells is approximately 24 µg/L. If the plant was receiving 7 mgd and treating to an effluent arsenic concentration less than 2 µg/L, 1.9 mgd could be bypassed and combined with an expected arsenic concentration of 8 µg/L. An example calculation is provided, which shows the input parameters needed for determining the bypass flow rate.

$$Q_{BY} = \frac{7\ MGD\ \times (8\ \mu g/L - 2\mu g/L)}{(24\mu g/L) \times \left(1 - {}^{2\mu g/L}/_{24\mu g/L}\right)}$$

$$Q_{BY} = 1.9\ MGD$$

The 14-inch bypass line is sized for 3 mgd, and recombines after filtration, but before post-chlorination.

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DESCRIPTION	UNITS	CRITERIA DESIGN	CRITERIA BUILDOUT
PLANT FLOW RATE			
PROCESS DESIGN CAPACITY	MGD	6	12
MINIMUM PLANT FLOW	MGD	1	1
BYPASS FLOW CAPACITY	MGD	3	6
WELL PUMPS			
NUMBER OF WELLS	NO.	6	11
CAPCITY OF PUMPS, EA	GPM	600-1,600	
NUMBER OF VFDs	NO.	0	0
FLASH MIX			
TYPE: PUMP DIFFUSION			
NUMBER OF PUMPS	NO.	1	2
NUMBER OF VFDs	NO.	1	2
ENERGY INPUT, G	SEC^{-1}	1,000	1,000
CAPCITY OF PUMPS, EA	GPM	150	150
SIZE OF PUMPS, EA	HP	3	3
CHEMICALS			
CHLORINE			
TYPE: CHLORINE GAS			
DOSE RANGE	MG/L	0.5 - 1.5	0.5 - 1.5
ADDITION POINT	-	PLANT INFLUENT/EFFLUENT	
NUMBER OF CYLINDERS	NO.	2	4
CYLINDER SIZE, EA	LBS	150	150
DAYS OF CONNECTED STORAGE	DAYS	6	6
FERRIC CHLORIDE			
DOSE RANGE	MG/L	3.0 - 10.0	3.0 - 10.0
ADDITION POINT	-	FLASH MIX	
MAX DOSE AT PEAK FLOW	GPD	100	200
NUMBER OF TANKS	NO.	2	4
TANK SIZE, EA	GAL	1,600	1,600
DAYS OF STORAGE	DAYS	30	30
FILTRATION SYSTEM			
TYPE: HORIZONTAL PRESSURE VESSELS			
FILTER LOADING AND CAPACITY			
NUMBER OF VESSELS	NO.	2	4
NUMBER OF CELLS PER VESSEL	NO.	4	4
VESSEL DIAMETER	FT	12	12
CELL LENGTH	FT	9	9
CELL AREA	SF	108	108
TOTAL VESSEL AREA	SF	432	432
TOTAL VESSEL LENGTH	FT	36	36
NOMINAL FILTRATION RATE	GPM/SF	4.8	4.8
NOMINAL CELL CAPACITY	MGD	1	1
FILTERS OUT OF SERVICE FOR BACKWASHING	NO.	1	1
FIRM DESIGN FILTER CAPACITY (ONE WASHING)	GPM/SF	6.4	6.4
FILTER MEDIA			
TYPE: DUAL MEDIA			
ANTHRACITE DEPTH	IN	36	36
ANTHRACITE EFFECTIVE SIZE	MM	1.05	1.05
SAND DEPTH	IN	12	12
SAND EFFECTIVE SIZE	MM	0.6	0.6
L/d	-	1,360	1,360
FILTER UNDERDRAIN			
TYPE: PLATE WITH NOZZLES			
FILTER BACKWASH			
TYPE: DISTRIBUTION PRESSURE, AIR SCOUR			
MAXIMUM BACKWASH RATE	GPM/SF	20	20
FILTER DRAIN RATE/DURATION	GPM / MIN	510 / 15	510 / 15
BACKWASH STEP			
AIR EVACUATE RATE/DURATION	GPM / MIN	1,200 / 3	1,200 / 3
HIGH-RATE BW RATE/DURATION	GPM / MIN	2,160 / 5	2,160 / 5
MEDIA RESTRATIFY RATE/DURATION	GPM / MIN	1,300 / 2	1,300 / 2
TOTAL REQUIRED BW VOLUME + 1.25 SAFETY FACTOR	GAL	21,250	21,250
TOTAL BW VOLUME PRODUCED/DURATION	GAL / MIN	29,000 / 30	29,000 / 30
AIR SCOUR			
DESIGN AIR SCOUR RATE	SCFM/SF	4	4
AIR SCOUR FLOW RATE	SCFM	432	432
AIR SCOUR TIME	MIN	5	5
NUMBER OF BLOWERS	NO.	1	2
CAPACITY, EA	SCFM	500	500
SIZE, EA	HP	20	20
...NG DECANT			
	NO.	2	4
	FTXFT	30X30	30X30
	GAL	127,000	127,000
	HRS	6	6
	GPM	400	400

DESCRIPTION	UNITS	CRITERIA DESIGN	CRITERIA BUILDOUT
SOLIDS DRYING BEDS			
TYPE: RECTANGULAR, VERT. WALL, CONCRETE LINED			
NUMBER OF BEDS	NO.	4	8
DIM. OF BED (WXLXH)	FTXFTXFT	40X200X4	40X200X4
VOLUME, EA	GAL	240,000	240,000
WATER DEPTH	FT	2	2
SOLIDS LOADING RATE	LBS/SF	8	8
SOLIDS HANDLING CAPACITY, EA	LBS	66,000	66,000
TOTAL SOLIDS HANDLING CAPACITY	LBS/YR	220,000	440,000
AVG. UNIT SOLIDS PRODUCTION RATE	DRY LBS/MGAL	100	100
TOTAL AVG. ANNUAL SOLIDS PRODUCTION	DRY LBS/YR	162,000	324,000
DRYING BEDS RETURN SUBMERSIBLE PUMPS			
NUMBER (1 + 1)	NO.	2	4
CAPACITY, EA	GPM	100	100
SIZE, EA	HP	2	2
BACKWASH WASTE PUMP STATION			
TYPE: END SUCTION CENTRIFUGAL			
BACKWASH WASTE DECANT PUMPS			
NUMBER (1 + 1)	NO.	2	4
CAPACITY, EA	GPM	420	420
SIZE, EA	HP	8	8
BACKWASH WASTE SLUDGE PUMPS			
NUMBER	NO.	2	4
CAPACITY, EA	GPM	500	500
SIZE, EA	HP	8	8

GUNLOCK WTF DESIGN CRITERIA

FIGURE 1.7

CITY OF ST. GEORGE
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DATE
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CITY OF ST. GEORGE
GUNLOCK WATER TREATMENT FACILITY DESIGN
GENERAL
DESIGN CRITERIA

VERIFY SCALES
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SHEET NO.
OF XX

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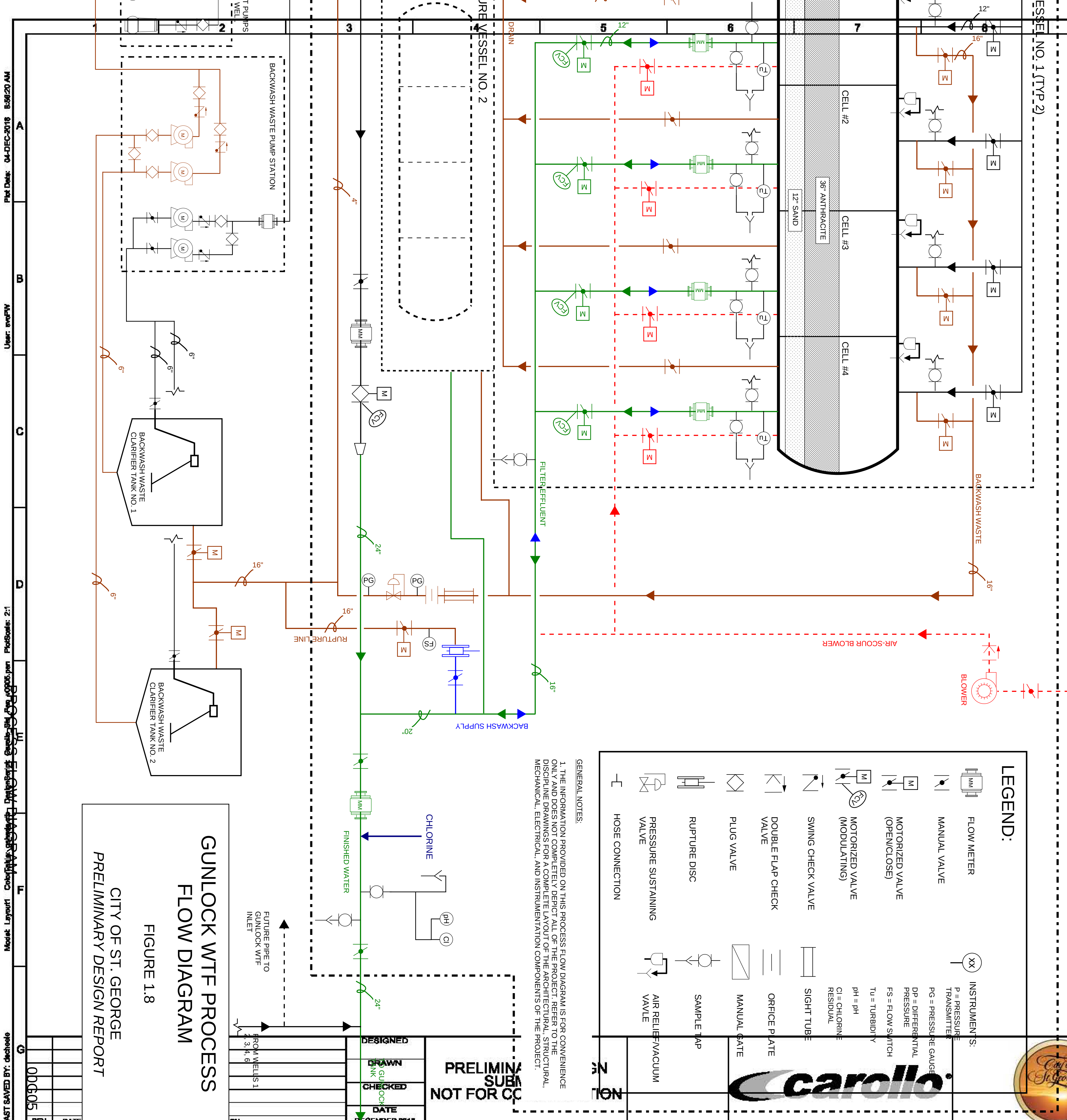

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CITY OF ST. GEORGE
GUNLOCK WATER TREATMENT FACILITY DESIGN
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1.4.1.3 Chemical Addition and Mixing

Benchtop testing and piloting at the Gunlock Wells was conducted by Carollo from 2015 to 2016 to determine chemical dosing for arsenic removal. The study indicated that ferric chloride performed better compared to alum with optimal doses ranging from 3 to 5 mg/L. Pre-oxidizing with chlorine showed no significant benefit during piloting at the Gunlock site. However, the testing showed that the arsenic in the Gunlock well field is predominantly arsenate, or As(V), although some data showed the dominant form to be arsenite, or As(III). Therefore, the ability to pre-oxidize with chlorine is included in the design.

Chlorine Addition

Chlorine will be used to disinfect the water at two possible locations: the influent of the treatment plant, prior to flash mixing, and along the finished water pipeline, after blending. Two dosing locations are recommended in order to oxidize well water prior to the arsenic vessel media and polish or trim the chlorine residual in the treated water prior to entering the distribution system. Two chlorine addition methods were investigated for the City. These were on-site hypochlorite generation and chlorine gas. A comparison of the two technologies is shown in Table 1.5, which represents installed capacity of 6 mgd with an average flow of 3 mgd.

Table 1.5 Chlorine Technology Comparison

Category	On-Site Hypo Generation	Chlorine Gas
Average Flow (mgd)	3	3
NaOCl Conc. (%)	0.8	NA
Average Dose (mg/L)	1.0	1.0
Chlorine Consumption (lb/d)	25	25
Type of Storage	1 Day Tank	2 Gas Cylinders
Size of Storage	3,000 gal	150 lbs
Storage Time (days)	9	12
Capital Costs	$337,500	$239,360
Annual O&M Costs	$38,360	$29,355
Life Cycle Costs	$950,000	$708,000

Notes:
(1) Represents installed capacity of 6 mgd and an average flow of 3 mgd.

Due to the lower capital, Operations and Maintenance (O&M), and life cycle costs, and the City's familiarity to the technology, chlorine gas has been selected over on-site hypochlorite generation. The chlorine gas system will consist of two 150-pound chlorine gas cylinders positioned upon a cylinder weight scale. The scale provides operators an indication of chlorine spent and when to replace empty cylinders. Both cylinders are connected to chlorine gas piping that routes to wall mounted chlorinators that regulate gas flow based upon the desired feed concentration and production flow rate. The chlorinators provide a regulated gas flow to the eductors, where plant water and gas mix to create a chlorine solution that is then pumped to the injection locations. Due to the elevated safety risk of chlorine gas, the proposed chlorination room for the Gunlock WTF will be fitted with chlorine analyzers that sense the presence of chlorine gas within the room at a 1 part per million (ppm) detection limit. If the limit is exceeded, alarms will initiate shutoff valves on the chlorine cylinders. These automatic closing valves provide the secondary level of safety to the initial containment of the cylinders. The chlorination room will be equipped with heating to provide climate control for the optimal performance of the gas cylinder system. The chlorination room will also provide space to store up to 10 total 150-pound chlorine cylinders (no more than 2,500 pounds should be stored as to stay below the requirement for risk management plans per the Clean Air Act).

Flash Mix

Ferric chloride will be stored and utilized at the WTF site. Ferric chloride will be mixed into the groundwater stream via a flash mix diffusion pump. Ferric chloride storage tanks were sized for high flows (6 mgd) and max dose (10 mg/L) with a 30-day holding capacity. This equates to 500 pounds per day, or 100 gallons per day of ferric chloride, with a storage concentration of 42 percent and specific gravity of 1.45. Two double walled polyurethane tanks, sized 11 feet tall with an 8.5 feet diameter, have been selected for redundancy and space constraints to hold 1,500 gallons each.

The 3-horsepower (hp) flash mix pump was designed around the parameters in Table 1.6.

Table 1.6 Flash Mix Calculations

Description	Units	Design Condition
Conditions		
RW Flow	mgd	6
RW Diameter	in	24
Mixing Zone	Diameters	1.5
Nozzle Flow	gpm	150
Nozzle Diam	in	1.5
Absolute Viscosity	lb s/sq ft $x10^{-5}$	2.954
Calculated Fields		
RW Flow	gpm	4,164
Mixing Time	sec	1.0
% of flow	%	3.6%
RW Velocity	fps	3.0
Nozzle Velocity	fps	27.3
Mixing Power	hp	0.4
G	sec^{-1}	931
G x t		943
Momentum Ratio	Mixing/RW	0.33

Notes:
(1) RW Flow = mgd*694.
(2) Mixing Time = Diameter*Mixing Zone/12/velocity.
(3) % of flow = Nozzle Flow/RW Flow.
(4) RW Velocity = RW flow/448/(3.12/4*(RW diameter/12)^2).
(5) Nozzle Velocity = Nozzle flow/448/(3.12/4*(Nozzle diameter/12)^2).
(6) Mixing Power = Nozzle flow*(Nozzle Velocity^2/64/4)/3961.
(7) G = (Mixing power*550/(abs visc*0.00001)/(3.14/4*(RW diam/12)^3*Mixing Zone))^0.5.

A duty-standby pump orientation was not selected for this design to reduce footprint and costs, since flash mixing is not critical to the system. If the pump is out of service, plant staff may need to increase the coagulant dose to compensate for the lack of mixing provided by the pump. Hydraulic mixing would occur in the main header and filter inlet orifices. During these circumstances arsenic removal requirements can still be achieved.

After flash mixing, the single pipe conveying the incoming flow splits to the headers of the pressure vessels.

1.4.1.4 Pressure Vessels

The inline pressure vessels treat water in a closed system by relying on the pressure produced by the Gunlock well field pumps to deliver water to the treatment plant site, filter the water, and return the treated water, at a reduced pressure as a result of the treatment head losses, to the transmission line. The filters are contained within two steel pressure vessels, each with four independent internal compartments operating side by side to treat a total of 6 mgd at design capacity.

A 12-foot diameter vessel with 9-foot long cells (totaling 36 feet in length) was selected as the best alternative for the Gunlock and Sand Hollow facilities, targeting a nominal filter loading rate of 5 gallons per minute per square foot (gpm/sf). Each vessel has the capacity to treat flows from as low as 1 mgd and up to 3 mgd. The filters were designed to have each cell act independently, allowing for optimizing the flow control through each cell. A motorized valve will open at the inlet of each filter cell and the flow will be controlled by a flow control valve in conjunction with a flow meter at the effluent of each cell. During a backwash sequence a cell can be backwashed individually while the other three cells are in operation, instead of simultaneously backwashing the entire pressure vessel at one time, allowing for longer filter run times and better control.

The media configuration of the filters was designed based on the results of the pilot study, where 36 inches of anthracite (effective size [ES] 1.05 millimeter [mm]) over 12 inches of sand (ES 0.6 mm) performed best, based on filter run time, turbidity breakthrough and head loss, out of all the pilot filters. Therefore, this media configuration was selected for design.

Backwash Procedure

Backwashing of a cell will be initiated upon one of three setpoints. The first setpoint is head loss across the filter. As the filter media collects solids, the pressure on the upstream side of the media will increase. Each cell will be equipped with a differential pressure sensor/transmitter by which a backwash can be initiated based on an operator-adjustable setpoint. The second setpoint is turbidity of the filtrate water. As the filter media becomes loaded, eventually, particulates work through the media and register as turbidity in the filtrate. Each cell will be equipped with a turbidity meter to measure the filtered water turbidity, and when an operator-adjustable setpoint is reached (e.g., 1.0 Nephelometric Turbidity Units [NTU]), a backwash will be initiated. Finally, the third backwash setpoint is based on time (or total flow processed since the last backwash). The recommended normal operation of the filters will be for an operator to initiate a backwash once every 24 hours. The pilot study results indicated that filter run times could be as high as 30 hours. However, it is recommended that in order to achieve a consistent operation of the backwash system as well as the backwash water/sludge handling, the filters be operated with consistent backwashes every 24 hours. With lower incoming treatment flows, the filter run times could be increased beyond 24 hours however filter run times should never exceed

3 days (72 hours). Final setpoints for backwashing will be developed after startup and testing of the full-scale facilities.

A backwash (BW) is initiated by closing the filter inlet valve and opening the backwash waste valve. The pressure vessel cells are designed to pull backwash flows from the other cells still online and/or the distributions system, as needed, to achieve the backwash flow rate. If the plant is running at 3 mgd through one or two pressure vessels, the one backwashing cell will pull all the flow from the remaining online cells, resulting in no net effluent flow going to the distribution system. The filters are designed so that at the full 2,100 gpm filter design capacity can be filtered through three cells during backwash at 6.4 gpm/sf filtration rate if only one filter vessel is operating. If the WTF is producing less than 3 mgd the remaining flow will need to come from the distribution system. With the proposed configuration, the combined flow from the upper and lower wells entering the pipe to the Gunlock tank must exceed 2,100 gpm during a filter backwash. The backwash steps with corresponding flowrates and duration is shown in Table 1.7.

Table 1.7 Backwash Procedure

Step	Flowrate (gpm)	Time (min)	Volume (gal)
Filter Drain	508	15	7,614
BW 1 (Air Scour)	0	5	0
BW 2 (Air Evacuate)	1,200	3	3,600
BW 3 (High-rate BW)	2,160	5	10,800
BW 4 (Media Restratify)	1,300	2	2,600
Total	-	**30**	**21,250**
Total w/ 1.25 Safety Factor	-	**30**	**29,000**

A 20 gpm/sf high-rate backwash enables proper bed expansion during backwashing for the specified media configuration. Total backwash time is estimated at 30 minutes per cell, with a total volume of 21,250 gallons. A 1.25 safety factor was applied to ensure that the backwash water storage system will not be undersized.

A rupture disc, with a specified pressure rating, will be placed on the backwash supply line as an added safety measure. This ensures that back pressures within the pressure vessel do not exceed the vessel safety rating. If pressures are exceeded, the rupture disc will break and send the water to the backwash waste line. Flow will be detected by a flow switch and the motorized valve (normally open) will then close to prevent loss of water from the distribution system to the backwash waste system. Plant staff will receive an alert, so they can close a manual valve and isolate the rupture disc for repair/ replacement.

A filter air scour system is included for the pressure filters due to the deeper media beds (48 inches). Air scour helps break up the media via agitation and force the accumulated particles into suspension. The filter air scour system was designed at 4 standard cubic feet per minute per square foot (scfm/sf). During the backwash sequence, a motorized valve will open to the cell being backwashed allowing air to flow up through the filer media. The air scour step will occur by itself and will terminate prior to the introduction of backwash water flow to prevent media loss that can occur with simultaneous air-water wash. There will be four motorized valves per pressure vessel, one for each cell. The source of the air for the air scour will be supplied by a dedicated 20-horsepower air blower unit sized to deliver the design air scour flow rate. The air flow rate will be constant; therefore, no modulating valves are needed. A duty/standby configuration for the blowers has not been included so simplify the system and manage costs. The filter vessels can be backwashed without air scour if the blower system is unavailable, but increased backwash frequency may be required.

The backwash waste water will flow from the filters to the backwash clarification tanks through a 16-inch backwash waste line.

1.4.1.5 Solids Handling

Backwash waste water flows by gravity to one of two concrete, rectangular backwash clarification tanks. A drain pump is provided to drain each cell to the clarifications tanks as the first backwash step to prepare for air scour. A duty/standby configuration for the drain pump has not been included to simplify the system and manage costs. The filter vessels can be backwashed without air scour if the drain pump is unavailable, but increased backwash frequency may be required.

The backwash clarifier tanks will be completely enclosed, so the decant water from the tanks can be recycled back to the front of the plant and retain classification as groundwater. The operating volume of each tank is sufficient to receive one full vessel backwash (four cells). Following a backwash, the water will be stored, allowed to settle/clarify, and then processed by either decant pumping from the top of the water surface or by sludge blow-down from the bottom of the tank. The decant water will be collected by a floating decanter and then pumped to the front end of the treatment system at no greater than 10 percent of the process flow rate, or about 200 gpm per backwash tank (400 gpm total pumped from both tanks). The return line will connect with the raw groundwater line upstream of the chemical addition points. The sludge will be removed from the tank bottom through a blowdown process and pumped to the drying beds for further processing.

A decant pump wet well, with two submersible pumps, will be provided at the drying beds to facilitate sludge thickening and dewatering by collecting any water that clarifies on top of the sludge and pumping that water to an adjacent drying bed to evaporate. If approved by the Utah Department of Water Quality, the pumps in the wet well could also pump to a nearby irrigation line that is in Gunlock Road for disposal or to an on-site retention pond. Sludge will be dried via solar energy to no less than 15 percent dried solids and disposed of via land fill.

Drying Beds

The maximum solids production is based on 6 mgd flows and 10 mg/L ferric dose. The calculations are shown in Table 1.8.

Table 1.8 Sludge Production

Month	Ave Daily Flow	Monthly Flow (MG)	Average WQ and Dosages						Ave USPR (dry-lbs/month)	Solids Production dry-(lbs/month)	Cumulative Total (dry-lbs)
			Turbidity (NTU)	TOC (mg/L)	Ferric (mg/L)	PEC (mg/L)	PEA (mg/L)	PAC (mg/L)			
Jan	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	18,686
Feb	6.0	168	3.80	0.7	10.0	0.0	0.0	0.0	100	16,878	35,564
Mar	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	54,250
April	6.0	180	3.80	0.7	10.0	0.0	0.0	0.0	100	18,083	72,334
May	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	91,020
June	6.0	180	3.80	0.7	10.0	0.0	0.0	0.0	100	18,083	109,104
July	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	127,790
Aug	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	146,476
Sept	6.0	180	3.80	0.7	10.0	0.0	0.0	0.0	100	18,083	164,559
Oct	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	183,246
Nov	6.0	180	3.80	0.7	10.0	0.0	0.0	0.0	100	18,083	201,329
Dec	6.0	186	3.80	0.7	10.0	0.0	0.0	0.0	100	18,686	220,015
Ave / Total	**6.0**	**2,190**								**lbs/MG =**	**100**

Notes:
(1) TSS:NTU = 1.42.
(2) Coagulant Factor = 0.63.
(3) TOC Removal = 0.25.
(4) Turbidity values represent the max turbidity measured during the pilot study.

The solids production per year for maximum dose and flows was 220,015 pounds per year of dry solids (dry-lbs/yr) or 603 pounds per day (dry-lbs/d). Using a drying factor of 8 pounds per square foot (dry-lbs/sf) annually, the design size of the drying beds is four beds, each 40 feet wide by 200 feet long. Four beds allows for redundancy while treating sludge generated from two vessels, where one bed could be on-line (receiving clarified waste washwater), one could be decanting, one could be drying, and the last could be cleaned and ready for service. The drying beds are being designed for of 4 foot water depth to provide adequate volume of sludge drying as well as potential water storage during winter months when the regional evaporation rate is less than during the summer months. Drying sludge will accumulate in these beds to a determined depth and dryness before being emptied by earthmoving-type equipment. Disposal of the dried sludge will be via hauling to the landfill. It is anticipated that one drying bed go through at least two fill/dry cycles per year (4 lbs/sf each cycle) because thin sludge layers dry much faster than thick sludge layers.

Water decanted to the decant pump station wet well from the drying beds will be controlled with downward opening decant weir gates at the end of each bed. The weir gate will be lowered as water separates from the settling solids and will flow by gravity to the wet well equipped with two 2-horsepower submersible pumps. As water flows into the wet well, the pumps will be controlled by level instrumentation and once the level reaches a setpoint, the pumps will start and send the water to another selected drying bed, an on-site retention pond or if permitted, the irrigation line. This design flow rate is independent of the backwash return flow and therefore is a smaller pump with lower capacity than the backwash waste return pumps.

Backwash Clarifier Tanks

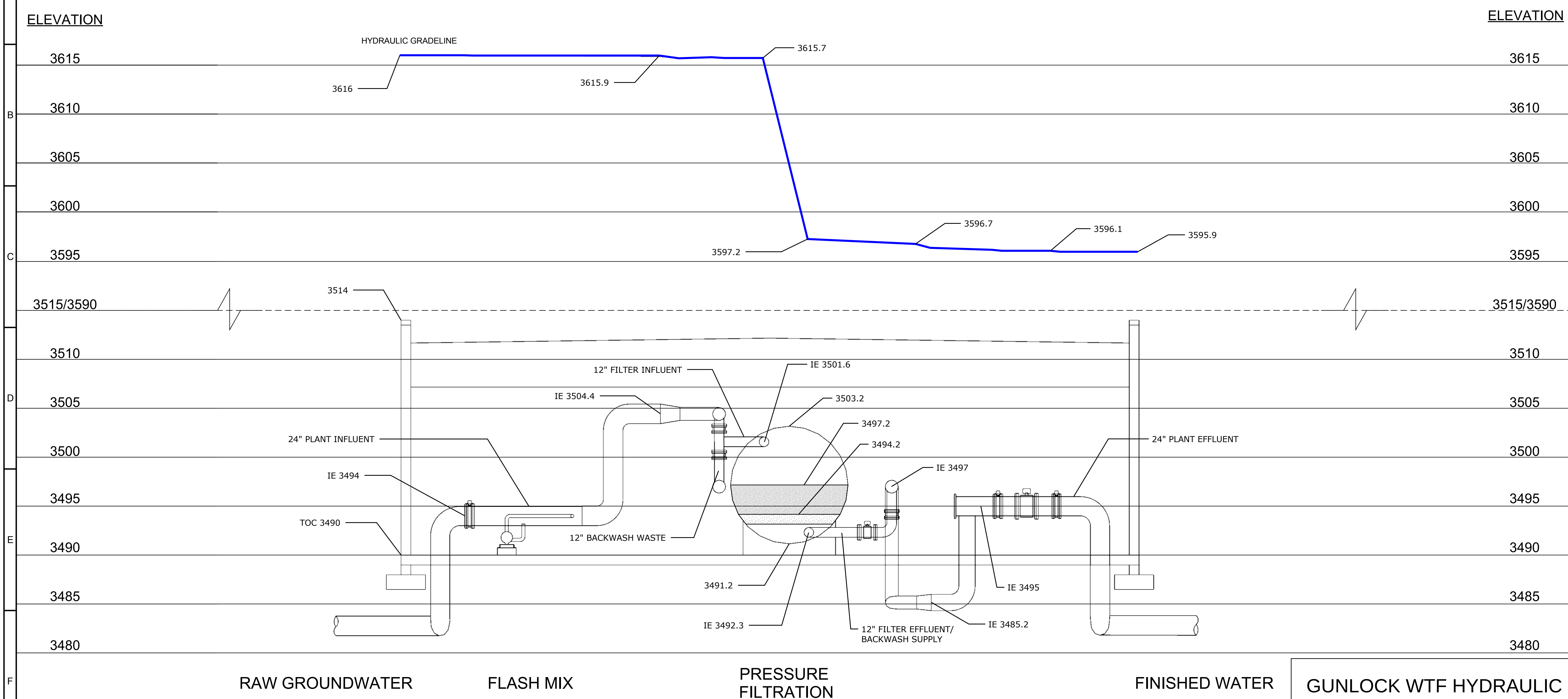
The two backwash clarifier tanks are each designed to hold four backwashes, or one entire pressure vessel backwash. Each tank is rectangular with a 30-foot length and width and approximate height of 20 feet. The tanks will have a pyramidal bottom of 30 degrees with a center hopper to collect the sludge. A 6-inch sludge line from the hopper of each tank will be routed to a pump that will send the sludge to the drying beds. The tanks will be constructed of concrete. It is proposed that the tanks will be above-grade for cost reduction of sub-grade installation. Additionally, sample ports will be installed along the lower 3 feet of the tank at 1-foot intervals so that operators can verify the depth of the sludge blanket and determine adequate blow down volume. Each tank will be equipped with a floating decanter and decant return pumps.

Normal operation of the tanks will be to send up to four cell-backwashes to each tank. This normally would be one pressure vessel backwashed per tank but could be any combination of four backwashes. It is estimated that a backwash will take approximately 30 minutes as shown in Table 1.9. For four backwashes, that time duration would be 2 hours of backwashes per tank. The normal operation would be to backwash each vessel once in a 24-hour period. The breakdown of tank operation would be as follows:

- Backwash = 2 hours.
- Tank settling = 4 hours.
- Decant = 16 to 18 hours.
- Sludge blow down = 2 hours (overlapping decant time).

1.4.1.6 Hydraulic Profile

The estimated head loss through the plant is 22 feet, flowing at 6 mgd with no cells in backwash. The largest loss is through the pressure filter, with an estimated loss of 8 psi right before a backwash (i.e., solids loaded in filter bed). The hydraulic profile through the plant is shown in Figure 1.9.



HYDRAULIC PROFILE (6 MGD)

SCALE: 1" = 10'

GUNLOCK WTF HYDRAULIC PROFILE

FIGURE 1.9

CITY OF ST. GEORGE
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HYDRAULIC PROFILE

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1.4.2 Sand Hollow

1.4.2.1 Basis of Design

Figure 1.10 summarizes the general basis for design and equipment sizing for the Sand Hollow GWTP, which will be owned and operated by the WCWCD. The process flow diagram for the Sand Hollow GWTP is shown in Figure 1.11. Due to the similarities between the Gunlock and the Sand Hollow sites, the Sand Hollow GWTP has been designed similarly to the Gunlock WTF, except the plant was designed around a 3-mgd capacity with a future expansion to 6 mgd. As discussed in Section 1.2.2, the West Dam Springs pump station has been found to be high in manganese, causing colored water events in the distribution system when operated. The pump station also has high arsenic levels. Therefore, both manganese and arsenic treatment are of concern at the Sand Hollow GWTP.

A pilot study at the West Dam Springs was performed by Carollo for the WCWCD in 2016 wherein it was shown that manganese levels can be reduced by approximately 90 percent by oxidizing with chlorine as sodium hypochlorite, immediately before filtration and maintaining a free chlorine residual in the filter effluent. In addition, arsenic levels can be reduced to 2 μg/L or less using a coagulant immediately before filtration. Therefore, even though the Sand Hollow GWTP is designed similar to the Gunlock WTF, which is concerned primarily with arsenic treatment, the Sand Hollow GWTP will be capable of meeting the primary goal of manganese removal and the secondary goal of arsenic removal. The other significant differences between the two designs is the chlorine treatment technology, sand separator system, and bypass vault. WCWCD has selected on-site sodium hypochlorite generation instead of chlorine gas as their preferred chlorine technology. This will be discussed in more detail in the next sections. Due to the other processes being similar to the Gunlock WTF, some treatment processes will refer to corresponding sections under the Gunlock WTF above.

1.4.2.2 Bypass System

A bypass vault is proposed for the Sand Hollow GWTP for the ground water flows coming from the Sand Hollow well field. Most, if not all, of the flow coming from the Sand Hollow well field will be routed from the incoming groundwater line around the treatment building and recombined with treated water from the vessel to produce a blended water of treated and untreated groundwater with acceptable manganese and arsenic levels. Section 1.4.1.2 describes the process for blending including an example calculation. Equipment sizing associated with the bypass system will be different than the Gunlock WTF.

As described in Section 1.3.2.2, all of the water from West Dam Springs will be treated at the Sand Hollow GWTP. If the West Dam Springs wells are not producing the required 2,100 gpm for a backwash, supplemental flows from the Sand Hollow well field will normally be available to backwash the filter cells. This will be done in one of two ways.

- A portion of the Sand Hollow well water can be treated through the GWTP. A valve vault located outside the GWTP will house a 16-inch connection line between the West Dam Springs flows and the Sand Hollow well field flows. The line will be fitted with a flow meter, flow control valve, and check valve. The 30-inch Sand Hollow well field pipeline will be equipped with a flow meter and flow control valve. If any portion of the Sand Hollow well field will be treated, all of the wells must operate to overcome the additional headloss through the GWTP and a flow control valve on the 30-inch pipe will be used to divert some of the water through the 16-inch pipe to the GWTP. The connection line to the GWTP will be sized to accommodate flows up to 3 mgd, for future expansion (adding the second pressure vessel). A check valve is placed on bypass line so untreated water from West Dam Springs cannot flow back into the Sand Hollow well field pipeline. The schematic for the bypass vault is outlined in Figure 1.11 and a mechanical plan and sections are provided in Figure 1.12.

- The second way Sand Hollow well field flows will be provided for backwash is through the 30-inch bypass line where it ties into the new Sand Hollow Regional Pipeline and joins the treated effluent line from the pressure vessel. Any well field flows bypassing the GWTP are automatically available to flow back up the effluent line to the pressure vessel for backwash supply. This will allow the WCWCD to operate the vessels at a lower production rates than the 3 mgd design rate and still be able to backwash with a 2,100 gpm flow rate.

If the combined West Dam Springs and San Hollow well field flow is less than the required 2,100 gpm, there are provisions to use water from the Dixie Springs tank to provide supplemental backwash flows as discussed in Section 1.4.2.7 (Hydraulic Profile).

DESCRIPTION	UNITS	CRITERIA DESIGN	CRITERIA BUILDOUT
PLANT FLOW RATE			
PROCESS DESIGN CAPACITY	MGD	3	6
MINIMUM PLANT FLOW	MGD	1	1
BYPASS FLOW CAPACITY	MGD	8	8
WELL PUMPS			
NUMBER OF WELLS	NO.	16	21
CAPCITY OF PUMPS, EA	GPM	300-1,500	
NUMBER OF VFDs	NO.	3	8
FLASH MIX			
TYPE: PUMP DIFFUSION			
NUMBER OF PUMPS	NO.	1	1
NUMBER OF VFDs	NO.	1	1
ENERGY INPUT, G	SEC^{-1}	1,000	1,000
CAPCITY OF PUMPS, EA	GPM	150	150
SIZE OF PUMPS, EA	HP	3	3
CHEMICALS			
CHLORINE			
TYPE: ON-SITE GENERATION			
DOSE RANGE	MG/L	1.0 - 3.0	1.0 - 3.0
ADDITION POINT	-	PLANT INFLUENT/EFFLUENT	
SODIUM HYPOCHLORITE CONCENTRATION	%	0.8	0.8
SOLUTION STRENGTH	LBS/GAL	0.08	0.08
TANK SIZE	GAL	3,000	3,000
DAYS OF STORAGE	DAYS	9	4.5
FERRIC CHLORIDE			
DOSE RANGE	MG/L	3.0 - 10.0	3.0 - 10.0
ADDITION POINT	-	FLASH MIX	
MAX DOSE AT PEAK FLOW	GPD	50	100
NUMBER OF TANKS	NO.	1	2
TANK SIZE, EA	GAL	1,500	1,500
DAYS OF STORAGE	DAYS	30	30
FILTRATION SYSTEM			
TYPE: HORIZONTAL PRESSURE VESSELS			
FILTER LOADING AND CAPACITY			
NUMBER OF VESSELS	NO.	1	2
NUMBER OF CELLS PER VESSEL	NO.	4	4
VESSEL DIAMETER	FT	12	12
CELL LENGTH	FT	9	9
CELL AREA	SF	108	108
TOTAL VESSEL AREA	SF	432	432
TOTAL VESSEL LENGTH	FT	36	36
NOMINAL FILTRATION RATE	GPM/SF	4.8	4.8
NOMINAL CELL CAPACITY	MGD	1	1
FILTERS OUT OF SERVICE FOR BACKWASHING	NO.	1	1
FIRM DESIGN FILTER CAPACITY (ONE WASHING)	GPM/SF	6.4	6.4
FILTER MEDIA			
TYPE: DUAL MEDIA			
ANTHRACITE DEPTH	IN	36	36
ANTHRACITE EFFECTIVE SIZE	MM	1.05	1.05
SAND DEPTH	IN	12	12
SAND EFFECTIVE SIZE	MM	0.6	0.6
L/d	-	1,380	1,380
FILTER UNDERDRAIN			
TYPE: PLATE WITH NOZZLES			
FILTER BACKWASH			
TYPE: DISTRIBUTION PRESSURE, AIR SCOUR			
MAXIMUM BACKWASH RATE	GPM/SF	20	20
FILTER DRAIN RATE/DURATION	GPM / MIN	510 / 15	510 / 15
BACKWASH STEP			
AIR EVACUATE RATE/DURATION	GPM / MIN	1,200 / 3	1,200 / 3
HIGH-RATE BW RATE/DURATION	GPM / MIN	2,160 / 5	2,160 / 5
MEDIA RESTRATIFY RATE/DURATION	GPM / MIN	1,300 / 2	1,300 / 2
TOTAL REQUIRED BW VOLUME + 1.25 SAFETY FACTOR	GAL	21,250	21,250
TOTAL BW VOLUME PRODUCED/DURATION	GAL / MIN	29,000 / 30	29,000 / 30
AIR SCOUR			
DESIGN AIR SCOUR RATE	SCFM/SF	4	4
AIR SCOUR FLOW RATE	SCFM	432	432
AIR SCOUR TIME	MIN	5	5
NUMBER OF BLOWERS	NO.	1	1
CAPACITY, EA	SCFM	500	500
SIZE, EA	HP	20	20
BACKWASH WASTE CLARIFIER TANKS			
TYPE: RECTANGULAR WITH FLOATING DECANT			
	NO.	1	2
	FTXFT	30X30	30X30
	GAL	127,000	127,000
	HRS	6	6
	GPM	400	400

DESCRIPTION	UNITS	CRITERIA DESIGN	CRITERIA BUILDOUT
SOLIDS SETTLING BASINS			
TYPE: RECTANGULAR, VERT. WALL, CONCRETE LINED			
NUMBER OF BEDS	NO.	3	4
DIM. OF BED (WXLXH)	FTXFTXFT	40X200X4	40X200X4
VOLUME, EA	GAL	240,000	240,000
WATER DEPTH	FT	2	2
SOLIDS LOADING RATE	LBS/SF	8	8
SOLIDS HANDLING CAPACITY, EA	LBS	22,667	34,000
TOTAL SOLIDS HANDLING CAPACITY	LBS/YR	68,000	136,000
AVG. UNIT SOLIDS PRODUCTION RATE	DRY LBS/MGAL	74	74
TOTAL AVG. ANNUAL SOLIDS PRODUCTION	DRY LBS/YR	81,000	162,000
DRYING BEDS RETURN SUBMERSIBLE PUMPS			
NUMBER (1 + 1)	NO.	2	2
CAPACITY, EA	GPM	100	100
SIZE, EA	HP	2	2
BACKWASH WASTE PUMP STATION			
TYPE: END SUCTION CENTRIFUGAL			
BACKWASH WASTE DECANT PUMPS			
NUMBER (1 + 1)	NO.	2	2
CAPACITY, EA	GPM	420	420
SIZE, EA	HP	8	8
BACKWASH WASTE SLUDGE PUMPS			
NUMBER	NO.	2	2
CAPACITY, EA	GPM	500	500
SIZE, EA	HP	8	8

SAND HOLLOW GWTP DESIGN CRITERIA

FIGURE 1.10

WCWCD
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carollo

WASHINGTON COUNTY WATER CONSERVANCY DISTRICT

WASHINGTON COUNTY WATER CONSERVANCY DISTRICT
SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN
GENERAL
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VERIFY SCALES
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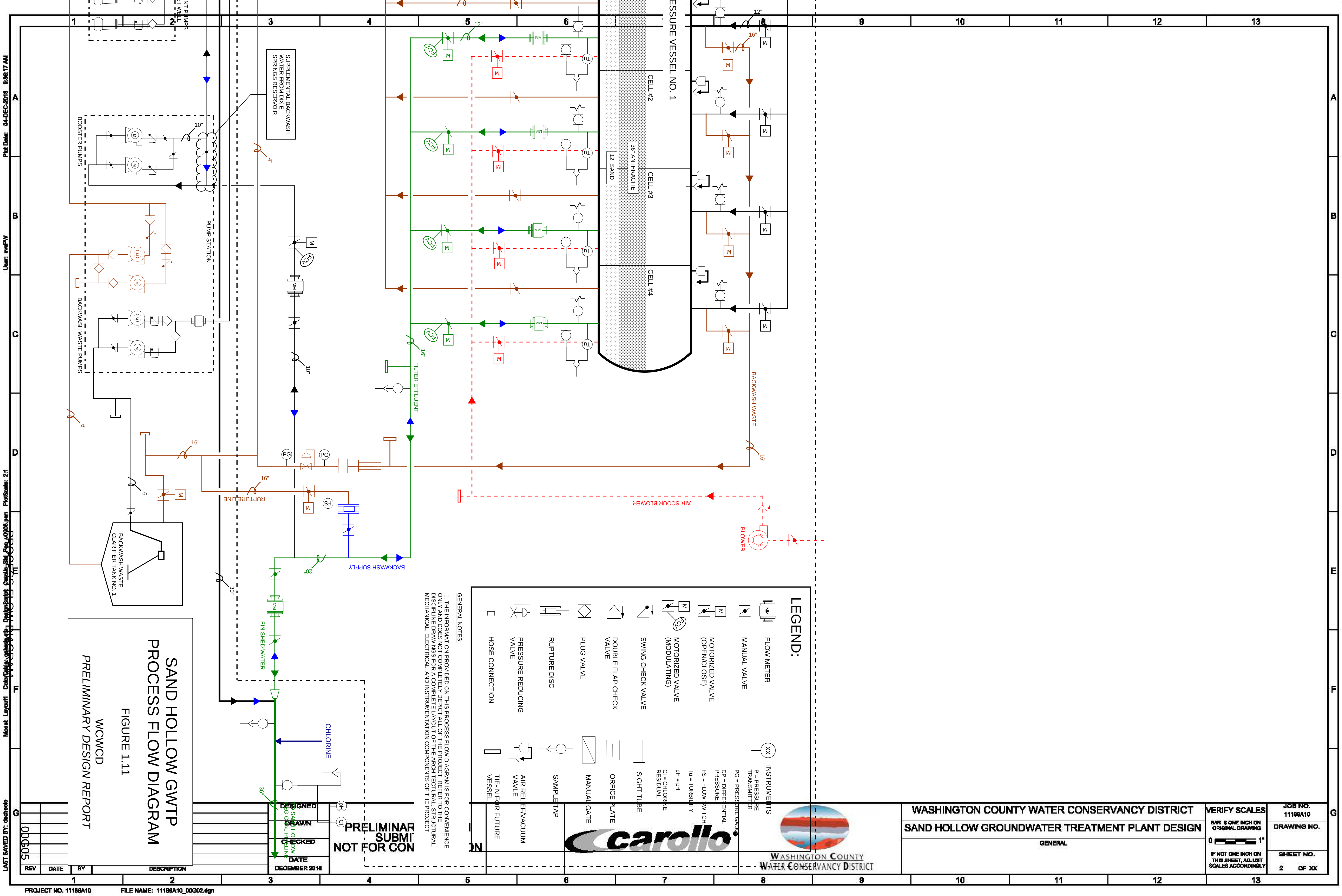

SAND HOLLOW GWTP
PROCESS FLOW DIAGRAM
FIGURE 1.11
WCWCD
PRELIMINARY DESIGN REPORT
SUPPLEMENTAL BACKWASH WATER FROM DIXIE SPRINGS RESERVOIR
BOOSTER PUMPS
PUMP STATION
BACKWASH WASTE PUMPS
BACKWASH WASTE CLARIFIER TANK NO. 1
RUPTURE LINE
BACKWASH SUPPLY
FINISHED WATER
CHLORINE
FILTER EFFLUENT
BACKWASH WASTE
AIR-SCOUR BLOWER
BLOWER
ESSURE VESSEL NO. 1
CELL #2
CELL #3
CELL #4
36" ANTHRACITE
12" SAND
LEGEND:
FLOW METER
MANUAL VALVE
MOTORIZED VALVE (OPEN/CLOSE)
MOTORIZED VALVE (MODULATING)
SWING CHECK VALVE
DOUBLE FLAP CHECK VALVE
PLUG VALVE
RUPTURE DISC
PRESSURE REDUCING VALVE
HOSE CONNECTION
INSTRUMENTS:
P = PRESSURE TRANSMITTER
PG = PRESSURE GAUGE
DP = DIFFERENTIAL PRESSURE
FS = FLOW SWITCH
Tu = TURBIDITY
pH = pH
Cl = CHLORINE RESIDUAL
SIGHT TUBE
ORFICE PLATE
MANUAL GATE
SAMPLE TAP
AIR RELEASE/VACUUM VAVLE
TIE-IN FOR FUTURE VESSEL
GENERAL NOTES:
1. THE INFORMATION PROVIDED ON THIS PROCESS FLOW DIAGRAM IS FOR CONVENIENCE ONLY AND DOES NOT COMPLETELY DEPICT ALL OF THE PROJECT. REFER TO THE DISCIPLINE DRAWINGS FOR A COMPLETE LAYOUT OF THE ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL, AND INSTRUMENTATION COMPONENTS OF THE PROJECT.
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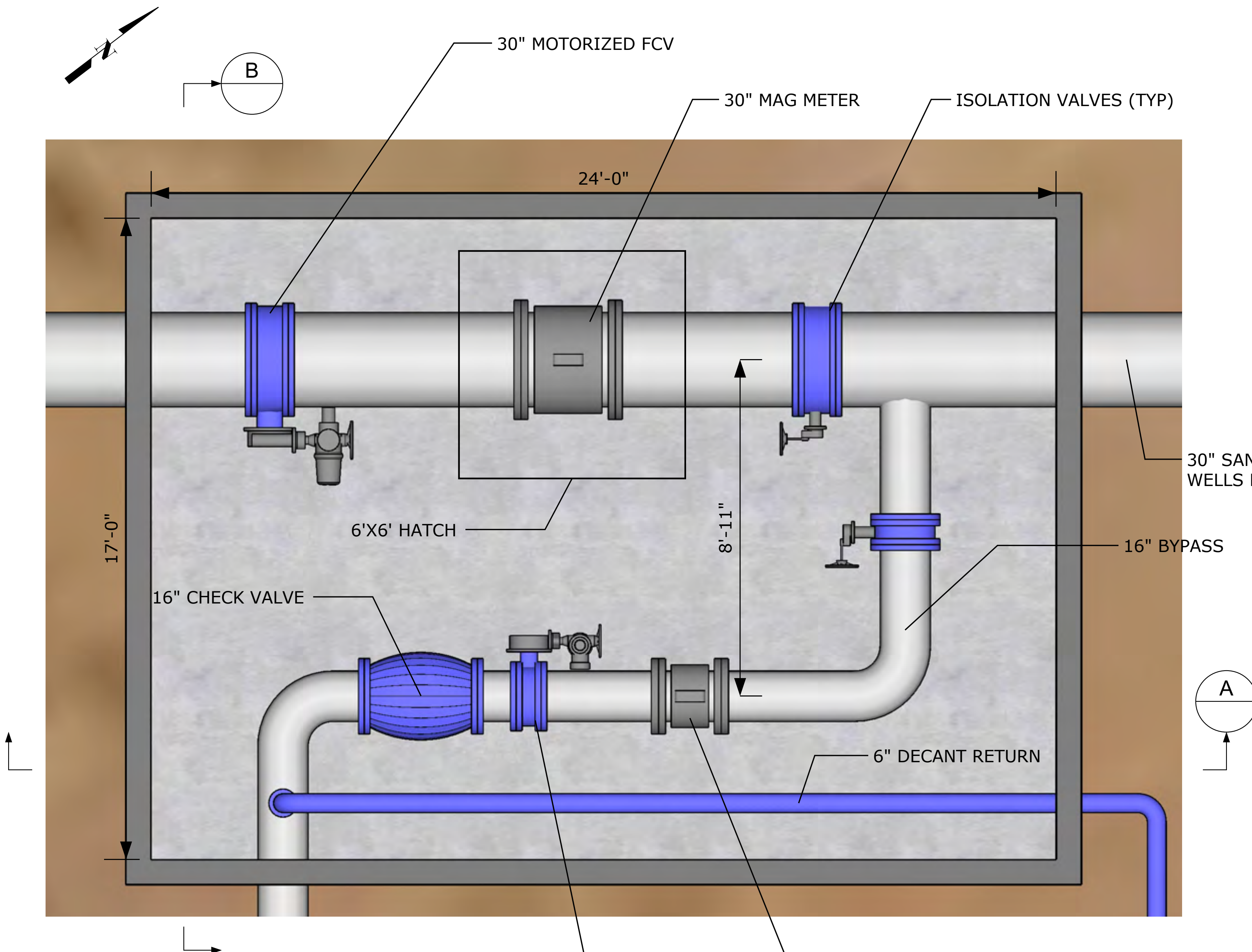
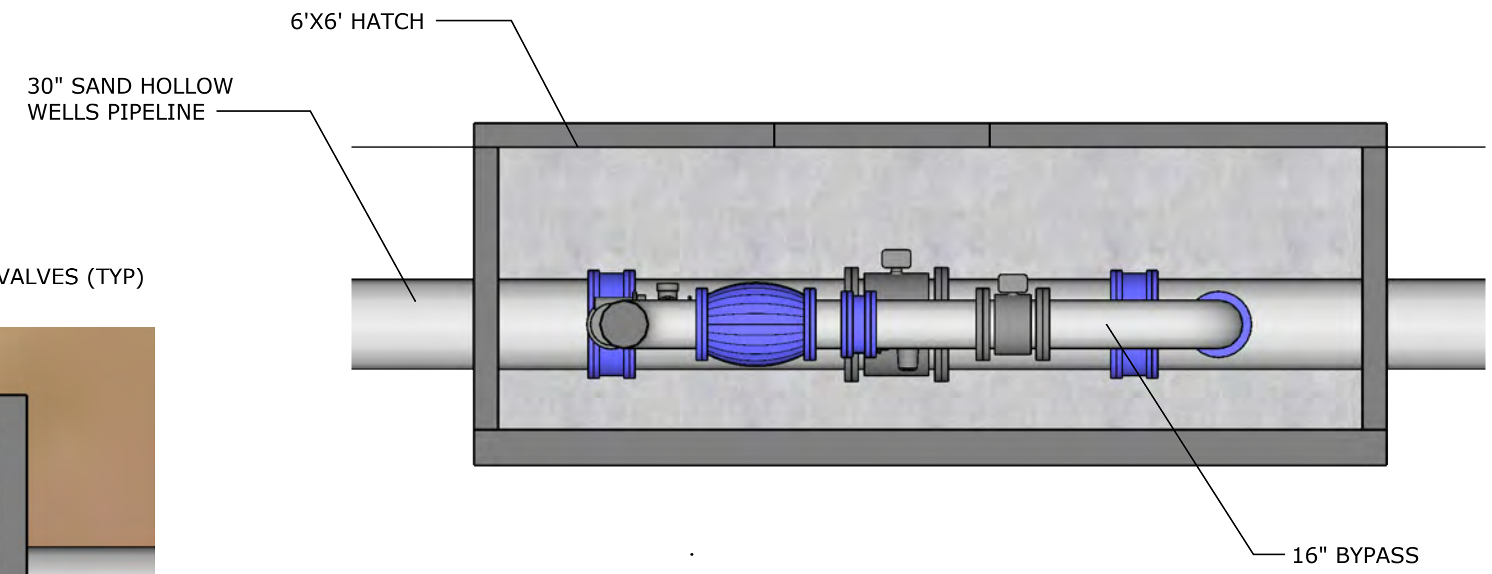


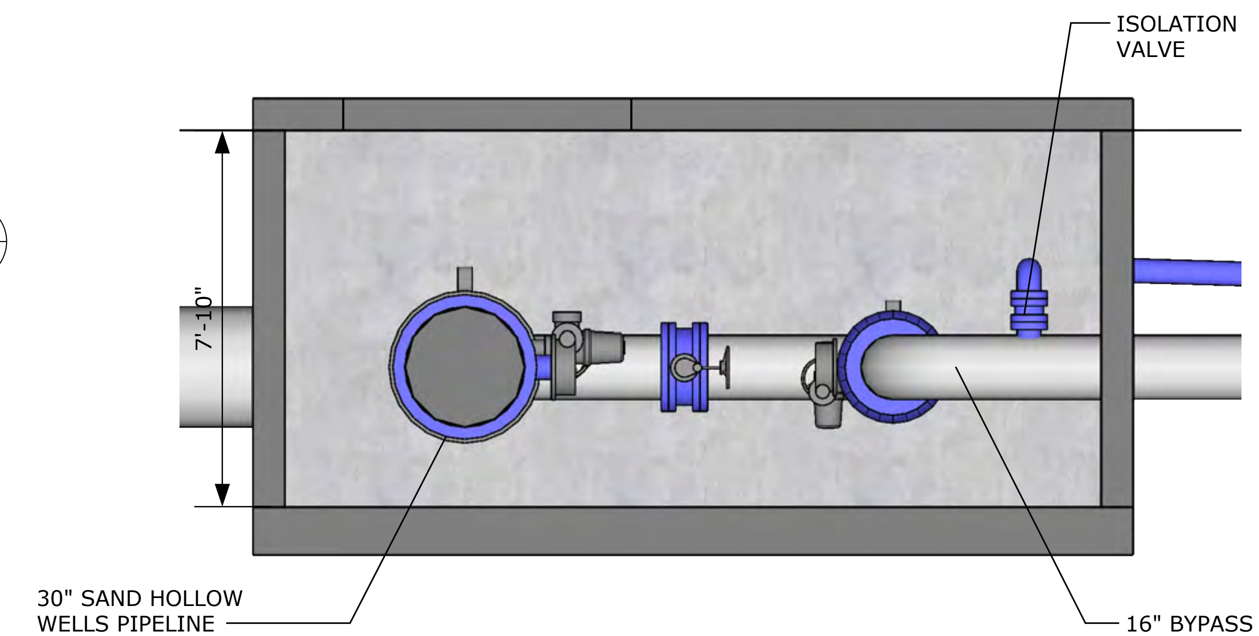
BYPASS VAULT - PLAN

SCALE: 1/4" = 1'



A BYPASS VAULT - SECTION 1

SCALE: 3/16" = 1'



B BYPASS VAULT - SECTION

SCALE: 1/4" = 1'

SAND HOLLOW GWTP - BYPASS VALVE VAULT

FIGURE 1.12

WCWCD

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WASHINGTON COUNTY WATER CONSERVANCY DISTRICT

SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN

MECHANICAL

BYPASS VAULT - PLAN AND SECTIONS

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1.4.2.3 Sand Separators

Sand has been found in the water being pumped from the West Dam Springs pumps. Fine sand is also prevalent in the existing Sand Hollow wells. Fine sand particles that have entered the filter would be washed out during the backwash process; however larger sand particles will stay in the filter and accumulate over time. Only limited sieve analysis is available, and it indicates the potential for sand accumulation. To mitigate this issue, Carollo recommends sand separators at the plant influent to remove any sand within the West Dam Springs water. Carollo also recommends that sand separators be installed at future Sand Hollow well sites if the District plans on treating those wells at the GWTP when the second pressure vessel is installed. Sand separators work best as close to the well pump as possible and to prevent sand from dropping out in transmission pipelines.

Significant pressure losses are associated with sand separators large enough to treat 3 mgd. Therefore, it is recommended that three smaller sand separators be installed in parallel to minimize head loss through the system. Each sand separator will have a flow rate capacity of approximately 700 gpm, with a total system loss of 5 psi. This 5 psi loss is in addition to the 7 psi lost through the pressure filters.

1.4.2.4 Chemical Addition and Mixing

The pilot study performed in 2016 by Carollo determined that ferric chloride performed better compared to alum with optimal doses ranging from 3 to 5 mg/L for arsenic removal and also aided in the removal of manganese. Pre-oxidizing with chlorine was shown to be essential for oxidizing manganese for removal and aided in arsenic removal. The chorine dosage was determined to be most effective at 1.5 mg/L as sodium hypochlorite. The ability to pre-oxidize with chlorine is included in the design.

Chlorine Addition

Chlorine will be used for oxidation and disinfection at two locations: the influent of the treatment plant, prior to flash mixing, and along the finished water pipeline, after blending with the Sand Hollow well field flows. The two dosing locations are recommended in order to oxidize the manganese in the well water prior to the arsenic vessel media and polish or trim the chlorine residual in the treated and Sand Hollow well field water prior to entering the distribution system. WCWCD has selected an on-site sodium hypochlorite generating system (OSHG) for the Sand Hollow GWTP not only to supply chlorine to the pressure filter, but also for supplying chlorine to other wells within the Sand Hollow well field. As discussed above, these other wells from the Sand Hollow well field will combine with the treated water into the new Sand Hollow Regional Pipeline that begins at the Sand Hollow GWTP. The OSHG system will be sized for up to 11 mgd of water flow. OSHG technology information is shown in Table 1.9.

The OSHG system will consist of a 200 lbs/d generation system that is skid mounted containing electrolytic cells, a rectifier, brine pump, piping, valves, instrumentation, and controls. A brine storage tank and sodium hypochlorite solution storage tank will be provided. Table 1.9 provides the OSHG system design parameters.

Table 1.9 OSHG System Design Parameters

Equipment	Quantity/Size
Skid Mounted System	1
40 lbs/d electrolytic cell	5
Brine pump	1
Transformer Rectifier	1
Hydrogen Dilution Blower	1
Dual tank water softener	1
Brine storage tank	575 gal / 60” dia x 46” ht.
Hypochlorite tank	5,000 gal / 8’ dia x 14’ ht
Metering pump	2
Hydrogen detector	1

The OSHG system will be housed inside the treatment building but will not require a dedicated room for the equipment for climate control. The brine storage tank will be placed outside, so the process area will not be affected by salt dust during salt refill which is done by bulk delivery trucks blowing sand into the tank.

Flash Mix

Ferric chloride will be stored and utilized at the Sand Hollow GWTP site. Ferric chloride will be mixed into the groundwater stream via a flash mix diffusion pump. Ferric chloride storage tanks were sized for maximum flows (6 mgd) and maximum dose (10 mg/L) with a 30-day holding capacity. This equates to 500 pounds per day or 100 gallons per day of ferric chloride, with a storage concentration of 42 percent and specific gravity of 1.45. One double walled polyurethane tank, sized 11 feet tall with an 8.5-foot diameter, has been selected to hold 1,500 gallons. There will be space provided for the second tank to be added once the second pressure vessel is installed. See Table 1.6 for flash mix calculations and Section 1.4.1.3 for flash mix pump design.

1.4.2.5 Pressure Vessels

A single 3-mgd capacity pressure vessel will be provided for the Sand Hollow GWTP with space in the treatment building for a second 3-mgd pressure vessel in the future. The pressure vessel will be designed identical to the pressure vessels described for the Gunlock WTF under Section 1.4.1.4. A specially designed knockout wall will be provided on the east side of the building so the second 3-mgd filter can be installed at a future date and the knockout wall repaired, if it is ever needed.

Backwash Procedure

Backwash of the pressure vessel will be designed the same as the Gunlock WTF as described in Section 1.4.1.4.

1.4.2.6 Solids Handling

Backwash waste water will be processed by sending the flow to a concrete, rectangular backwash clarification tank, the same as described in Section 1.4.1.5. For Sand Hollow, one backwash clarifier tank will be constructed initially, with space for a future tank when the future filter vessel is installed.

Drying Beds

The max solids production is based on 6 mgd flows and 10 mg/L ferric dose for the ultimate build out of the site to two pressure vessels. The calculations are shown in Table 1.10. Solids production will be half of the value presented in Table 1.10 if the facility operates initially at its installed 3 mgd capacity.

Table 1.10 Sand Hollow Sludge Production

Month	Ave Daily Flow	Monthly Flow (MG)	Average WQ and Dosages						Ave USPR (lbs/month)	Solids Production (lbs/month)	Cumulative Total (lbs)
			Turbidity (NTU)	TOC (mg/L)	Ferric (mg/L)	PEC (mg/L)	PEA (mg/L)	PAC (mg/L)			
Jan	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	11,532
Feb	6.0	168	0.20	1.7	10.0	0.0	0.0	0.0	62	10,416	21,948
Mar	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	33,480
April	6.0	180	0.20	1.7	10.0	0.0	0.0	0.0	62	11,160	44,640
May	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	56,172
June	6.0	180	0.20	1.7	10.0	0.0	0.0	0.0	62	11,160	67,332
July	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	78,863
Aug	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	90,395
Sept	6.0	180	0.20	1.7	10.0	0.0	0.0	0.0	62	11,160	101,555
Oct	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	113,087
Nov	6.0	180	0.20	1.7	10.0	0.0	0.0	0.0	62	11,160	124,247
Dec	6.0	186	0.20	1.7	10.0	0.0	0.0	0.0	62	11,532	135,779
Ave / Total	**6.0**	**2,190**								**lbs/MG**	**62**

Notes:
(1) TSS:NTU = 1.42.
(2) Coagulant Factor = 0.63.
(3) TOC Removal = 0.25.

The solids production per year for maximum dose and flows was 135,779 lbs/yr or 372 lbs/d. Using a drying factor of 8 lbs/sf annually, the design size of the drying beds is four beds ultimately with the second pressure vessel installed, each 40 feet wide by 200 feet long. However, for the initial phase, only three beds will be constructed with the capability of adding the fourth drying bed in the future. The size of each bed is larger than needed for the drying of sludge, but needed for volume of backwash if future decant is available and for potential storage. The initial three beds allows for redundancy, where one bed could be on-line receiving clarified waste washwater, one could be decanting, and one could be drying. The drying beds are designed for a 4-foot water depth to provide adequate volume of sludge drying as well as potential water storage during winter months when the regional evaporation rate is less than during the summer months. Drying sludge would accumulate in these beds to a determined depth and dryness before being emptied by earthmoving-type equipment. It is anticipated that one drying bed go through at least two fill/dry cycles per year (4 lbs/sf each cycle) because thin sludge layers dry much faster than thick sludge layers. Disposal of the dried sludge will be via hauling to the landfill. Wing walls will also be placed around the drying beds to mitigate the beds from filling up with sand.

The drying beds will be designed with a decant structure as described for the Gunlock WTF to allow free water on top of drying sludge to be decanted and pumped back to the operating drying bed or an onsite retention pond.

Backwash Clarifier Tanks

A single backwash clarifier tank will be provided for the pressure vessel similar to the Gunlock WTF design. A second tank will not be needed until the second pressure vessel is installed in the future, but the site will be master planned to accommodate the second backwash clarifier tank. In the interim, if there are any maintenance issues with the decanter or the tank, the GWTP will not be able to backwash its filter vessel until the clarifier is repaired. During this time, the West Dam Springs will have to be pumped back to the Sand Hollow reservoir. The backwash clarifier tank will be designed similar to the Gunlock WTF site, as described in Section 1.4.1.5.

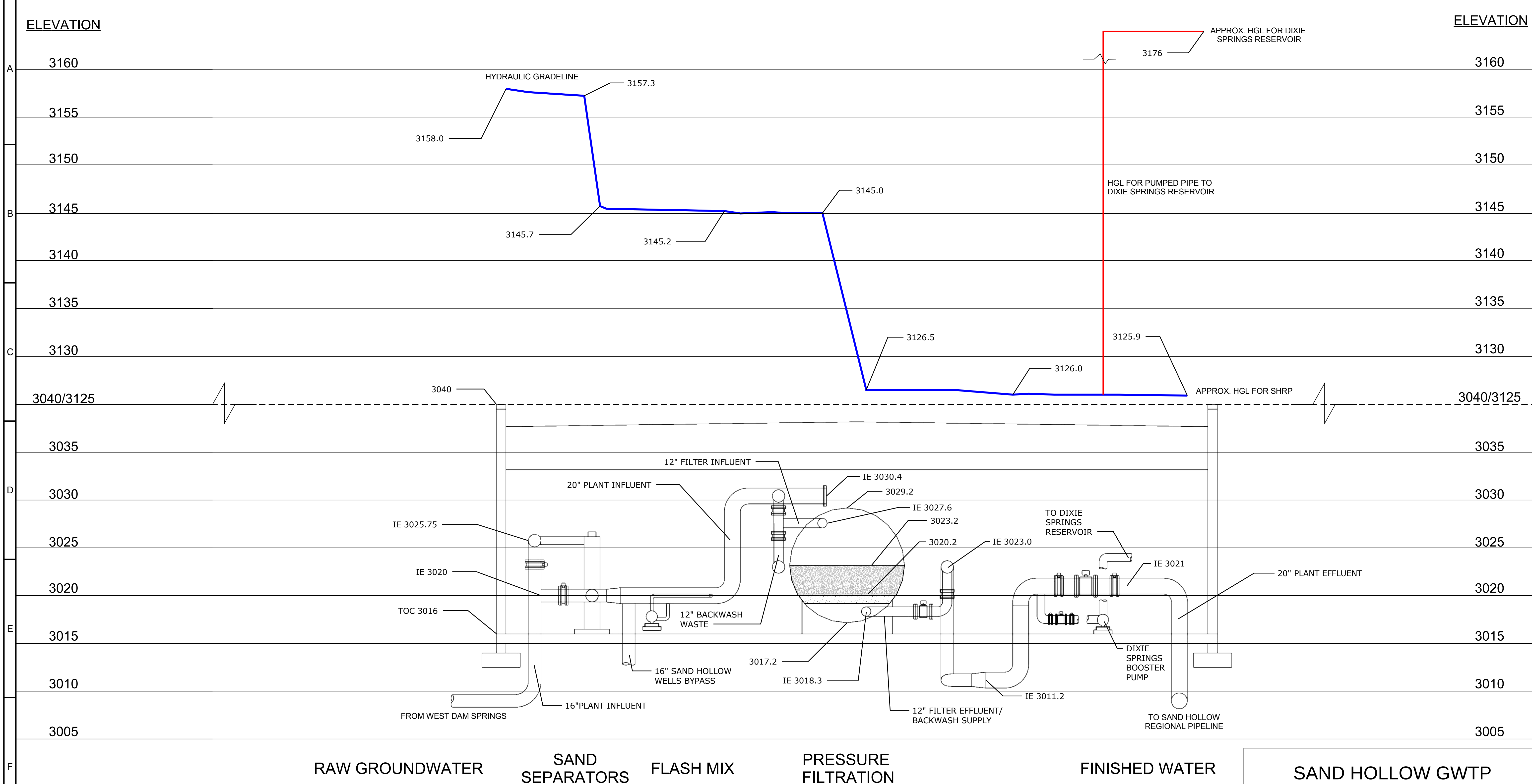
Normal operation of the tank will be to send up to four backwashes to the tank. This normally would be one pressure vessel backwash. It is estimated that a backwash will take approximately 30 minutes, as shown in Table 1.7. For four backwashes, that time duration would be 2 hours of backwashes per tank. The normal operation would be to backwash each vessel once in a 24-hour period. The breakdown of tank operation would be as follows:

- Backwash = 2 hours.
- Tank settling = 4 hours.
- Decant = 16 to 18 hours.
- Sludge blow down = 2 hours (overlapping decant time).

1.4.2.7 Hydraulic Profile

The estimated head loss through the plant is 37 feet, flowing at 3 mgd with no cells in backwash. The largest losses are through the pressure filter, with an estimated loss of 8 psi, and the sand separators, with an estimated loss of 5 psi. The hydraulic profile through the plant is shown in Figure 1.13.

The Sand Hollow GWTP and well fields ultimately deliver groundwater to two potable water destinations: the existing Dixie Springs Reservoir and the SHRP currently under design. The required hydraulic grade to deliver water to the Dixie Springs tank from the Sand Hollow GWT is approximately 50 feet higher than required to deliver to the SHRP (based on the high point in the SHRP, as currently designed). Since only a fraction of the water is delivered to the Dixie Springs tank, the operating hydraulic grade for both the plants and the wells is based on discharging to the lower SHRP. A separate pump station pumps only the required water to the higher Dixie Springs tank. This configuration, shown on both Figures 1.11 and 1.13, will save significant electricity and operating costs.



HYDRAULIC PROFILE (3 MGD)

SCALE: 1" = 10'

SAND HOLLOW GWTP HYDRAULIC PROFILE

FIGURE 1.13

WCWCD

PRELIMINARY DESIGN REPORT

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SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN

GENERAL

HYDRAULIC PROFILE

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1.5 Building Layout

1.5.1 Gunlock

The building layout and design concepts for the Gunlock WTF are shown in Figures 1.14 through 1.20 and described below. The Backwash Waste Clarifier concepts are shown in Figures 1.21 through 1.23, and the drying bed concepts are shown in Figure 1.24. The clarifiers and drying beds are described in previous sections of this report.

1.5.1.1 Building Layout

The treatment building will be located at the Upper BLM site, as described in the site layout Section 1.3.1.3. The preferred building style is concrete, cast-in-place walls on a concrete slab. The roofing system will be a flat-roof style truss system with skylights to provide natural lighting within the buildings. A simple architectural parapet will be provided around the perimeter of the building. The overall footprint of the treatment building is 88 feet by 68 feet by 24 feet tall. Additional details and dimension are shown within the figures.

The pressure vessels, flash mix pump, air blower and ferric chloride storage tanks are located within a central process room. Four enclosed rooms will be provided within the building:

- A chlorine room with separate climate control to provide additional heating for this room, and double door access.
- A unisex restroom with toilet, sink, and single door access.
- An operator control room containing a working space for operators.
- An electrical room containing electrical gear, Programmable Logic Controller (PLC), and potential remote terminal unit (RTU) systems with double door access for facility equipment installation/removal.

A grating catwalk between the pressure vessels provides access to the upper valves and components. It is expected that the catwalk will be used infrequently and only for maintenance. The catwalk access is provided by a ladder at either end of the platform. The lower valves and components for the vessels are accessible from under the catwalk. The building provides sufficient space around the perimeter of the vessels to access and work on the pressure vessels and the accompanying piping, and move equipment with a small fork lift.

Building ingress and egress will be provided by exterior doors, including an 8-foot by 10-foot double door for large equipment. This double door provides access with better moisture and thermal protection than a typical roll-up door. Architectural features to improve aesthetics include various color selections and several building profile options (e.g., roof types and soffit/overhand). The City has requested no exterior windows, except for windows installed in doors.

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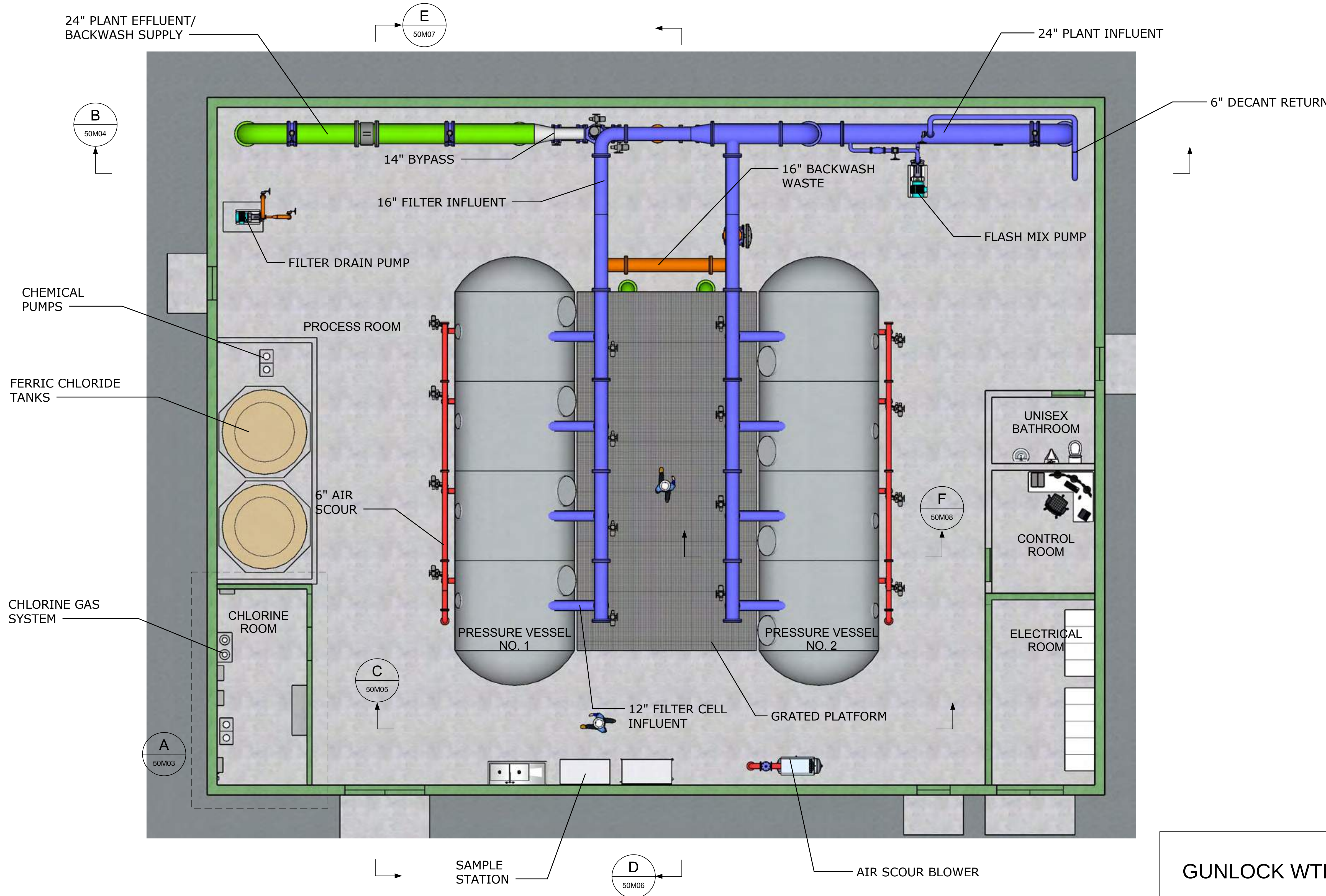

TREATMENT BUILDING - UPPER PLAN
SCALE: 3/32" = 1'

GUNLOCK WTF - UPPER PLAN

FIGURE 1.14

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CITY OF ST. GEORGE
GUNLOCK WATER TREATMENT FACILITY DESIGN
MECHANICAL
TREATMENT BUILDING - UPPER PLAN

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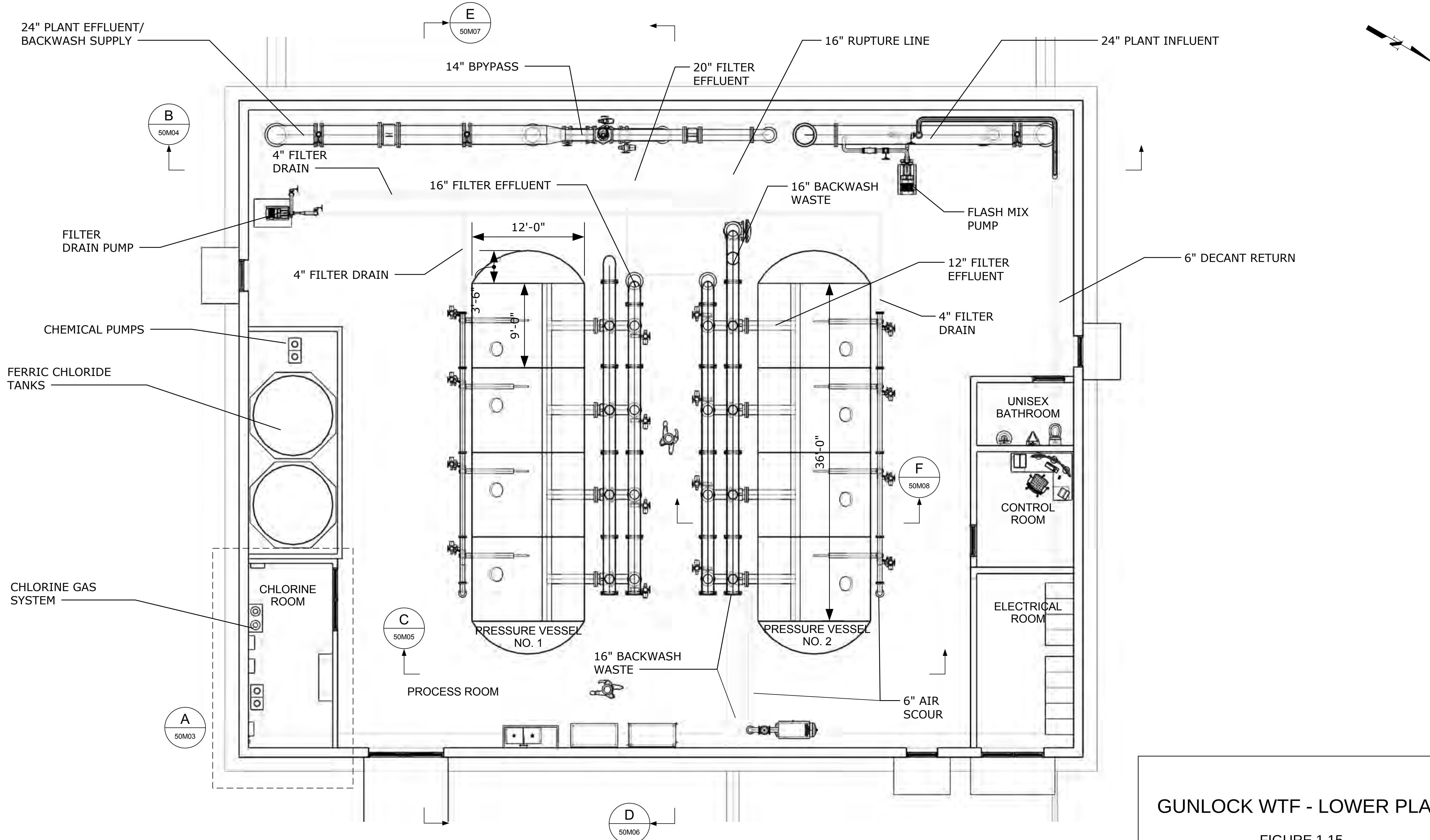

TREATMENT BUILDING - LOWER PLAN

SCALE: 3/32" = 1'

GUNLOCK WTF - LOWER PLAN

FIGURE 1.15

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CITY OF ST. GEORGE
GUNLOCK WATER TREATMENT FACILITY DESIGN
MECHANICAL
TREATMENT BUILDING - LOWER PLAN

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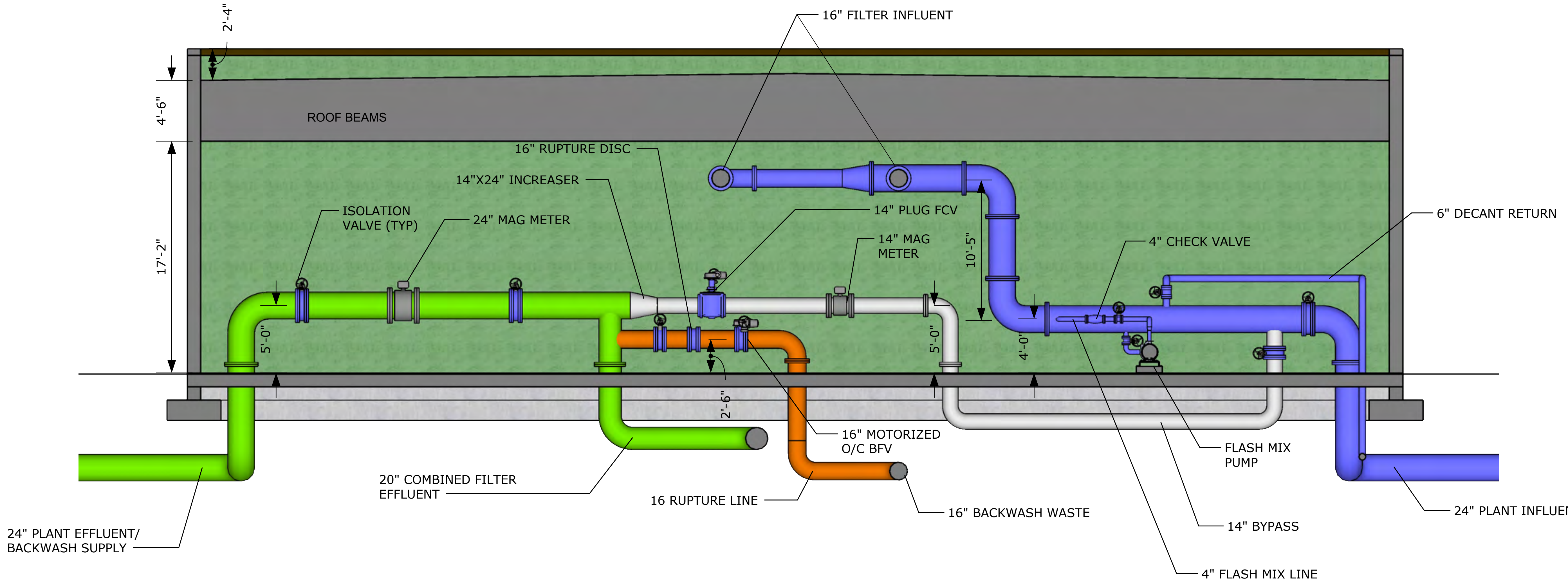

B TREATMENT BUILDING - BACK WALL SECTION

SCALE: 1/8" = 1'

GUNLOCK WTF - SECTION

FIGURE 1.16

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GUNLOCK WATER TREATMENT FACILITY DESIGN

MECHANICAL

TREATMENT BUILDING - SECTION

VERIFY SCALES

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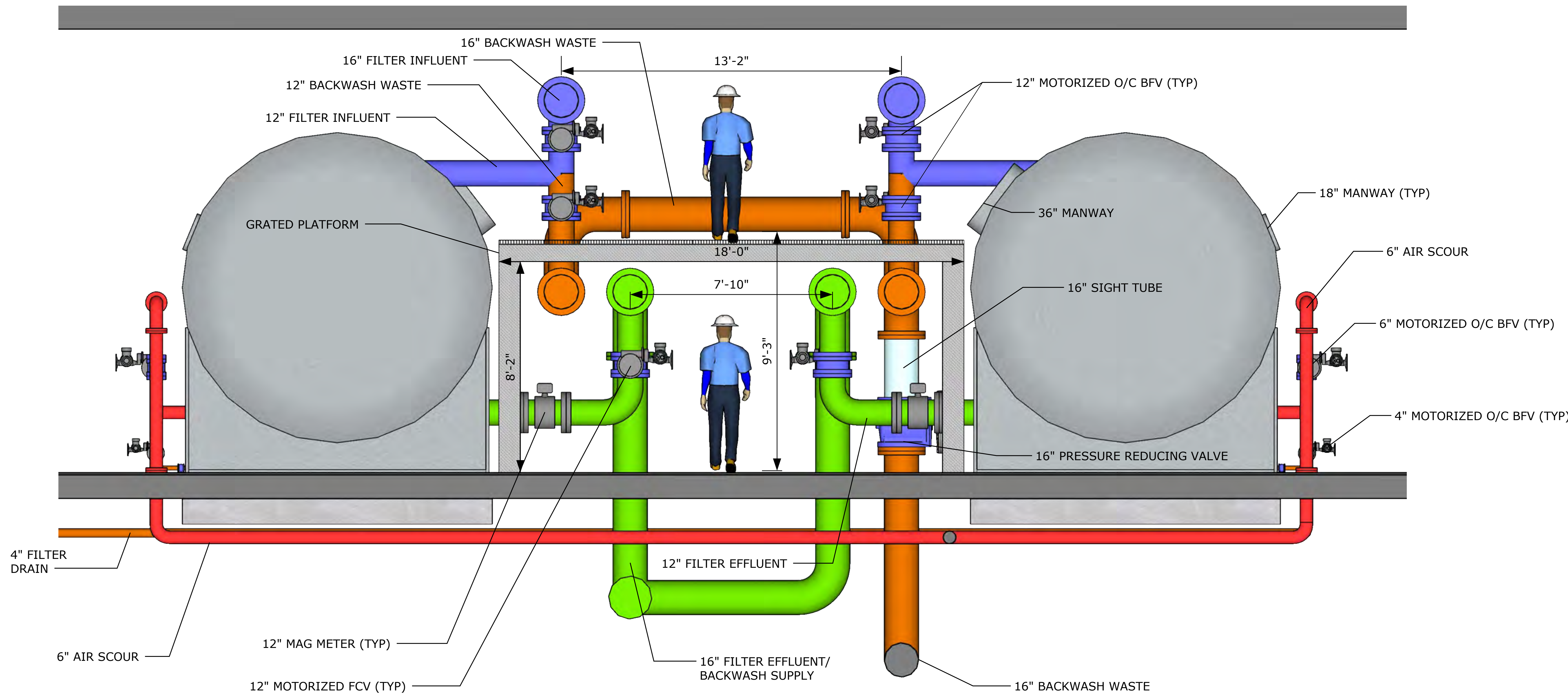

C TREATMENT BUILDING - PRESSURE VESSEL - SECTION 1

SCALE: 1/4" = 1'

GUNLOCK WTF - PRESSURE VESSEL - SECTION 1

FIGURE 1.17

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GUNLOCK WATER TREATMENT FACILITY DESIGN

MECHANICAL

TREATMENT BUILDING - PRESSURE VESSEL - SECTION 1

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DRAWING NO. 50M05

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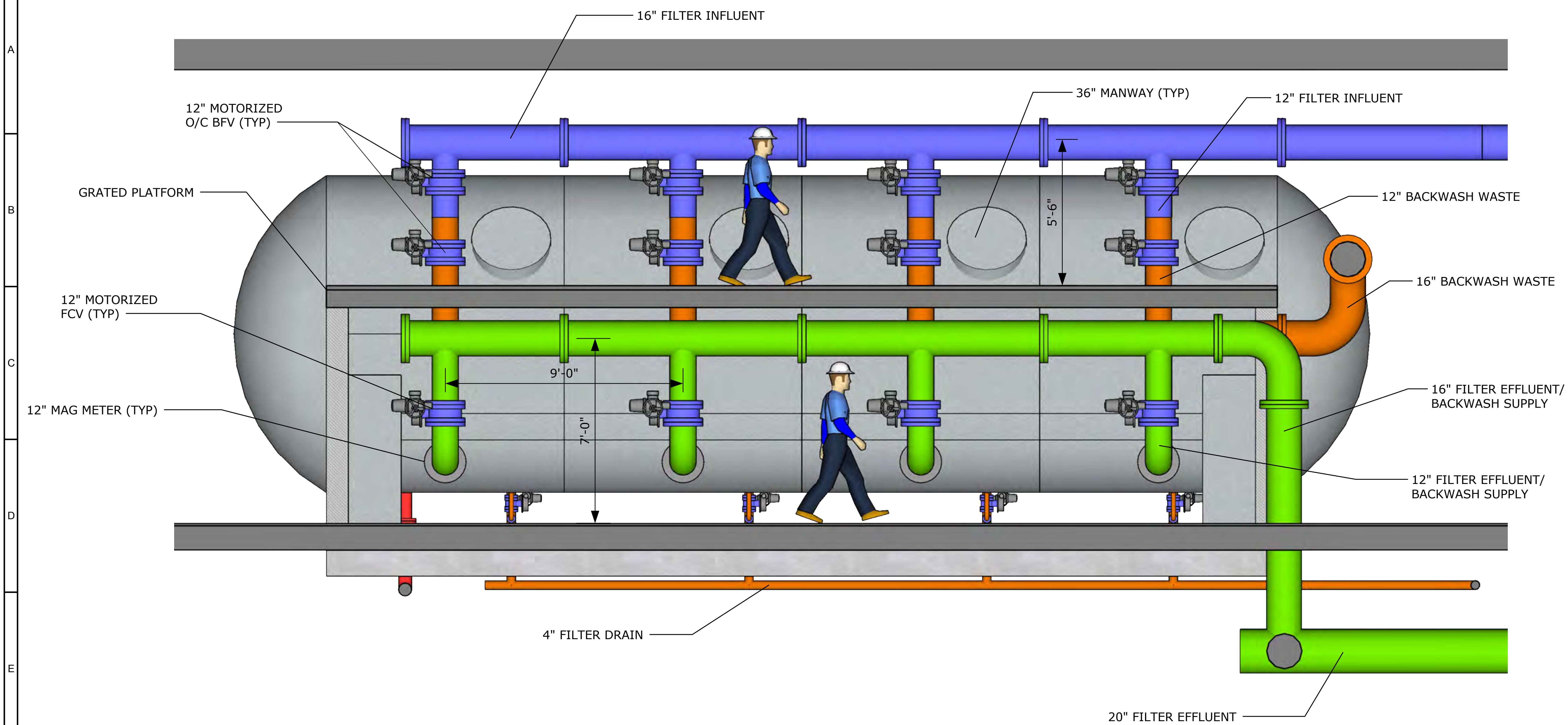

D TREATMENT BUILDING - PRESSURE VESSEL - SECTION 2

SCALE: 1/4" = 1'

GUNLOCK WTF - PRESSURE VESSEL - SECTION 2

FIGURE 1.18

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GUNLOCK WATER TREATMENT FACILITY DESIGN

MECHANICAL

TREATMENT BUILDING - PRESSURE VESSEL - SECTION 2

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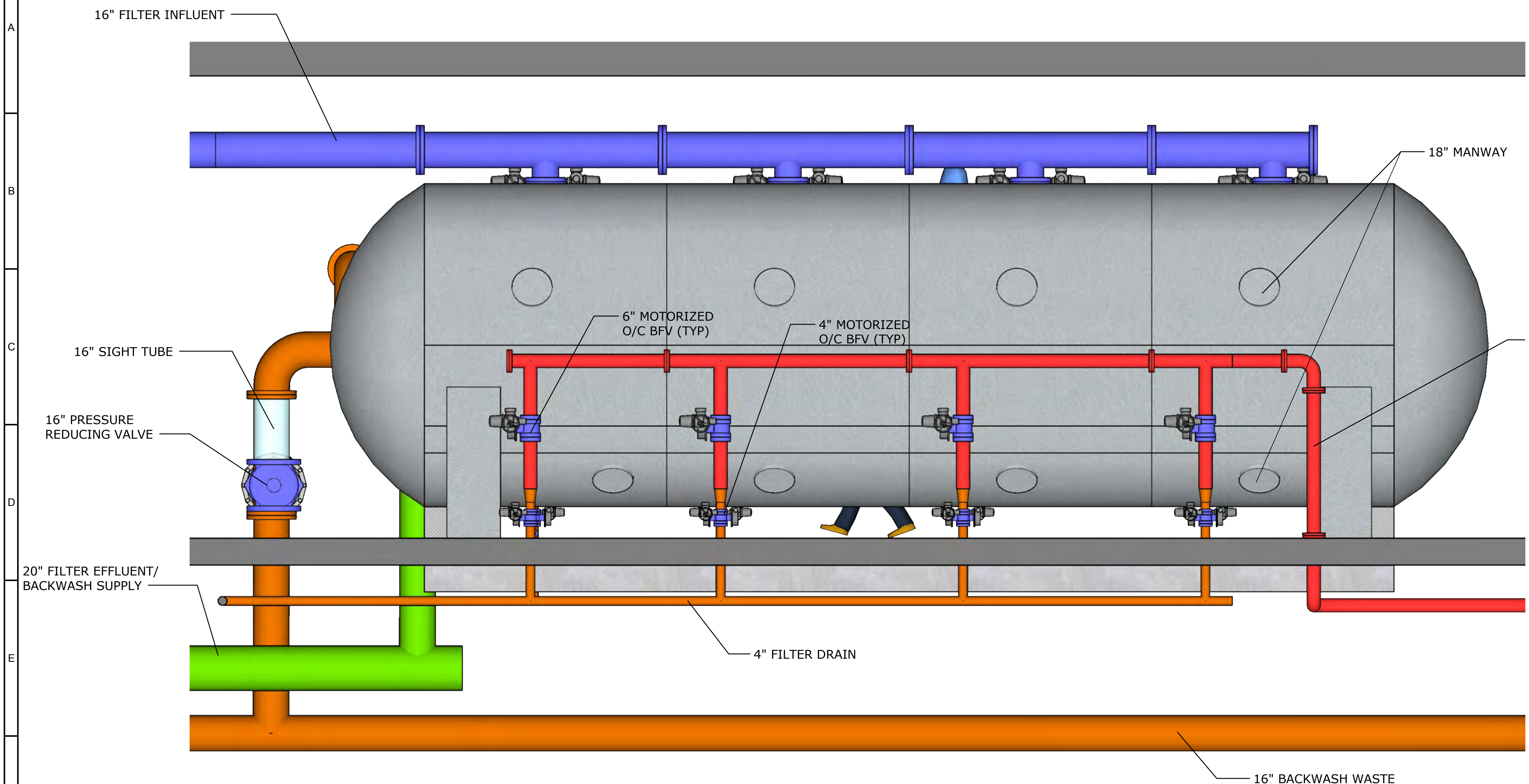

E TREATMENT BUILDING - PRESSURE VESSEL - SECTION 3

SCALE: 1/4" = 1'

GUNLOCK WTF - PRESSURE VESSEL - SECTION 3

FIGURE 1.19

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GUNLOCK WATER TREATMENT FACILITY DESIGN

MECHANICAL

TREATMENT BUILDING - PRESSURE VESSEL - SECTION 3

VERIFY SCALES

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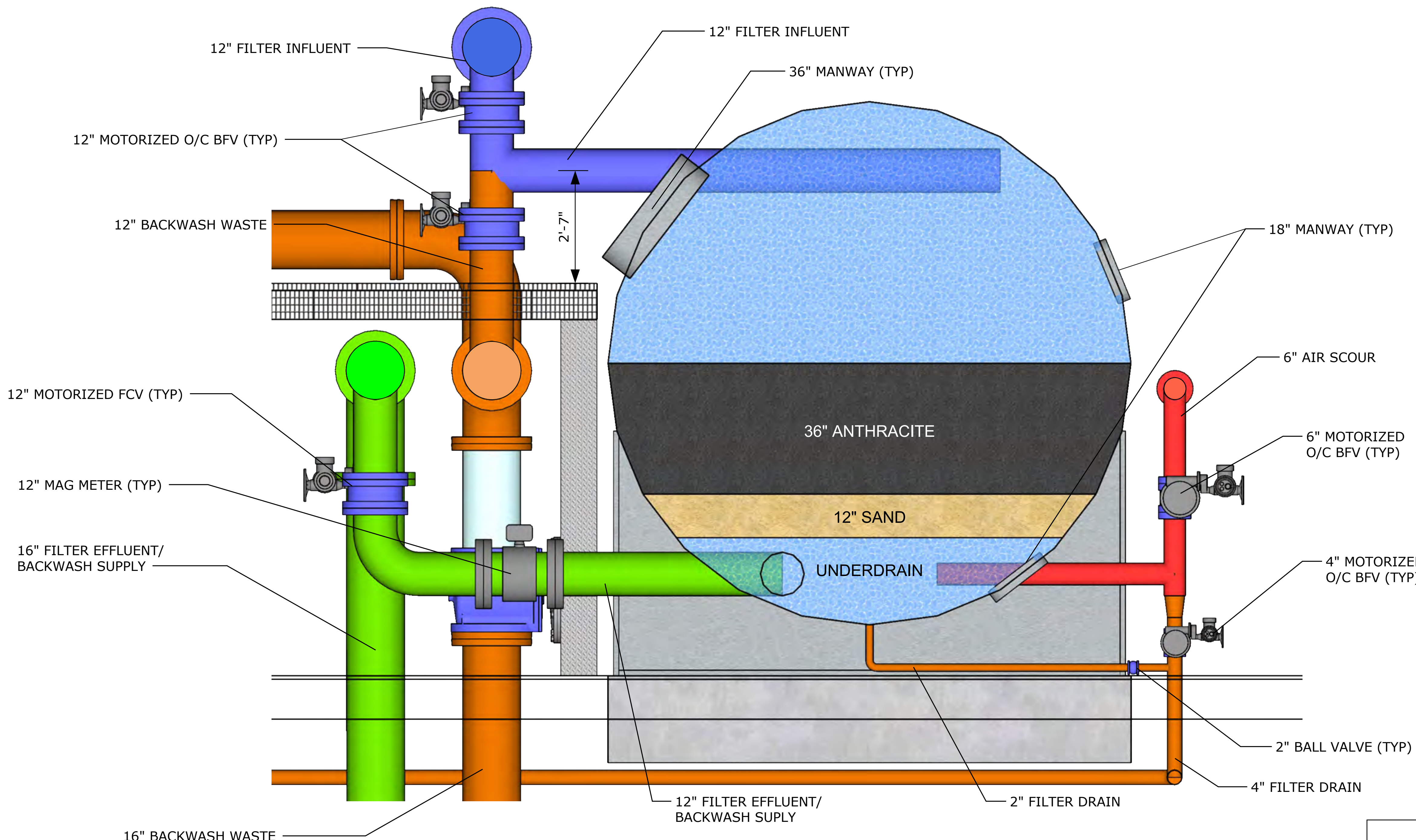

F TREATMENT BUILDING - PRESSURE VESSEL - SECTION 4

SCALE: 3/8" = 1'

GUNLOCK WTF - PRESSURE VESSEL - SECTION 4

FIGURE 1.20

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TREATMENT BUILDING - PRESSURE VESSEL - SECTION 4

VERIFY SCALES

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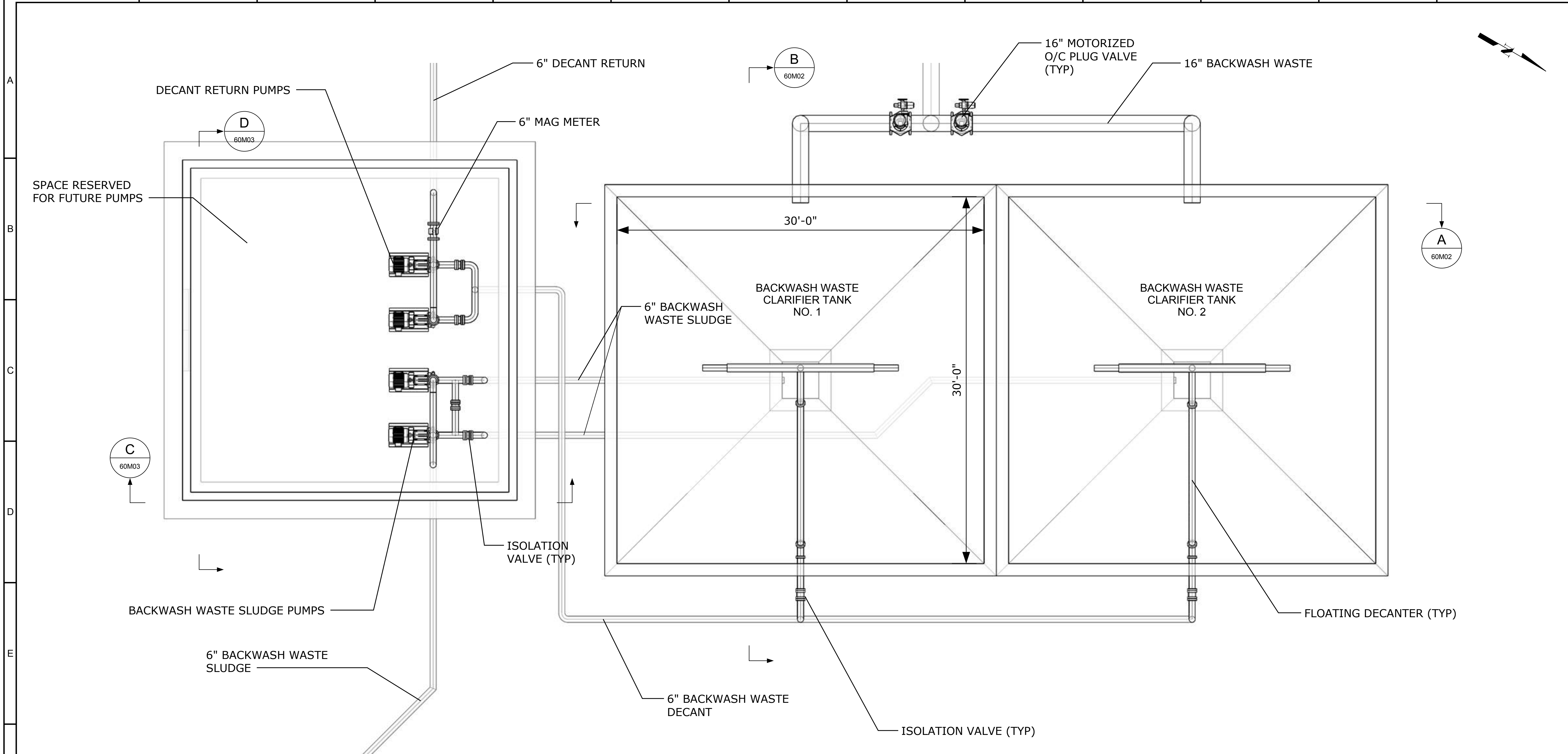

BWW CLARIFIER TANKS & PUMP STATION - PLAN

SCALE: 1/8" = 1'

GUNLOCK WTF - BACKWASH WASTE CLARIFIERS AND PUMP STATION - PLAN

FIGURE 1.21

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CITY OF ST. GEORGE

GUNLOCK WATER TREATMENT FACILITY DESIGN

MECHANICAL

BACKWASH WASTE CLARIFIER TANKS AND PUMP STATION - PLAN

VERIFY SCALES

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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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SHEET NO.

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GUNLOCK WTF - BACKWASH WASTE CLARIFIERS - SECTIONS

FIGURE 1.22

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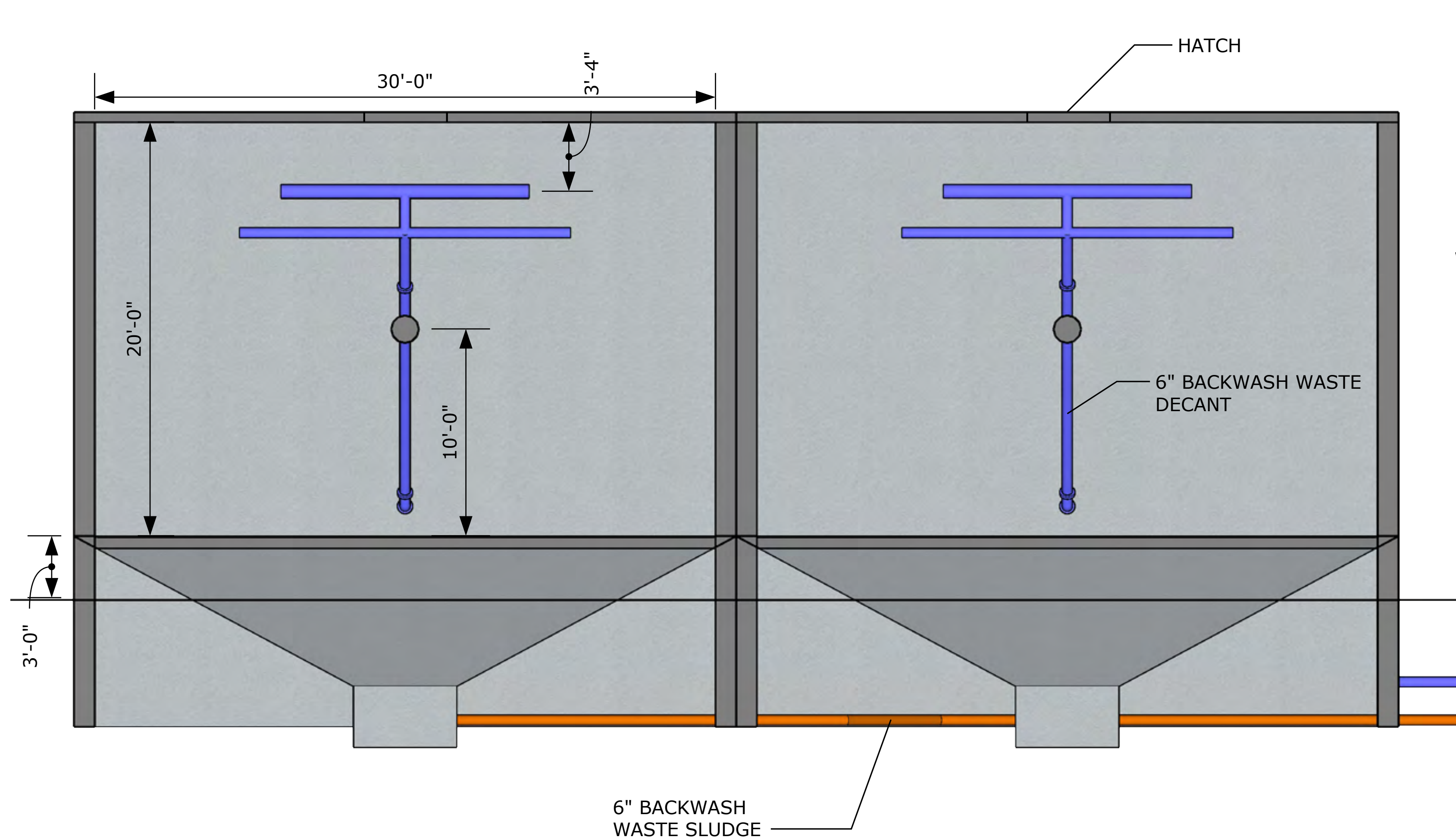
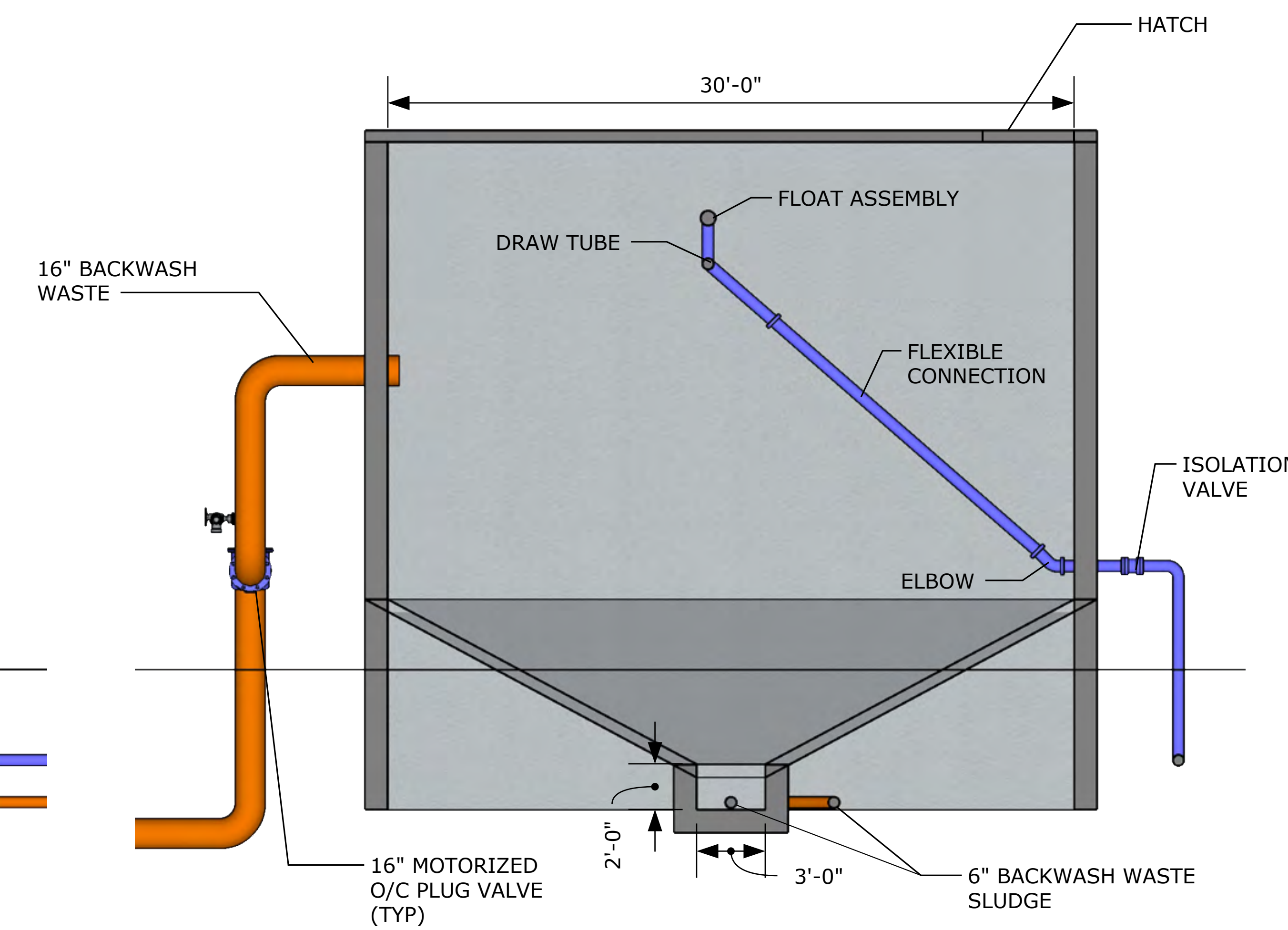


A BWW CLARIFIER TANKS - WEST SECTION
SCALE: 1/8" = 1'



B BWW CLARIFIER TANKS - SOUTH SECTION
SCALE: 1/8" = 1'

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MECHANICAL
BACKWASH WASTE CLARIFIER TANKS - SECTIONS

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GUNLOCK WTF - PUMP STATION - SECTIONS

FIGURE 1.23

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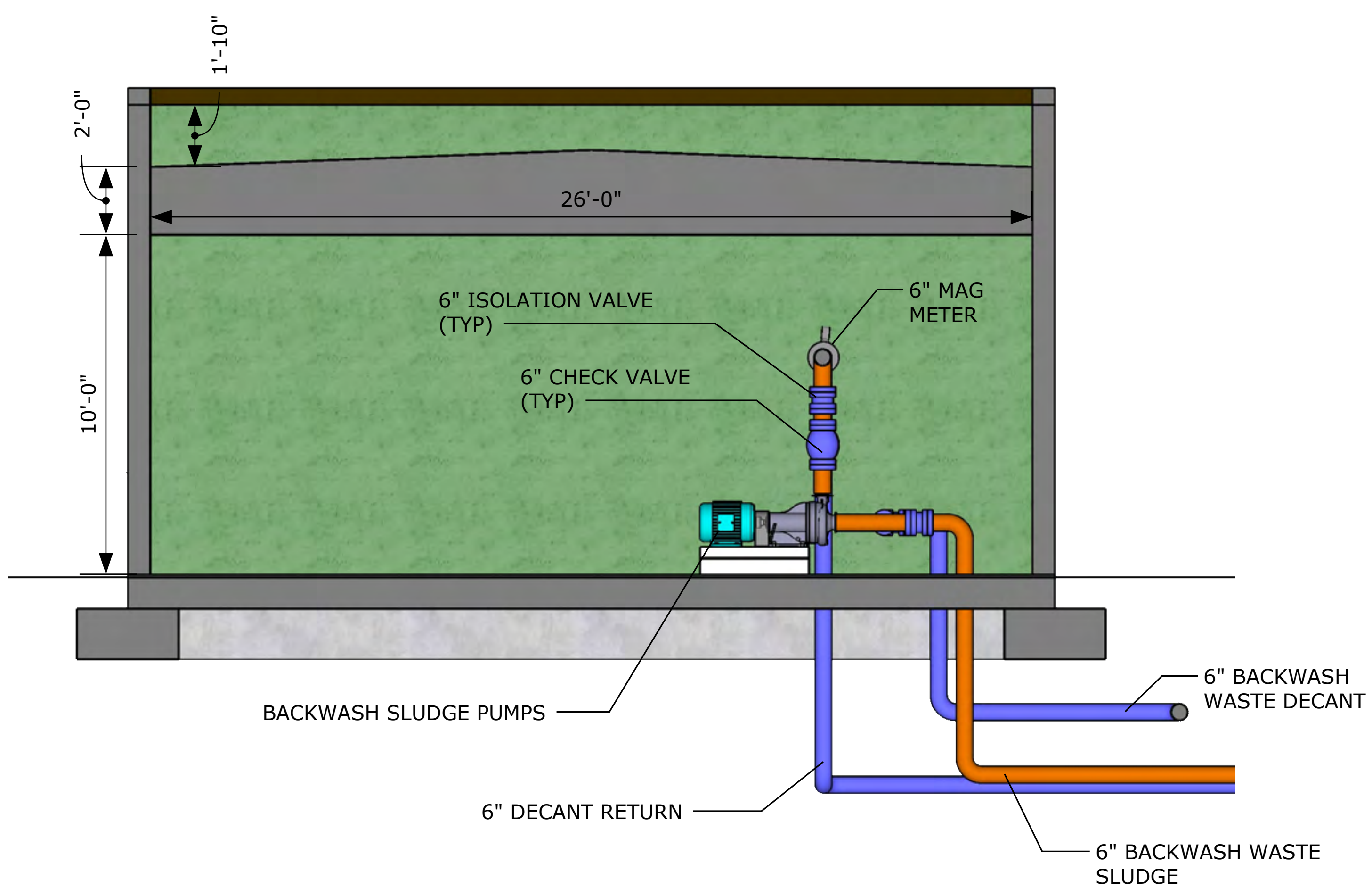
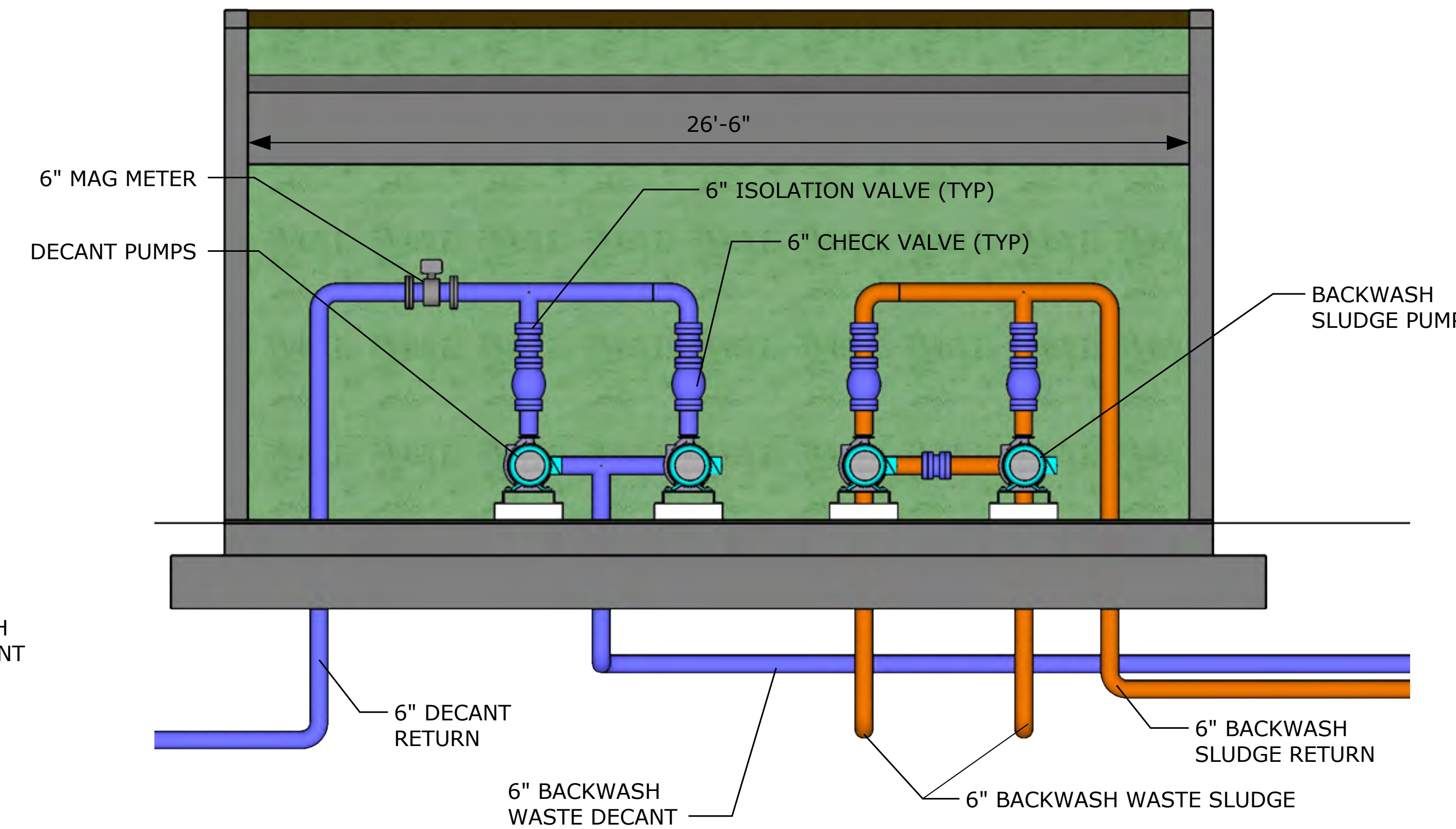


C — PUMP STATION - EAST SECTION
SCALE: 3/16" = 1'



D — PUMP STATION - SOUTH SECTION
SCALE: 3/16" = 1'

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GUNLOCK WATER TREATMENT FACILITY DESIGN
MECHANICAL
PUMP STATION - SECTIONS

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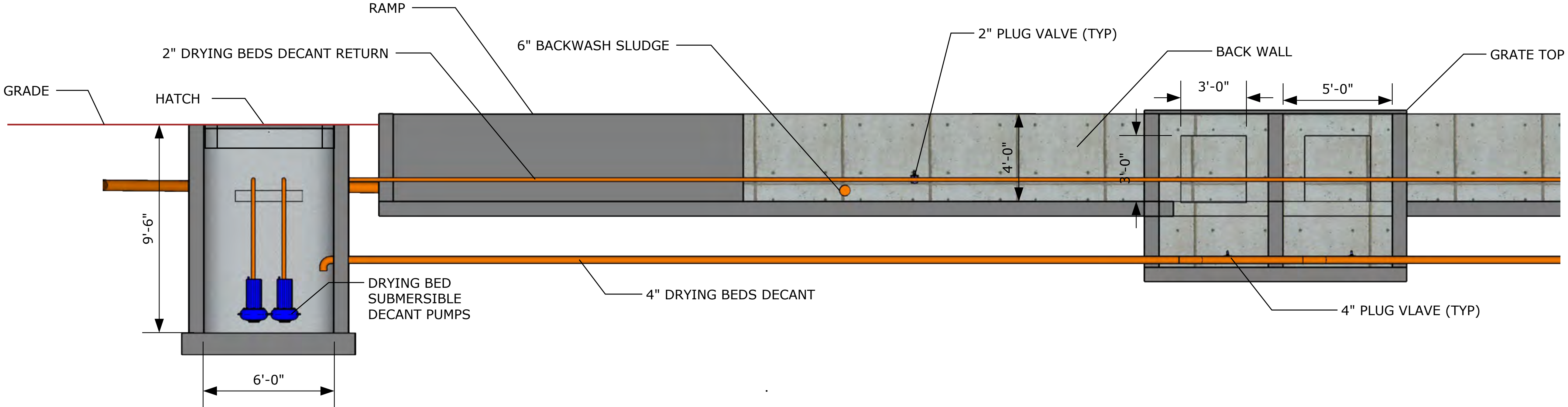
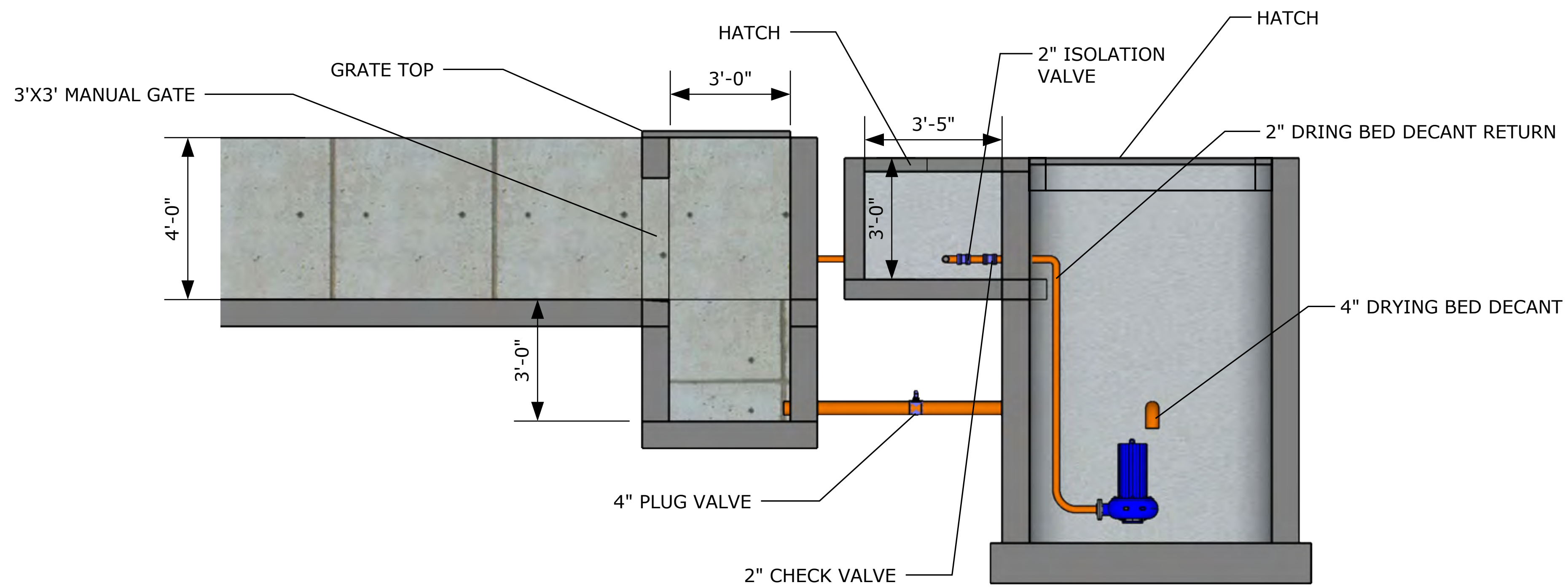


A DRYING BEDS - NORTH SECTION
SCALE: 3/16" = 1'



B DRYING BEDS - EAST SECTION
SCALE: 1/4" = 1'

GUNLOCK WTF - DRYING BEDS - SECTIONS

FIGURE 1.24

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CITY OF ST. GEORGE
GUNLOCK WATER TREATMENT FACILITY DESIGN
MECHANICAL
DRYING BEDS - SECTIONS

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1.5.1.2 Building HVAC and Plumbing

Climate control will be provided for the treatment building. The main process area will have wall mounted evaporative cooling but no heating system. The chlorine gas room will have a ventilation fan and heaters for process requirements. The restroom, operator room, and electrical room will all have heating, ventilation, and air conditioning (HVAC) for heating and cooling.

Plumbing will be provided for the restroom sink and toilet and several hose bibb locations for wash-down water. An emergency shower/eyewash will be provided in the chlorine and ferric chloride areas. Utility water will be provided for the chlorine system with a backflow system to protect the potable water system. Floor drains will be provided around the pressure vessels and in the chemical areas. The floor drains will all be plumbed to drain to the sludge drying beds. The sanitary sewer from the restroom will be plumbed to the on-site waste water holding tank.

1.5.2 Sand Hollow

The Sand Hollow GWTP building, Backwash Waste Clarifier and drying bed concepts are similar to those at the Gunlock WTF, with few differences. Consequently, Figures 1.14 through 1.24 and Section 1.5.1 generally apply to Sand Hollow GWTF as well, except as modified herein.

The most significant differences within the building are highlighted on Figures 1.25 and 1.26 and described below. The details for the Backwash Waste Clarifier and drying beds differ only in the number of units initially constructed - one clarifier instead of two, and three drying beds instead of four. The clarifier pump station at Sand Hollow GWTP also includes the duty and standby pumps for pumping potable water to Dixie Springs, as shown on Figure 1.27.

1.5.2.1 Building Layout

The treatment building will be located adjacent to the West Dam Springs site, as described in the site layout in Section 1.3.2.3. The Sand Hollow GWTP building layout is similar to the Gunlock WTF in all aspects except the following:

- Only one vessel will be initially constructed. The second vessel will be added as part of a future expansion in the same configuration as Gunlock WTF. Refer to Figure 1.25.
- A sand separator system is included in the corner adjacent to the flash mix pump. Refer to Figure 1.25.
- There is an on-site hypochlorite generation equipment located in the main process room, instead of a chlorine gas system located in an isolated chlorine room. The brine storage tank is located outside to minimize building footprint and facilitate bulk salt deliveries. Refer to Figure 1.25.
- The filter inlet and outlet header configuration along the wall shown in Section B for each facility is different for Sand Hollow. The primary differences are highlighted below and in Figure 1.26:
  - The filter inlet piping from West Dam Springs connects to the sand separators that can also be bypassed.
  - Bypass piping for well water that will not be filtered, along with decant return piping is provided in an exterior vault at Sand Hollow rather than internal to the building at Gunlock.
  - The Sand Hollow filter effluent piping includes a tee and flow meter to the Dixie Springs pump station.

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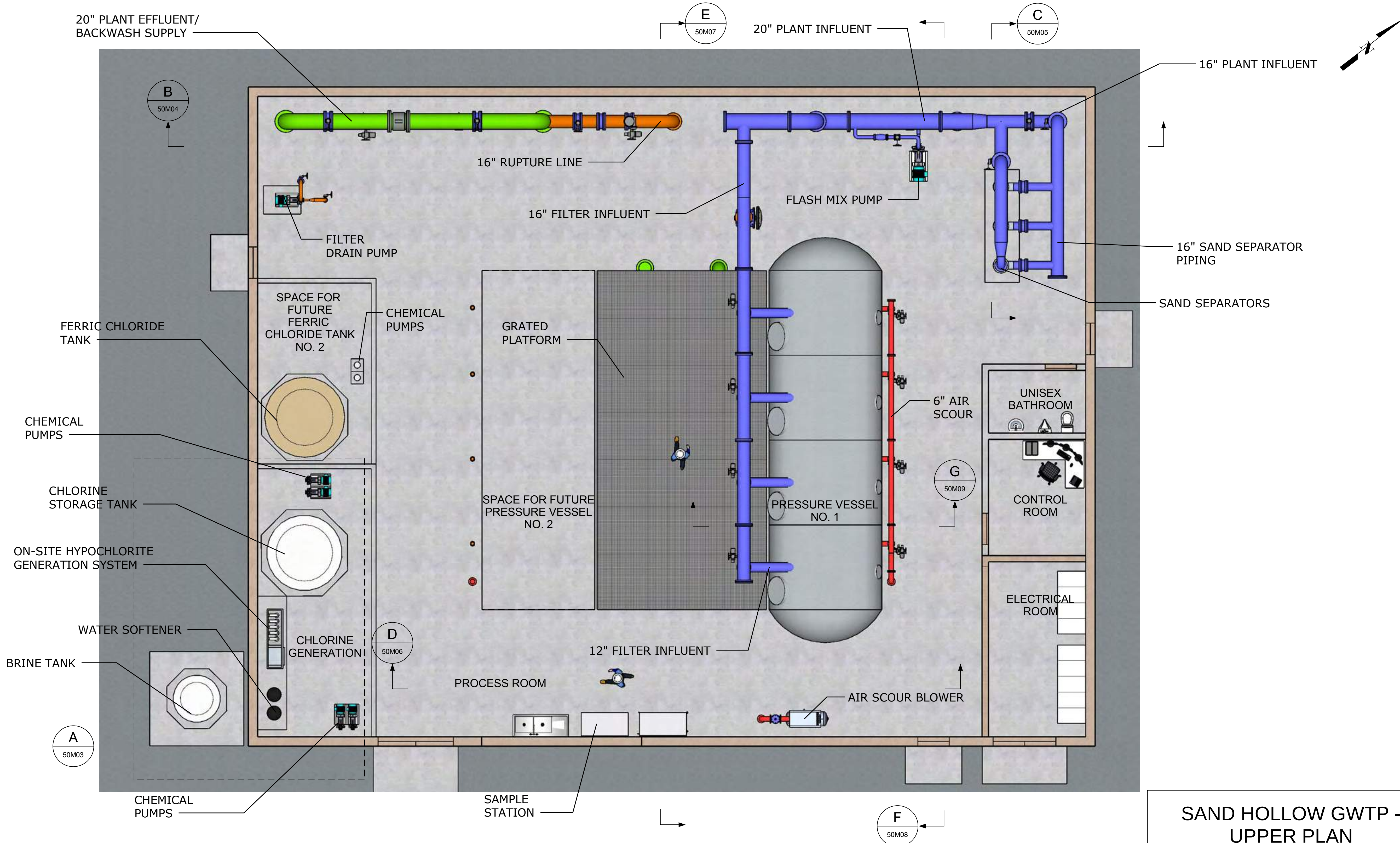

TREATMENT BUILDING - UPPER PLAN

SCALE: 3/32" = 1'

SAND HOLLOW GWTP - UPPER PLAN

FIGURE 1.25

WCWCD

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SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN

MECHANICAL

TREATMENT BUILDING - UPPER PLAN

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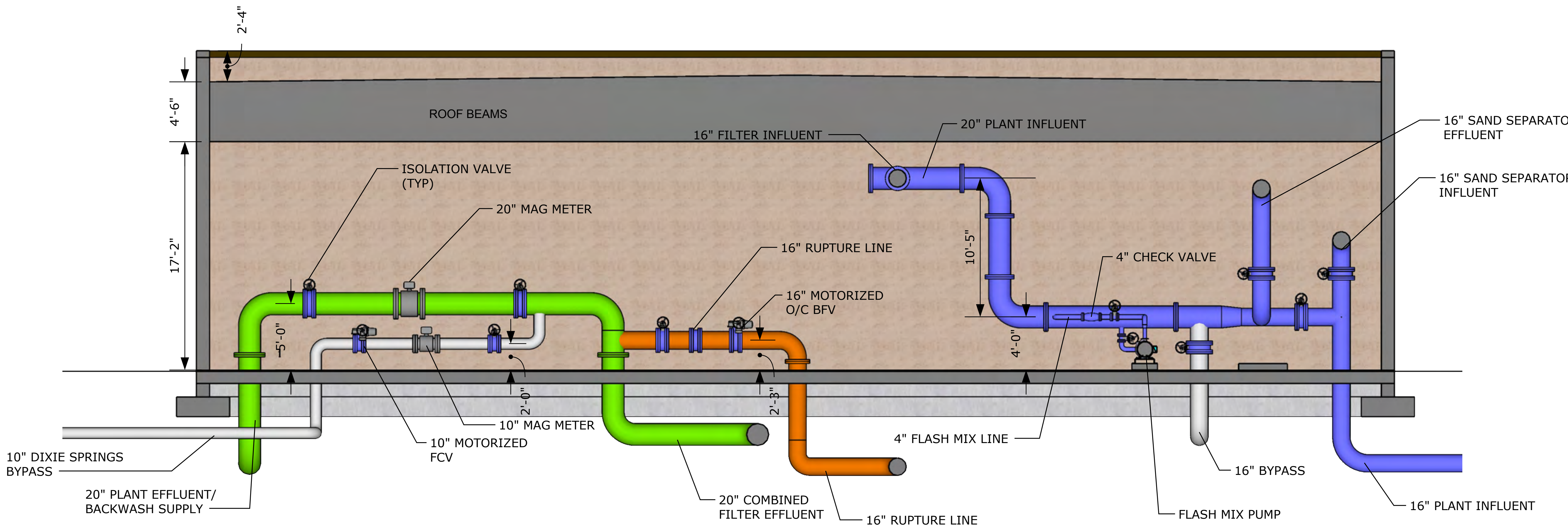

B TREATMENT BUILDING - BACK WALL SECTION

SCALE: 1/8" = 1'

SAND HOLLOW GWTP - SECTION

FIGURE 1.26

WCWCD

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SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN

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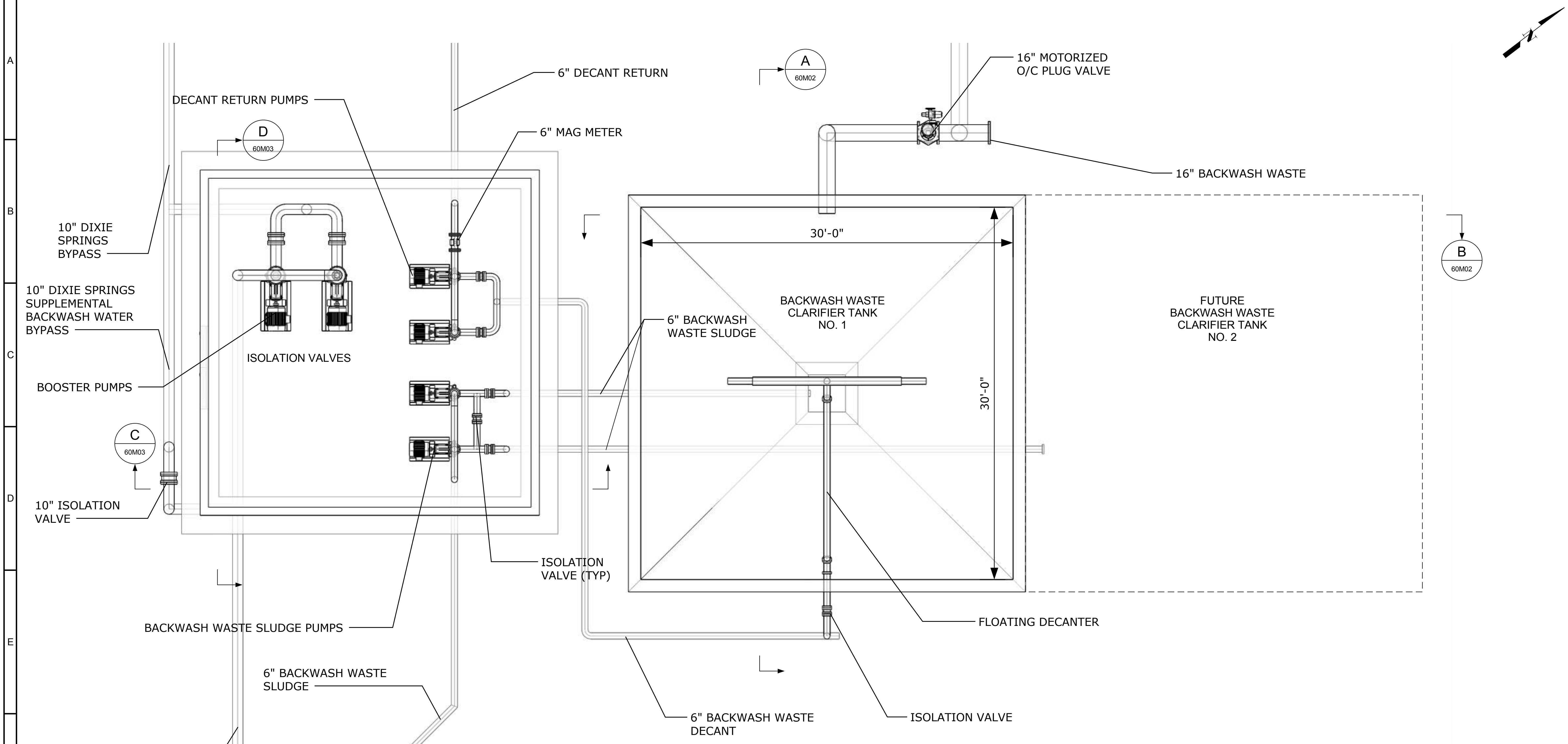

BWW CLARIFIER TANKS & PUMP STATION - PLAN

SCALE: 1/8" = 1'

SAND HOLLOW GWTP - BWW CLARIFIER TANK AND PUMP STATION - PLAN

FIGURE 1.27

WCWCD

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SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN

MECHANICAL

BACKWASH WASTE CLARIFIER TANKS AND PUMP STATION - PLAN

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1.5.2.2 Building HVAC and Plumbing

The climate control and HVAC for Sand Hollow is identical to Gunlock except:

- There is no separate HVAC system for the chlorine area because it is not in a separate room.
- The sanitary sewer from the restroom will be plumbed to the nearby existing 8-inch sanitary sewer line instead of a holding tank.

1.6 Electrical and Instrumentation and Controls

1.6.1 Gunlock

1.6.1.1 Electrical Equipment and Sizing

The Gunlock WTF will receive 480-volt (V) electrical service from a St. George Power-owned transformer. Coordination with St. George Power on exact service requirements will occur during final design. This power source is equipped with backup power generation to supply the Gunlock WTF in the event of normal power failure. Therefore, a backup or emergency power generator at the site will not be included in the design.

Appendix A contains load study data for the WTF, which is used for determining the expected sizing criteria for both motor control center (MCC) and the new transformer furnished by St. George Power. The load study in Appendix A includes the following:

- 480-volt Loads:
  - Air Scour Blower.
  - Chemical Pumps.
  - Clarifiers.
  - Flash Mix Pump.
  - Filter Drain Pump.
  - Backwash Waste (BWW) Return Pumps.
  - Decant Return Pumps.
  - Valves.
- 120-volt Loads:
  - Lighting/outlets.
  - HVAC.
  - Instrumentation.

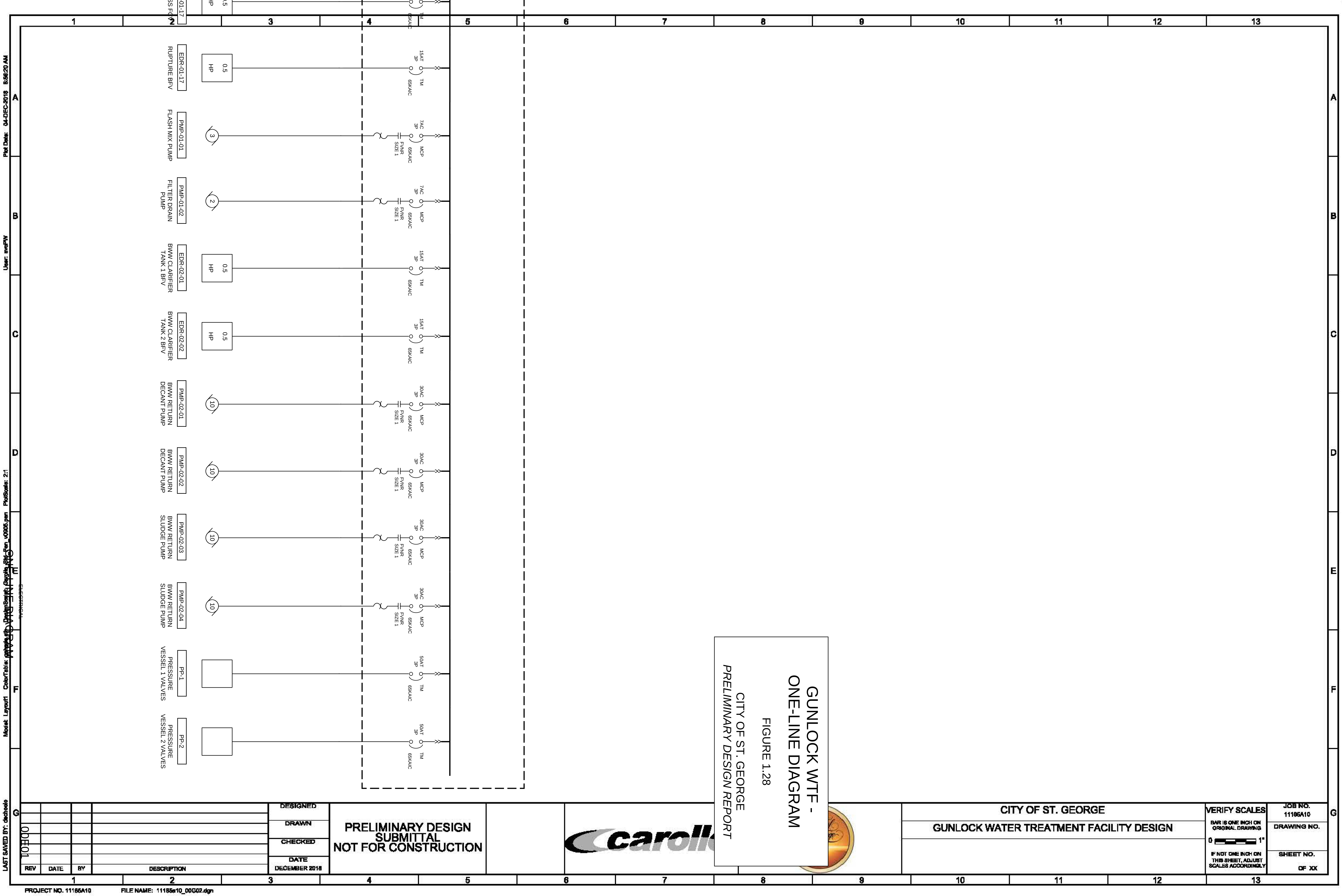
The load study calculates the amperage rating of the MCC and the transformer using three different methods: National Electrical Code (NEC) Article 215, NEC Article 430, and "Operating Loads" (the sum of the non-continuous load plus the continuous load, not including standby loads). Typically, the most conservative of the three calculations is used for equipment sizing. From the load study calculation, NEC Article 215 is the most conservative. The equipment ratings are determined by rounding up the load study calculation to the next standard size of equipment. The MCC is preliminarily sized for 450 amperes (A) and the estimated transformer size is 300 kVA. Actual equipment sizing will be determined during final design, and will be vetted with process and building loads to ensure that adequate capacity is available in the new MCC One-Line Diagram.

A preliminary power supply one-line diagram is shown in Figure 1.28 The utility transformer will be connected to a utility meter/cabinet and then an outdoor service entrance disconnect, which will feed the MCC. The MCC will serve as the main electrical distribution, as well include the starters for the pumps. The MCC will also feed two power panels (PP). Each power panel will supply power to the valves for a single pressure vessel.

1.6.1.2 Process and Instrumentation Diagram

The Gunlock WTF will have a PLC located in the electrical room, where the PLC will monitor and control the associated treatment systems. The PLC will utilize a telemetry unit to transmit the control and status to the City's remote Supervisory Control and Data Acquisition (SCADA) system.

Preliminary process and instrumentation diagrams (P&IDs) for the pressure vessels are shown in Figure 1.29 and Figure 1.30.



GUNLOCK WTF - ONE-LINE DIAGRAM

FIGURE 1.28

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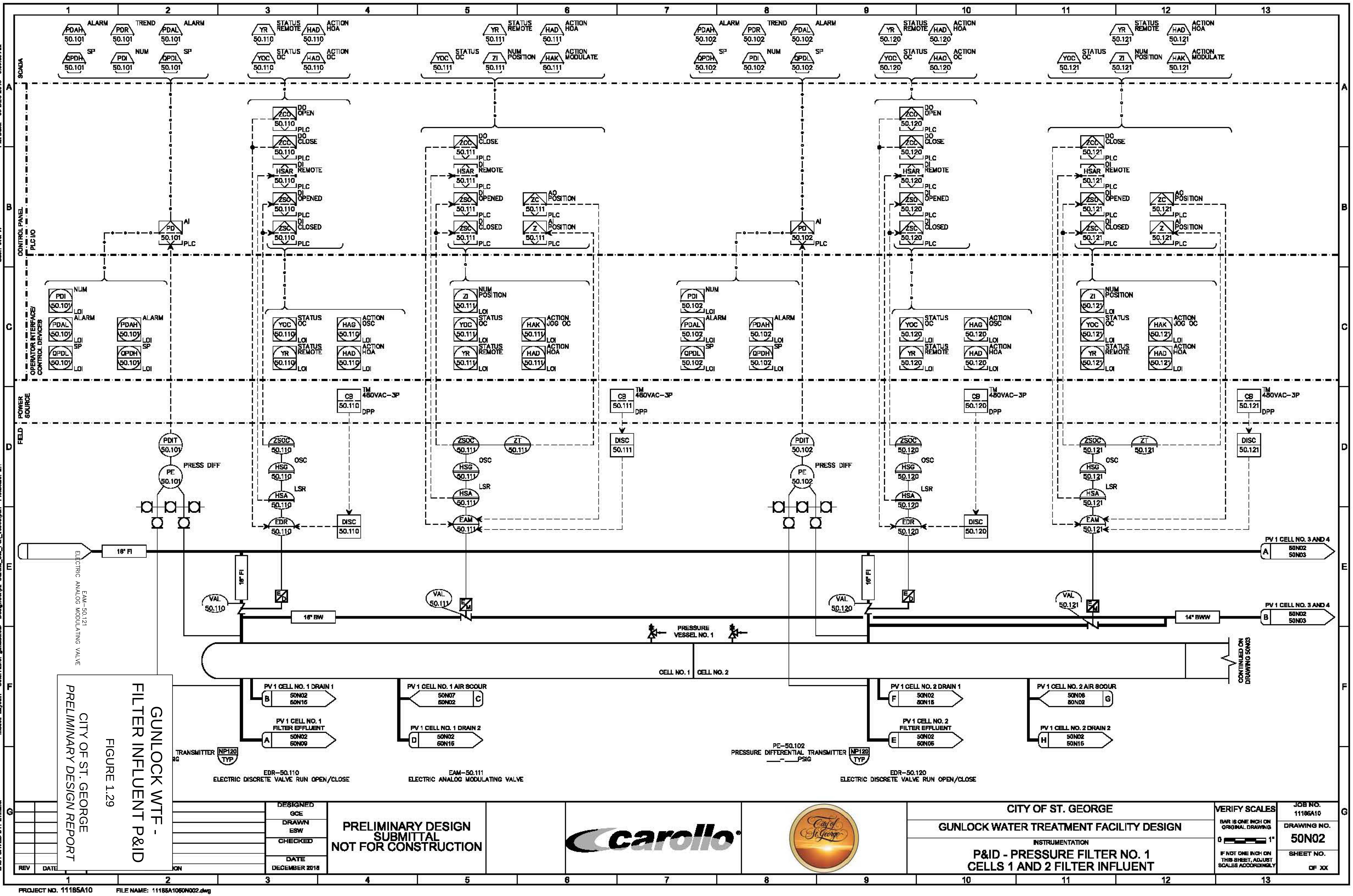

GUNLOCK WTF - FILTER INFLUENT P&ID

FIGURE 1.29

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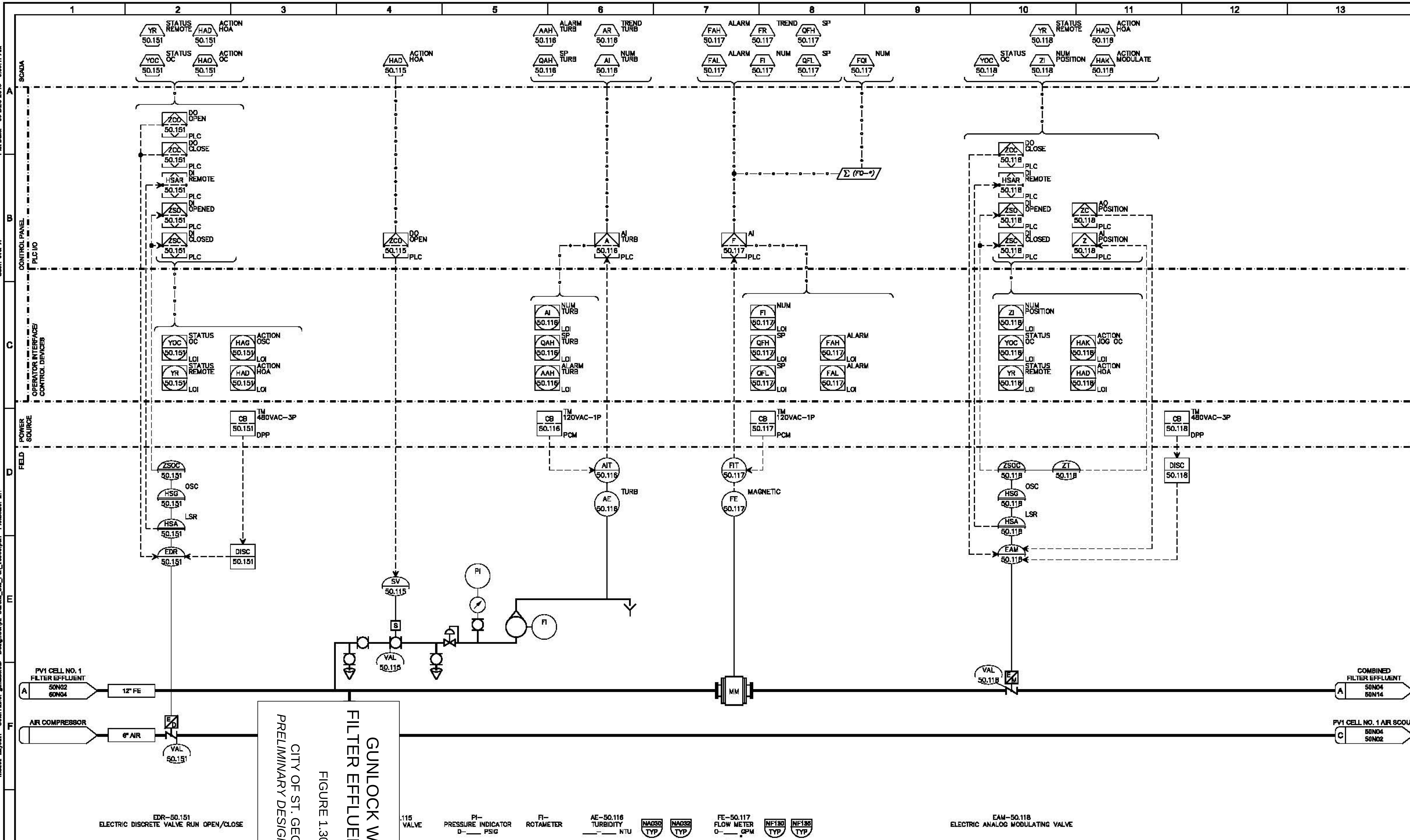

GUNLOCK WTF - FILTER EFFLUENT P&ID

FIGURE 1.30

CITY OF ST. GEORGE

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CITY OF ST. GEORGE

GUNLOCK WATER TREATMENT FACILITY DESIGN

INSTRUMENTATION

P&ID - PRESSURE FILTER NO. 1 CELL 1 FILTER EFFUENT

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 11165A10

DRAWING NO. 50N04

SHEET NO. OF XX

PROJECT NO. 11165A10 FILE NAME: 11165A1050N004.dwg

Plot Date: 05-DEC-2018 8:35:17 AM User: evcPW DesignScript: Carollo_Std_Pen_v0005.pen PlotScale: 2:1 ColorTable: gshade.ctb Model: Layout1 LAST SAVED BY: EWittner

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1.6.2 Sand Hollow

The Sand Hollow GWTP electrical and instrumentation design criteria will be similar to the Gunlock WTF, except it will receive 480-volt (V) electrical service from Dixie Power. As a reference, refer to Figure 1.28 for the one-line diagram and Figures 1.29 and 1.30 for preliminary P&IDs. WCWCD has determined that if there was a loss of power to the Sand Hollow GWTP, the associated wells feeding the GWTP would also be without power and do not have backup power associated with them. Because no water could be pumped to the GWTP, it was decided that providing a backup power generator at the GWTP is not needed at this time. Therefore, a backup power generator will not be included in the design.

1.7 Cost Estimate

This Section provides current cost estimate for each facility and compares the current estimate with previous cost estimates provided by prior planning documents.

1.7.1 Gunlock

In September of 2016, Carollo prepared and submitted Technical Memorandum No. 2 - Gunlock Arsenic Treatment Project / Pilot Analysis to the City of St. George, which included a cost estimate for a 6-mgd inline filtration system with pressure vessels similar to what is presented in this Preliminary Design Report.

The Gunlock total estimated project cost for the 6-mgd arsenic treatment facility in the 2016 memorandum was $11.4 million (M) and included two pressure vessels with dual media filters inside a masonry building, chemical storage and metering pumps, backwash storage tanks and pumps, solar drying facilities with a decant pump station, and electrical equipment including an emergency generator. The 2016 cost estimate is shown in Table 1.11. The probable project cost estimate for the Gunlock WTF as currently proposed is $12.8 M as summarized in Table 1.12.

The $1.4 M increase in cost between the 2016 cost estimate and the current cost estimate is a result of further developed process treatment details and added. These details include such items as cast-in-place concrete building construction, larger drying beds to accommodate sludge drying and potential water storage in winter months, concrete backwash tanks versus steel backwash tanks and single-cell flow control operation of the vessels for more operational control of the vessels. A bid market allowance is included estimating that the bid climate will be positive (multiple bidders) due to the current favorable economy however still including some allowance if the bidding turnout is lower than anticipated. The overall contingency was maintained at 20 percent at this bid level but will be lowered as the 60 percent cost estimate is formulated during design.

Costs for this report were developed according to the Association for the Advancement of Cost Engineering International (AACEI) Class 4 Budget Estimate, with a level of accuracy range of approximately plus 30 percent to minus 15 percent.

Table 1.11 2016 Cost Estimate for Gunlock WTF

Item		Total
Site Civil		$1,514,000
6 mgd Treatment Building		$2,189,000
Backwash Clarifier Tanks		$597,000
Decant Pump Station		$381,000
Solids Drying Beds		$1,377,000
Electrical and I&C	@ 20%	$1,212,000
HVAC	@ 5%	$273,000
Total Direct Cost		**$7,543,000**
Contingency	@ 20%	$1,509,000
Escalation to Mid-Point	@ 3%	$272,000
Bid Market Allowance	@ 20%	**$467,000**
Total Estimated Construction Cost		**$9,791,000**
Engineering, Legal & Admin	@ 16%	$1,567,000
Total Estimated Project Cost		**$11,358,000**

Table 1.12 Current Cost Estimate for Gunlock WTF

Item		Total
Site Civil		$1,548,000
6 mgd Treatment Building		$3,515,000
Backwash Clarifier Tanks		$652,000
Decant Pump Station		$48,000
Solids Drying Beds		$603,000
Electrical and I&C	@ 20%	$1,274,000
HVAC	@ 5%	$319,000
Total Direct Cost		**$7,956,000**
Contingency	@ 20%	$1,592,000
Escalation to Mid-Point	@ 3%	$287,000
Bid Market Allowance	@12%	$1,181,000
Total Estimated Construction Cost		**$11,019,000**
Engineering, Legal & Admin	@ 16%	$1,763,000
Total Estimated Project Cost		**$12,782,000**

1.7.2 Sand Hollow

Carollo prepared and submitted to WCWCD a Project Memorandum in October of 2016 as part of the West Dam Springs Water Treatment Plant Planning Level Cost Estimate which included a cost estimate for a 3-mgd inline filtration system with pressure vessels similar to what is presented in this Preliminary Design Report. However, that estimate was based on a 3-mgd capacity and did not include infrastructure for chlorinating higher flows or for future expansion to 6 mgd.

The 2016 Sand Hollow total estimated project cost for the 3-mgd arsenic treatment facility was $6.8 M and included a single pressure vessel with dual media filters inside a smaller building , chemical storage and metering pumps, backwash storage tanks and pumps, solar drying facilities with a decant pump station, and electrical equipment including an emergency generator. All of these components were estimated around a much smaller facility with no future infrastructure included for future expansion to 6 mgd. The 2016 cost estimate is shown in Table 1.13. The probable project cost estimate for the Sand Hollow GWTP as currently proposed is $9.7 M as summarized in Table 1.14.

The $2.9 M increase in cost between the 2016 cost estimate and the current cost estimate is a result of the inclusion of infrastructure necessary to expand the groundwater treatment plant to 6 mgd in the future in addition to further developed process treatment details and added flexibility. These details include larger drying beds to accommodate sludge drying and potential water storage in winter months, sand separators, a larger sodium hypochlorite on-site generation system, concrete paving, booster pumps to pump up to 1,000 gpm of treated water to the Dixie Springs tank, and single-cell flow control operation of the vessels for more operational control of the vessels. A bid market allowance is included estimating that the bid climate will be positive (multiple bidders) due to the current favorable economy however still including some allowance if the bidding turnout is lower than anticipated. The overall contingency was maintained at 20 percent at this bid level but will be lowered as the 60 percent cost estimate is formulated during design.

Table 1.13 2016 Cost Estimate for Sand Hollow GWTP

Item		Total
Site Civil		$524,000
3 mgd Treatment Building		$1,260,000
Backwash Clarifier Tank		$321,000
Decant Pump Station		$322,000
Solids Drying Beds		$358,000
Chlorination Facility		$608,000
Mob/DeMob	@9%	$528,000
Electrical and I&C	@ 20%	$785,000
HVAC	@ 4.5%	$177,000
Total Direct Cost		**$4,883,000**
Contingency	@ 20%	$977,000
Total Estimated Construction Cost		**$5,860,000**
Engineering, Legal & Admin	@ 16%	$938,000
Total Estimated Project Cost		**$6,798,000**

Table 1.14 Current Cost Estimate for Sand Hollow GWTP

Item		Total
Site Civil		$1,255,000
3 mgd Treatment Building		$2,556,000
Backwash Clarifier Tank		$530,000
Decant Pump Station		$48,000
Solids Drying Beds		$452,000
Electrical and I&C	@ 20%	$969,000
HVAC	@ 5%	$243,000
Total Direct Cost		**$6,054,000**
Contingency	@ 25%	$1,211,000
Escalation to Mid-Point	@ 3%	$218,000
Bid Market Allowance	@ 12%	$898,000
Total Estimated Construction Cost		**$8,380,000**
Engineering, Legal & Admin	@ 16%	$1,341,000
Total Estimated Project Cost		**$9,721,000**

The Sand Hollow GWTP has a lower cost estimate than the Gunlock WTF. Gunlock is more expensive primarily because it has two filter vessels instead of one, a larger site layout, two backwash clarifier tanks instead of one, and four drying beds instead of three. These additional costs are more significant than the additional cost at Sand Hollow associated with the additional pump station for the Dixie Springs tank as well as a more complex bypass system for the Sand Hollow well field.

Appendix A

ELECTRICAL LOAD STUDY REPORTS

LOAD STUDY REPORT

PROJECT INFORMATION

PROJECT	GUNLOCK WATER TREATMENT FACILITY DESIGN
CLIENT	CITY OF ST. GEORGE
PROJECT NUMBER	11185A10
REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:23 PM

EQUIPMENT INFORMATION

TAG	MCC		
DESCRIPTION	GUNLOCK	PHASE, WIRE, KASC	3PH, 3W, 65 KAIC KASC
LOCATION	TREATMENT BUILDING	LARGEST MOTOR	15HP
VOLTAGE	480	COMMENTS	
BUS AMPS	600		

LOAD TOTALS

OPERATING KVA	OPERATING AMPS
184.2	221.6

NEC 215 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
230.3	277.0

NEC 430 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
213.6	256.9

DEFINITIONS

OPERATING = CONTINUOUS + INTERMITTENT

NEC 215 EQUIPMENT SIZING = 1.25 x CONTINUOUS + 1.0 x INTERMITTENT (BASED ON NEC ARTICLE 215)

NEC 430 EQUIPMENT SIZING = 1.25 x LARGEST MOTOR + 1.0 x ALL OTHER MOTORS + 1.25 x CONTINUOUS NON-MOTOR + 1.0 x INTERMITTENT NON-MOTOR (BASED ON NEC ARTICLE 430)

EQUIPMENT SIZING IS BASED ON THE LARGER OF NEC 215 AND NEC 430 CALCULATIONS (LARGER IS HIGHLIGHTED WHEN APPLICABLE)

Note: For 3-phase busses that feed single -phase loads, the amp summation under loads will not match the bus amps due to the difference in voltage.

Note: The values in this report are rounded from higher precision numbers. Manually summing the values shown may yield slightly varied results due to rounding error.

SUBFED EQUIPMENT

TAG	DESCRIPTION	EQUIPMENT SIZE	EQUIPMENT UNITS	STATUS	OPERATING KVA	OPERATING AMPS	BUS COMMENTS
PP-1		100.0	AMPS	NEW	14.6	17.6	
PP-2		100.0	AMPS	NEW	14.6	17.6	
				OPERATING LOAD SUBFED SUBTOTAL	29.3	35.2	

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
	CHEMICAL PUMPS	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
BLO-01-01	AIR SCOUR BLOWER	15	HP	FVNR	DUTY / CONTINUOUS	NEW	17.5	21.0	
BUILDING LOADS	HVAC AND LIGHTING	100	KVA		DUTY / CONTINUOUS	NEW	100.0	120.3	
EAM-01-17	BYPASS FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-17	RUPTURE BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
PMP-01-01	FLASH MIX PUMP	3	HP	VFD-6	DUTY / CONTINUOUS	NEW	4.0	4.8	
PMP-01-02	FILTER DRAIN PUMP	2	HP	FVNR	DUTY / CONTINUOUS	NEW	2.8	3.4	
EDR-02-01	CLARIFIER 1 BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-02-02	CLARIFIER 2 BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
PMP-02-01	BWW RETURN PUMP	10	HP	FVNR	DUTY / CONTINUOUS	NEW	11.6	14.0	
PMP-02-02	BWW RETURN PUMP	10	HP	FVNR	DUTY / CONTINUOUS	NEW	11.6	14.0	
PMP-02-03	BWW RETURN PUMP	10	HP	FVNR	STANDBY	NEW	11.6	14.0	

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REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:23 PM

EQUIPMENT INFORMATION

TAG	MCC		
DESCRIPTION	GUNLOCK	**PHASE, WIRE, KASC**	3PH, 3W, 65 KAIC KASC
LOCATION	TREATMENT BUILDING	**LARGEST MOTOR**	15HP
VOLTAGE	480	**COMMENTS**	
BUS AMPS	600		

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
PMP-02-04	DECANT RETURN PUMP	2	HP	FVNR	DUTY / CONTINUOUS	NEW	2.8	3.4	
					OPERATING LOAD SUBTOTAL		166.6	200.4	

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PROJECT INFORMATION

PROJECT	GUNLOCK WATER TREATMENT FACILITY DESIGN
CLIENT	CITY OF ST. GEORGE
PROJECT NUMBER	11185A10
REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:23 PM

EQUIPMENT INFORMATION

TAG	PP-1		
DESCRIPTION		PHASE, WIRE, KASC	3PH, 3W, 65 KAIC KASC
LOCATION		LARGEST MOTOR	0HP
VOLTAGE	480	COMMENTS	
BUS AMPS	100		

LOAD TOTALS

OPERATING KVA	OPERATING AMPS
14.6	17.6

NEC 215 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
18.3	22.0

NEC 430 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
14.9	17.9

DEFINITIONS

OPERATING = CONTINUOUS + INTERMITTENT

NEC 215 EQUIPMENT SIZING = 1.25 x CONTINUOUS + 1.0 x INTERMITTENT (BASED ON NEC ARTICLE 215)

NEC 430 EQUIPMENT SIZING = 1.25 x LARGEST MOTOR + 1.0 x ALL OTHER MOTORS + 1.25 x CONTINUOUS NON-MOTOR + 1.0 x INTERMITTENT NON-MOTOR (BASED ON NEC ARTICLE 430)

EQUIPMENT SIZING IS BASED ON THE LARGER OF NEC 215 AND NEC 430 CALCULATIONS (LARGER IS HIGHLIGHTED WHEN APPLICABLE)

Note: For 3-phase busses that feed single -phase loads, the amp summation under loads will not match the bus amps due to the difference in voltage.

Note: The values in this report are rounded from higher precision numbers. Manually summing the values shown may yield slightly varied results due to rounding error.

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
EAM-01-01	PV 1 CELL 1 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-02	PV 1 CELL 2 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-03	PV 1 CELL 3 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-04	PV 1 CELL 4 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-09	PV 1 CELL 1 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-10	PV 1 CELL 2 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-11	PV 1 CELL 3 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-12	PV 1 CELL 4 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-01	PV 1 CELL 1 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-02	PV 1 CELL 2 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-03	PV 1 CELL 3 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-04	PV 1 CELL 4 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-09	PV 1 CELL 1 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-10	PV 1 CELL 2 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-11	PV 1 CELL 3 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-12	PV 1 CELL 4 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
					OPERATING LOAD SUBTOTAL		14.6	17.6	

Date/Time displayed in this report reflect time in PST

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PROJECT INFORMATION

PROJECT	GUNLOCK WATER TREATMENT FACILITY DESIGN
CLIENT	CITY OF ST. GEORGE
PROJECT NUMBER	11185A10
REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:23 PM

EQUIPMENT INFORMATION

TAG	PP-2		
DESCRIPTION		PHASE, WIRE, KASC	3PH, 3W, 65 KAIC KASC
LOCATION		LARGEST MOTOR	0HP
VOLTAGE	480	COMMENTS	
BUS AMPS	100		

LOAD TOTALS		NEC 215 EQUIPMENT SIZING		NEC 430 EQUIPMENT SIZING	
OPERATING KVA	OPERATING AMPS	EQUIPMENT KVA	EQUIPMENT AMPS	EQUIPMENT KVA	EQUIPMENT AMPS
14.6	17.6	18.3	22.0	14.9	17.9

DEFINITIONS

OPERATING = CONTINUOUS + INTERMITTENT

NEC 215 EQUIPMENT SIZING = 1.25 x CONTINUOUS + 1.0 x INTERMITTENT (BASED ON NEC ARTICLE 215)

NEC 430 EQUIPMENT SIZING = 1.25 x LARGEST MOTOR + 1.0 x ALL OTHER MOTORS + 1.25 x CONTINUOUS NON-MOTOR + 1.0 x INTERMITTENT NON-MOTOR (BASED ON NEC ARTICLE 430)

EQUIPMENT SIZING IS BASED ON THE LARGER OF NEC 215 AND NEC 430 CALCULATIONS (LARGER IS HIGHLIGHTED WHEN APPLICABLE)

Note: For 3-phase busses that feed single -phase loads, the amp summation under loads will not match the bus amps due to the difference in voltage.

Note: The values in this report are rounded from higher precision numbers. Manually summing the values shown may yield slightly varied results due to rounding error.

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
EAM-01-05	PV 2 CELL 1 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-06	PV 2 CELL 2 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-07	PV 2 CELL 3 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-08	PV 2 CELL 4 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-13	PV 2 CELL 1 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-14	PV 2 CELL 2 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-15	PV 2 CELL 3 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-16	PV 2 CELL 4 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-05	PV 2 CELL 1 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-06	PV 2 CELL 2 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-07	PV 2 CELL 3 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-08	PV 2 CELL 4 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-13	PV 2 CELL 1 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-14	PV 2 CELL 2 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-15	PV 2 CELL 3 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-16	PV 2 CELL 4 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
					OPERATING LOAD SUBTOTAL		14.6	17.6	

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LOAD STUDY REPORT

PROJECT INFORMATION

PROJECT	SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN
CLIENT	WASHINGTON COUNTY WATER CONSERVANCY DISTRICT
PROJECT NUMBER	11186A10
REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:38 PM

EQUIPMENT INFORMATION

TAG	MCC		
DESCRIPTION	SAND HOLLOW	**PHASE, WIRE, KASC**	3PH, 3W, 65 KAIC KASC
LOCATION	TREATMENT BUILDING	**LARGEST MOTOR**	15HP
VOLTAGE	480	**COMMENTS**	
BUS AMPS	600		

LOAD TOTALS

OPERATING KVA	OPERATING AMPS
184.2	221.6

NEC 215 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
230.3	277.0

NEC 430 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
213.6	256.9

DEFINITIONS

OPERATING = CONTINUOUS + INTERMITTENT

NEC 215 EQUIPMENT SIZING = 1.25 x CONTINUOUS + 1.0 x INTERMITTENT (BASED ON NEC ARTICLE 215)

NEC 430 EQUIPMENT SIZING = 1.25 x LARGEST MOTOR + 1.0 x ALL OTHER MOTORS + 1.25 x CONTINUOUS NON-MOTOR + 1.0 x INTERMITTENT NON-MOTOR (BASED ON NEC ARTICLE 430)

EQUIPMENT SIZING IS BASED ON THE LARGER OF NEC 215 AND NEC 430 CALCULATIONS (LARGER IS HIGHLIGHTED WHEN APPLICABLE)

Note: For 3-phase busses that feed single -phase loads, the amp summation under loads will not match the bus amps due to the difference in voltage.

Note: The values in this report are rounded from higher precision numbers. Manually summing the values shown may yield slightly varied results due to rounding error.

SUBFED EQUIPMENT

TAG	DESCRIPTION	EQUIPMENT SIZE	EQUIPMENT UNITS	STATUS	OPERATING KVA	OPERATING AMPS	BUS COMMENTS
PP-1		100.0	AMPS	NEW	14.6	17.6	
PP-2		100.0	AMPS	NEW	14.6	17.6	
				OPERATING LOAD SUBFED SUBTOTAL	29.3	35.2	

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
	CHEMICAL PUMPS	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
BLO-01-01	AIR SCOUR BLOWER	15	HP	FVNR	DUTY / CONTINUOUS	NEW	17.5	21.0	
BUILDING LOADS	HVAC AND LIGHTING	100	KVA		DUTY / CONTINUOUS	NEW	100.0	120.3	
EAM-01-17	BYPASS FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-17	RUPTURE BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
PMP-01-01	FLASH MIX PUMP	3	HP	VFD-6	DUTY / CONTINUOUS	NEW	4.0	4.8	
PMP-01-02	FILTER DRAIN PUMP	2	HP	FVNR	DUTY / CONTINUOUS	NEW	2.8	3.4	
EDR-02-01	CLARIFIER 1 BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-02-02	CLARIFIER 2 BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
PMP-02-01	BWW RETURN PUMP	10	HP	FVNR	DUTY / CONTINUOUS	NEW	11.6	14.0	
PMP-02-02	BWW RETURN PUMP	10	HP	FVNR	DUTY / CONTINUOUS	NEW	11.6	14.0	

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TAG	MCC		
DESCRIPTION	SAND HOLLOW	**PHASE, WIRE, KASC**	3PH, 3W, 65 KAIC KASC
LOCATION	TREATMENT BUILDING	**LARGEST MOTOR**	15HP
VOLTAGE	480	**COMMENTS**	
BUS AMPS	600		

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
PMP-02-03	BWW RETURN PUMP	10	HP	FVNR	STANDBY	NEW	11.6	14.0	
PMP-02-04	DECANT RETURN PUMP	2	HP	FVNR	DUTY / CONTINUOUS	NEW	2.8	3.4	
						OPERATING LOAD SUBTOTAL	166.6	200.4	

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REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:38 PM

EQUIPMENT INFORMATION

TAG	PP-1		
DESCRIPTION		PHASE, WIRE, KASC	3PH, 3W, 65 KAIC KASC
LOCATION	TREATMENT BUILDING	LARGEST MOTOR	0HP
VOLTAGE	480	COMMENTS	
BUS AMPS	100		

LOAD TOTALS

OPERATING KVA	OPERATING AMPS
14.6	17.6

NEC 215 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
18.3	22.0

NEC 430 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
14.9	17.9

DEFINITIONS

OPERATING = CONTINUOUS + INTERMITTENT

NEC 215 EQUIPMENT SIZING = 1.25 x CONTINUOUS + 1.0 x INTERMITTENT (BASED ON NEC ARTICLE 215)

NEC 430 EQUIPMENT SIZING = 1.25 x LARGEST MOTOR + 1.0 x ALL OTHER MOTORS + 1.25 x CONTINUOUS NON-MOTOR + 1.0 x INTERMITTENT NON-MOTOR (BASED ON NEC ARTICLE 430)

EQUIPMENT SIZING IS BASED ON THE LARGER OF NEC 215 AND NEC 430 CALCULATIONS (LARGER IS HIGHLIGHTED WHEN APPLICABLE)

Note: For 3-phase busses that feed single -phase loads, the amp summation under loads will not match the bus amps due to the difference in voltage.

Note: The values in this report are rounded from higher precision numbers. Manually summing the values shown may yield slightly varied results due to rounding error.

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
EAM-01-01	PV 1 CELL 1 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-02	PV 1 CELL 2 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-03	PV 1 CELL 3 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-04	PV 1 CELL 4 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-09	PV 1 CELL 1 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-10	PV 1 CELL 2 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-11	PV 1 CELL 3 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-12	PV 1 CELL 4 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-01	PV 1 CELL 1 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-02	PV 1 CELL 2 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-03	PV 1 CELL 3 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-04	PV 1 CELL 4 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-09	PV 1 CELL 1 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-10	PV 1 CELL 2 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-11	PV 1 CELL 3 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-12	PV 1 CELL 4 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
					OPERATING LOAD SUBTOTAL		14.6	17.6	

Date/Time displayed in this report reflect time in PST

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LOAD STUDY REPORT

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PROJECT INFORMATION

PROJECT	SAND HOLLOW GROUNDWATER TREATMENT PLANT DESIGN
CLIENT	WASHINGTON COUNTY WATER CONSERVANCY DISTRICT
PROJECT NUMBER	11186A10
REPORT BY	MARISSA PETTY
REPORT DATE	11/9/2018 1:38 PM

EQUIPMENT INFORMATION

TAG	PP-2		
DESCRIPTION		PHASE, WIRE, KASC	3PH, 3W, 65 KAIC KASC
LOCATION	TREATMENT BUILDING	LARGEST MOTOR	0HP
VOLTAGE	480	COMMENTS	
BUS AMPS	100		

LOAD TOTALS

OPERATING KVA	OPERATING AMPS
14.6	17.6

NEC 215 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
18.3	22.0

NEC 430 EQUIPMENT SIZING

EQUIPMENT KVA	EQUIPMENT AMPS
14.9	17.9

DEFINITIONS

OPERATING = CONTINUOUS + INTERMITTENT

NEC 215 EQUIPMENT SIZING = 1.25 x CONTINUOUS + 1.0 x INTERMITTENT (BASED ON NEC ARTICLE 215)

NEC 430 EQUIPMENT SIZING = 1.25 x LARGEST MOTOR + 1.0 x ALL OTHER MOTORS + 1.25 x CONTINUOUS NON-MOTOR + 1.0 x INTERMITTENT NON-MOTOR (BASED ON NEC ARTICLE 430)

EQUIPMENT SIZING IS BASED ON THE LARGER OF NEC 215 AND NEC 430 CALCULATIONS (LARGER IS HIGHLIGHTED WHEN APPLICABLE)

Note: For 3-phase busses that feed single -phase loads, the amp summation under loads will not match the bus amps due to the difference in voltage.

Note: The values in this report are rounded from higher precision numbers. Manually summing the values shown may yield slightly varied results due to rounding error.

LOADS

TAG	DESCRIPTION	LOAD VALUE	LOAD UNITS	STARTING METHOD	LOAD DESIGNATION	LOAD STATUS	OPERATING KVA	OPERATING AMPS	COMMENTS
EAM-01-05	PV 2 CELL 1 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-06	PV 2 CELL 2 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-07	PV 2 CELL 3 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-08	PV 2 CELL 4 FILTER EFFLUENT FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-13	PV 2 CELL 1 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-14	PV 2 CELL 2 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-15	PV 2 CELL 3 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EAM-01-16	PV 2 CELL 4 BWW FCV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-05	PV 2 CELL 1 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-06	PV 2 CELL 2 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-07	PV 2 CELL 3 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-08	PV 2 CELL 4 FILTER INLET BFV	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-13	PV 2 CELL 1 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-14	PV 2 CELL 2 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-15	PV 2 CELL 3 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
EDR-01-16	PV 2 CELL 4 AIR SCOUR INLET	1/2	HP	FVNR	DUTY / CONTINUOUS	NEW	0.9	1.1	
					OPERATING LOAD SUBTOTAL		14.6	17.6	

Date/Time displayed in this report reflect time in PST

Appendix B

REQUIRED HEAD CALCULATIONS

Well 1

Friction Losses	
Pipe Label	Headloss (ft)
P26	0.2
P14	3.5
P18	2.1
P24	0.4
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	23.1
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3484
Desired Pressure at High Point	5 psi
Total Elevation Head	73.2
Head Loss Through Treatment Plant (ft)	0
Total Req'd Head at Ground Surface of Well (ft)	97

Well 2

Friction Losses	
Pipe Label	Headloss (ft)
P25	0.4
P17	2.4
P15	3.8
P11	6.3
Total Friction Head	12.9
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3581
Desired Pressure at High Point	5 psi
Total Elevation Head	-23.8
Head Loss Through Treatment Plant (ft)	0
Total Req'd Head at Ground Surface of Well (ft)	0

Well 3	
Friction Losses	
Pipe Label	Headloss (ft)
P19	1.6
P18	2.1
P24	0.4
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	21.0
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3447
Desired Pressure at High Point	5 psi
Total Elevation Head	110.2
Head Loss Through Treatment Plant (ft)	0
Total Req'd Head at Ground Surface of Well (ft)	132

Well 4	
Friction Losses	
Pipe Label	Headloss (ft)
P8	7.5
P14	3.5
P18	2.1
P24	0.4
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	30.4
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3449
Desired Pressure at High Point	5 psi
Total Elevation Head	108.2
Head Loss Through Treatment Plant (ft)	0
Total Req'd Head at Ground Surface of Well (ft)	139

Well 5	
Friction Losses	
Pipe Label	Headloss (ft)
P16	3.8
P5	12.7
P6	11.6
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	45.0
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3445
Desired Pressure at High Point	5 psi
Total Elevation Head	112.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	183

Well 6	
Friction Losses	
Pipe Label	Headloss (ft)
P9	6.9
P17	2.4
P15	3.8
P11	6.3
Total Friction Head	19.4
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3601
Desired Pressure at High Point	5 psi
Total Elevation Head	-43.8
Head Loss Through Treatment Plant (ft)	0
Total Req'd Head at Ground Surface of Well (ft)	0

Well 7	
Friction Losses	
Pipe Label	Headloss (ft)
P20	1.1
P6	11.6
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	29.6
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3488
Desired Pressure at High Point	5 psi
Total Elevation Head	69.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	124

Well 8	
Friction Losses	
Pipe Label	Headloss (ft)
P22	1.0
P7	10.5
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	28.4
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3454
Desired Pressure at High Point	5 psi
Total Elevation Head	103.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	157

Well 9	
Friction Losses	
Pipe Label	Headloss (ft)
P23	0.6
P5	12.7
P6	11.6
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	41.8
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3480
Desired Pressure at High Point	5 psi
Total Elevation Head	77.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	144

Well 10	
Friction Losses	
Pipe Label	Headloss (ft)
P13	5.6
P3	27.9
P6	11.6
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	62.0
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3468
Desired Pressure at High Point	5 psi
Total Elevation Head	89.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	177

Well 11	
Friction Losses	
Pipe Label	Headloss (ft)
P4	22.0
P3	27.9
P6	11.6
P10	6.8
P15	3.8
P11	6.3
Total Friction Head	78.4
Elevation Head	
Pipe Line High Point	3555
Well Ground Elevation	3484
Desired Pressure at High Point	5 psi
Total Elevation Head	73.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	177

Well 5	
Friction Losses	
Pipe Label	Headloss (ft)
P18	2.2
P19	1.1
P8	0.3
P6	11.7
Total Friction Head	15.2
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	3015.5
Desired Pressure at High Point	5 psi
Total Elevation Head	93.7
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	134

Well 6	
Friction Losses	
Pipe Label	Headloss (ft)
P1	0.0
P19	1.1
P8	0.3
P6	11.7
Total Friction Head	13.1
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	3023.5
Desired Pressure at High Point	5 psi
Total Elevation Head	85.7
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	124

Well 10	
Friction Losses	
Pipe Label	Headloss (ft)
P14	0.9
P12	1.1
P8	0.3
P6	11.7
Total Friction Head	14.0
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	3018
Desired Pressure at High Point	5 psi
Total Elevation Head	91.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	131

Well 11	
Friction Losses	
Pipe Label	Headloss (ft)
P13	1.2
P4	2.8
P9	0.2
P12	1.1
P8	0.3
P6	11.7
Total Friction Head	17.3
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	2975
Desired Pressure at High Point	5 psi
Total Elevation Head	134.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	177

Well 12	
Friction Losses	
Pipe Label	Headloss (ft)
P15	0.2
P2	1.5
P3	3.6
P4	2.8
P9	0.2
P12	1.1
P8	0.3
P6	11.7
Total Friction Head	21.4
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	2970
Desired Pressure at High Point	5 psi
Total Elevation Head	139.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	186

Well 13	
Friction Losses	
Pipe Label	Headloss (ft)
P11	1.7
P3	3.6
P4	2.8
P9	0.2
P12	1.1
P8	0.3
P6	11.7
Total Friction Head	21.4
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	2985
Desired Pressure at High Point	5 psi
Total Elevation Head	124.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	171

Well 15	
Friction Losses	
Pipe Label	Headloss (ft)
P10	0.3
P2	1.5
P3	3.6
P4	2.8
P9	0.2
P12	1.1
P8	0.3
P6	11.7
Total Friction Head	21.4
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	3005
Desired Pressure at High Point	5 psi
Total Elevation Head	104.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	151

Well 17	
Friction Losses	
Pipe Label	Headloss (ft)
P7	2.7
P6	11.7
Total Friction Head	14.4
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	3027
Desired Pressure at High Point	5 psi
Total Elevation Head	82.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface of Well (ft)	122

West Dam Springs to 2 MG Tank

Friction Losses	
Pipe Label	Headloss (ft)
P17	0.5
Total Friction Head	0.5
Elevation Head	
Full Tank Elevation	3158
Well Ground Elevation	3027
Desired Pressure at High Point	5 psi
Total Elevation Head	133.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface (ft)	159

West Dam Springs to SHRP

Friction Losses	
Pipe Label	Headloss (ft)
P16	0.0
P6	11.7
Total Friction Head	11.7
Elevation Head	
Pipe Line High Point	3107
Well Ground Elevation	3027
Desired Pressure at High Point	5 psi
Total Elevation Head	82.2
Head Loss Through Treatment Plant (ft)	25
Total Req'd Head at Ground Surface (ft)	119

WaterGEMS Headloss Calculations

Label	Length (ft)	Start Node	Stop Node	Diameter (inches)	Hazen Williams	Flow (gpm)	Velocity (ft/s)	Headloss (ft)
P1	11,422	J13	Gunlock Tank	18	130	3,819	4.81	48
P2	11,402	J12	Gunlock Tank	20	130	5,042	5.15	48
P3	1,896	J6	J1	10	130	1,600	6.54	27.9
P4	5,407	Well 11	J6	10	130	800	3.27	22
P5	866	J3	J1	10	130	1,600	6.54	12.7
P6	5,633	J1	J11	14	130	1,339	2.79	11.6
P7	4,744	J4	J11	20	130	3,561	3.64	10.5
P8	877	Well 4	J8	10	130	1,190	4.86	7.5
P9	1,841	Well 6	J2	8	130	425	2.71	6.9
P10	730	J11	J7	20	130	7,756	7.92	6.8
P11	1,496	J10	J12	20	130	5,042	5.15	6.3
P12	1,495	J10	J13	18	130	3,819	4.81	6.3
P13	464	Well 10	J6	8	130	800	5.11	5.6
P14	2,291	J8	J5	18	130	2,210	2.79	3.5
P15	2,313	J7	J10	30	130	8,861	4.02	3.8
P16	941	Well 5	J3	10	130	800	3.27	3.8
P17	5,772	J2	J7	18	130	1,105	1.39	2.4
P18	844	J5	J9	18	130	2,856	3.6	2.1
P19	194	Well 3	J5	8	130	646	4.12	1.6
P20	342	Well 7	J1	10	130	700	2.86	1.1
P21	893	J1	J4	20	130	2,561	2.62	1.1
P22	156	Well 8	J4	10	130	1,000	4.08	1
P23	52	Well 9	J3	8	130	800	5.11	0.6
P24	290	J9	J11	20	130	2,856	2.92	0.4
P25	2,086	Well 2	J2	18	130	680	0.86	0.4
P26	598	Well 1	J8	18	130	1,020	1.29	0.2