BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER SYSTEM
MASTER PLAN

U.S. DEPARTMENT OF AGRICULTURE – RURAL DEVELOPMENT

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY
SRF GRANT PROJECT NUMBER WWG-354-2012-10

December 2015

J-U-B Project No. 60-12-022

J·U·B ENGINEERS, INC.

Prepared by:
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STATE OF IDAHO
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BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

CHAPTER 1: INTRODUCTION

1.0 INTRODUCTION

1.1 PURPOSE AND NEED OF STUDY

The Bruneau Water and Sewer District has recently become aware of the need to evaluate the existing sewer treatment system. Sanitary flows from the community and effluent from the community's new water treatment plant have filled the community's existing wastewater treatment lagoon, requiring land application to prevent overflow of the lagoon. The District is uncertain of the capacity of the existing lagoon and slow-rate land application site to handle the additional flows from the water treatment plant. There is a second lagoon at the waste treatment location that is no longer in use. The District received a Wastewater Reuse Permit from IDEQ in 2009; however, they do not have sufficient effluent to grow a crop as required in the permit. The current lagoon with the slow-rate application site restricts the District to little or no growth. The existing lagoon is aging and there is no backup should any leaks or problems develop. The District needs to determine their options to bring the system in full compliance with their permits and to allow for population growth within the service area.

The District is aware of the potential detrimental health effects of the current system and the hindrance to their vitality and growth. Therefore, in 2012, the District authorized J-U-B ENGINEERS, Inc. (J-U-B) to develop a Wastewater System Master Plan to develop the sewer system alternatives necessary to address community development and to meet regulatory requirements.

1.2 SCOPE OF STUDY

In general, the Wastewater System Master Plan will provide the following:

- Delineate the boundaries of the Planning Area that can physically and economically be served by the wastewater system.
- Describe the existing environment and area within the Planning Area.
- Discuss the existing wastewater systems, including their condition and capacity.
- Project future population growth within the Planning Area for a 20-year planning period.
- Forecast future wastewater flows and waste loads over the 20-year planning period.
- Identify and describe the wastewater facilities needs over the 20-year planning period.
- Develop and evaluate improvement alternatives, including the "No Action" alternative, to allow the wastewater collection and treatment facilities to meet existing and future needs.
- Compare the improvement alternatives, potentially including economics, environmental impacts, energy use, reliability and implementability.
- Select and recommend the preferred improvement alternative(s) that best meets the needs of the Bruneau Water and Sewer District.

- Describe the selected improvements and provide justification for their implementation.

- Provide preliminary engineering design of the selected improvements, including energy requirements and environmental impacts.

- Develop an opinion of probable capital and operation and maintenance (O&M) costs for the improvements, including an evaluation of the user charge rates.

- Develop an implementation plan for the selected improvements.

- Discussing funding alternatives and financing options (loans, grants, Local Improvement District, bonding, etc.) for the selected improvements.

- Provide for public participation throughout the preliminary engineering process.

1.3 REPORT ORGANIZATION

The report is organized into six chapters based on the United States Department of Agriculture Rural Utilities Service Bulletin 1780-3 "Preliminary Engineering Report-Wastewater Facilities" and the aforementioned Scope of Study. The chapters include:

- Chapter 1 - Introduction
- Chapter 2 – Existing Conditions
- Chapter 3 – Future Conditions
- Chapter 4 – Development and Initial Screening of Alternatives
- Chapter 5 – Present Worth Analysis
- Chapter 6 – Implementation of Improvement Projects

A further breakdown on the organization of the Wastewater Master Plan is provided in the Table of Contents, Appendices, List of Tables and List of Figures.

1.4 COST OPINIONS

The cost opinions contained in this report are in 2015 dollars and may need to be inflated for the actual year of construction if implementation of the recommended improvements is delayed. The costs of most construction materials have varied dramatically in the past few years. The effect of the current economic downturn will have on construction cost is unknown. This volatility in the market and pricing of construction materials makes estimating future construction costs difficult.

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

CHAPTER 2: EXISTING CONDITIONS

2.0 EXISTING CONDITIONS

2.1 PLANNING AREA IDENTIFICATION

The Bruneau Water and Sewer District is located in southwestern Idaho in the eastern portion of Owyhee County (**see Figure 2-1**). It is situated in a predominantly agricultural region along State Highway 51 approximately 4 miles south of the Snake River and three-quarters mile east of the Bruneau River. The District falls within Sections 24 and 25 of Township 6 South, Range 5 East and Sections 19 and 30 of Township 6 South, Range 6 East of the Boise Meridian.

This Wastewater System Master Plan is based on a specific Planning Area which represents a geographical area and population that the District can reasonably be expected to serve within a 20-year design period from 2013 to 2033. Sufficient land is included in the Planning Area to accommodate the forecasted residential, commercial and industrial growth, and to allow some flexibility for future development of the community.

Figure 2-2 shows the Planning Area and existing Bruneau Sewer District boundary. The Planning Area includes the existing boundary. No other additional property was included due to the sparse development within the Planning Area that provides ample space for future growth through the 20-year planning period.

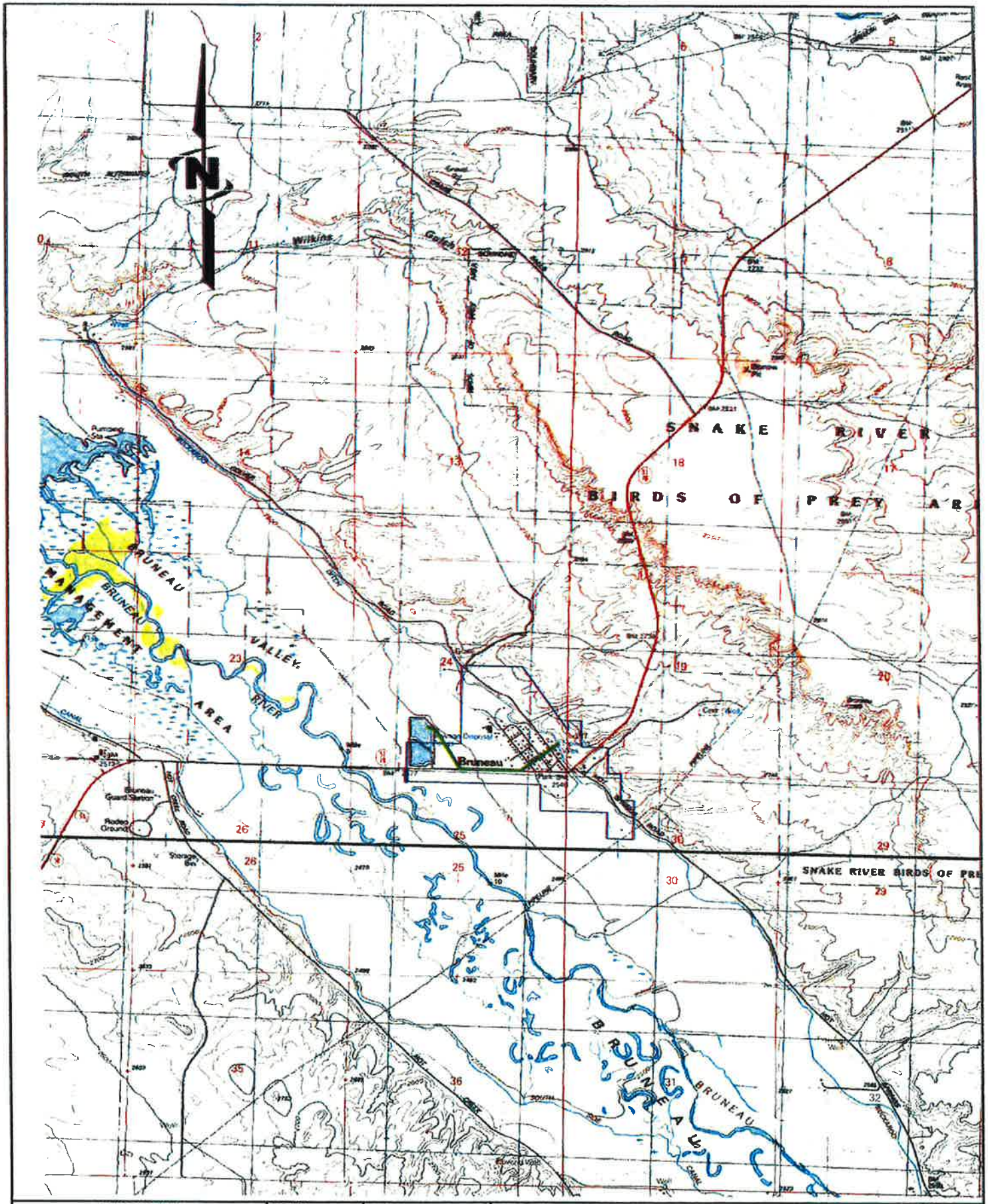
2.2 EXISTING PLANNING AREA CONDITIONS

2.2.1 Topography, Geology and Soils

The topography of the Bruneau Water and Sewer District Planning Area is depicted on the U.S. Geologic Survey (USGS) topographic map shown in **Figure 2-2**. As shown on the map, the Planning Area consists of relatively flat land with a general slope to the southwest with the base of the Bruneau Valley slope along the northeast boundary of the District. The ground surface elevation across the Planning Area ranges from approximately 2480 to 2675 feet above mean sea level.

The Bruneau Water and Sewer District is located within the Snake River Plain, a major late Cenozoic tectonic/volcanic plain that extends across southern Idaho for roughly 300 miles in a crescent shape. The plain is divided into two main sections identified as the Western and Eastern Snake River Plain that meet near Hagerman, Idaho. The Bruneau District Planning Area is located within the Western Snake River Plain.

According to Idaho State University, the Western Snake River Plain is a north-northwest trending 10-million year old basin bounded by normal faults. It is filled with thick sequences of basalt lava, sediments of Lake Idaho, and stream deposits derived from the Idaho batholith to the north and the Owyhee Mountains to the south. The arms of the crescent shape of the Snake River Plain appear to have been strongly shaped by extension of the crust on the North American Plain during the past 17 million years. The rocks in Owyhee County are rhyolitic tuffs and ash flows of the Idavada Volcanic Group and fluvial and lacustrine sediments with interbedded basalt flows of the Idaho Group.



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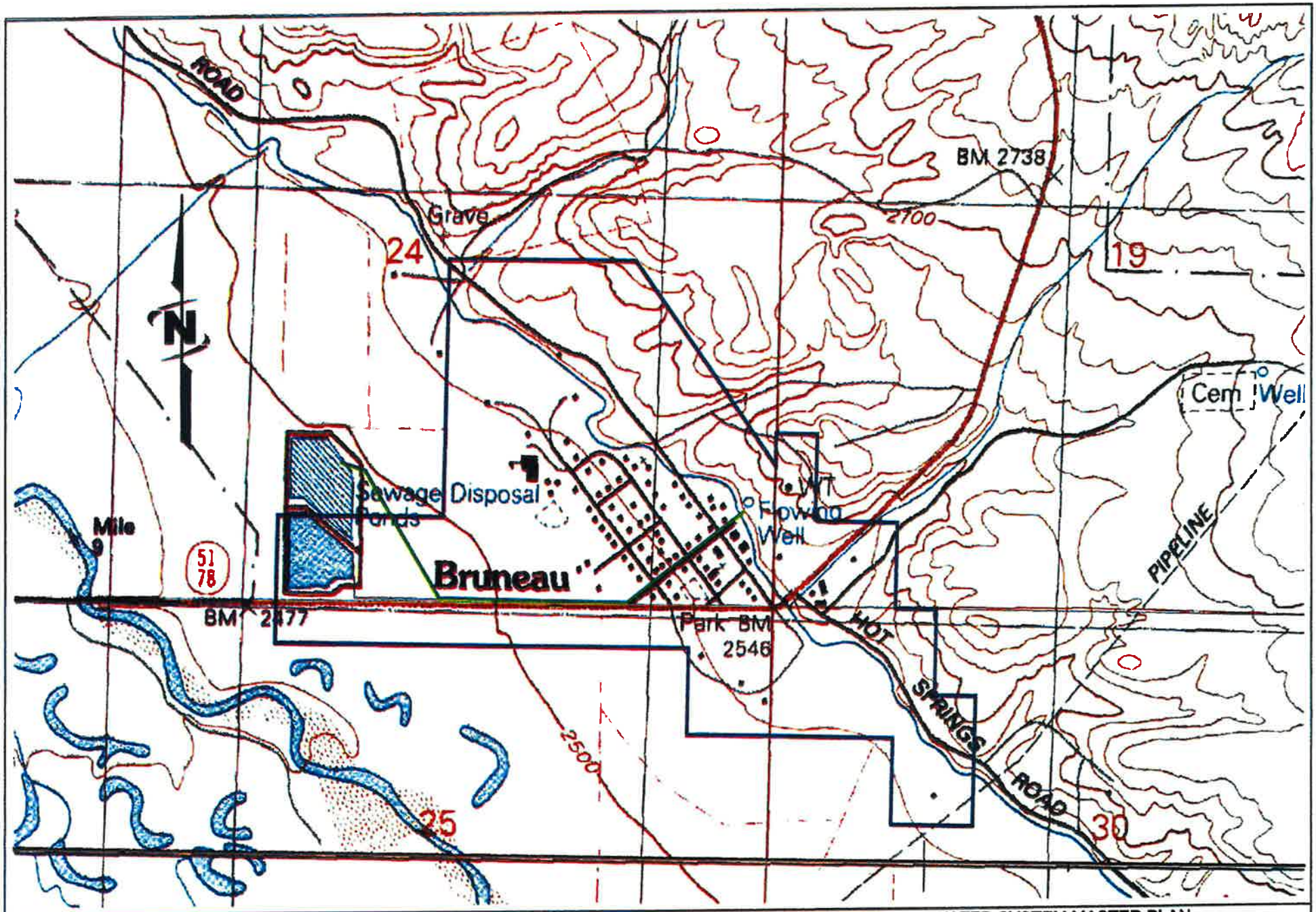
WASTEWATER MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 2-1
VICINITY MAP

SHEET 1



WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 2-2
DISTRICT BOUNDARIES

JUB
J-U-B ENGINEERS, INC.

The National Resources Conservation Service (NRCS) soil survey map of the Bruneau area is shown in **Figure 2-3**. These soil types are primarily suitable for irrigated cropland and rangeland. **Table 2-1** summarizes various qualitative and quantitative characteristics of the predominant soil types in the Planning Area.

Table 2-1. Soil Characteristics

Soil Map Unit	Description	Slope	Depth Class	Drainage Class	Permeability	Available Water Capacity	Potential Rooting Depth	Runoff
11	Bram silt loam	1 - 2%	Very Deep	Somewhat Poorly Drained	Moderately Slow	Moderate	36 - 60 in.	Slow
52	Dors-Loray complex	0 - 4%	Very Deep	Well Drained	Moderately rapid	Low	60+ in.	Slow
65	Garbutt silt loam	0 - 4%	Very Deep	Well Drained	Moderate	High	60+ in.	Slow
99	Loray-Dors complex	8 - 20%	Very Deep	Excessively Drained	Moderately Rapid	Low	60+ in.	Medium
100	Mazuma fine sandy loam	0 - 4%	Very Deep	Well Drained	Moderately Rapid	Moderate	60+in.	Slow
164	Typic Torriorthents-Badlands Complex	20 -70%	Shallow to Deep	Well Drained	Slow	Low to High	10 - 60 in.	Rapid

2.2.2 Surface and Groundwater Hydrology

The primary surface water body within the Bruneau Planning Area is the Buckaroo Ditch. This lateral runs from southeast to northwest through the boundary of the Planning Area. Water is provided to the Buckaroo Ditch from the Bruneau River from the diversion point located approximately 8 miles southeast of the District. The Bruneau River passes by the southwest corner of the District.

The source of groundwater in Bruneau is the Bruneau - Grandview Aquifer. This aquifer holds water within sedimentary sequences of unconsolidated to consolidated clay, silt, sand and gravel, basalts of the Banbury and Bruneau Formations and, at depth, silicic volcanics. The system is recharged by drainage from the Owyhee Mountains to the south, and direct infiltration of precipitation into the silicic volcanics, where exposed in the uplands. The average groundwater level in the Planning Area is approximately 26 feet below the ground surface (based on well log information in the area). Groundwater flow direction is generally northwest along the Bruneau River.

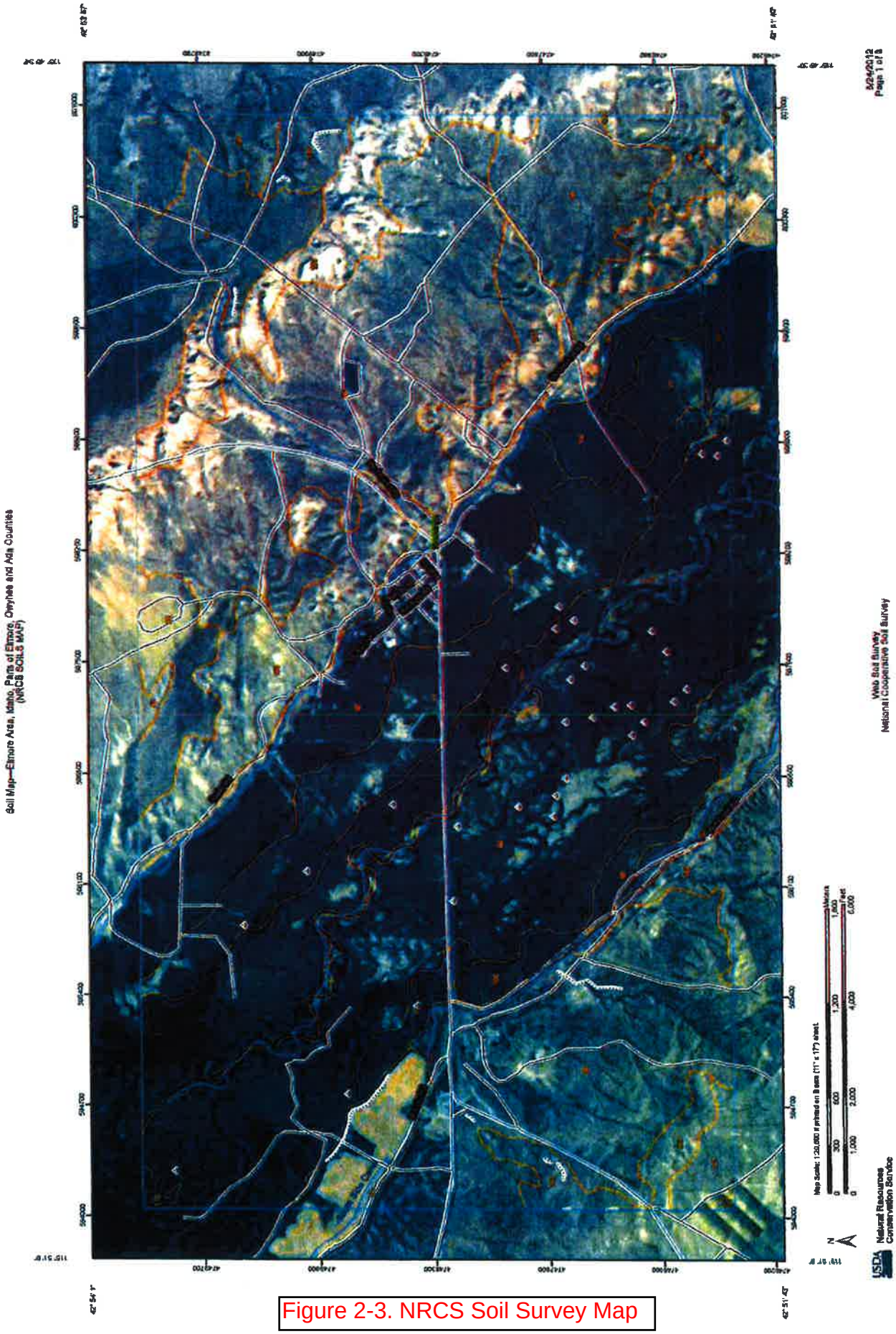


Figure 2-3. NRCS Soil Survey Map

2.2.3 Climate, Precipitation, Temperature and Prevailing Winds

Bruneau has a semi-arid climate typical of southern Idaho. **Table 2-2** summarizes historical temperature, precipitation, snowfall and evaporation data for the Planning Area. Winter weather is characterized by alternating high and low pressure systems that bring associated inclement or clear conditions. January is historically the coldest month with an average temperature of approximately 28.0°F. Most of the annual precipitation falls as snow during the winter months. Summer weather is normally dry with warm to hot temperatures. July is historically the warmest month with an average temperature of approximately 73.4°F. The warm summer temperatures combine with low relative humidity to produce an annual evaporation rate of approximately 40 inches. The prevailing wind direction in the area is from the west to southwest, and the average wind speed is approximately 5 to 7 mph. Tornadoes and funnel clouds are rare, as are destructive force winds.

Table 2-2. Monthly Climatic Data

Month	Mean Temperature[1] (°F)	Average Precipitation[2] (in)	Average Snowfall[1] (in)	Mean Evaporation[2] (in)
January	34.2	0.87	1.7	0.00
February	39.2	0.57	0.7	0.00
March	47.4	0.74	0.3	0.00
April	53.9	0.84	0.0	5.24
May	61.8	0.85	0.0	6.34
June	69.7	0.84	0.0	6.48
July	77.2	0.18	0.0	6.82
August	75.7	0.23	0.0	5.96
September	65.8	0.42	0.0	4.56
October	54.4	0.54	0.0	3.73
November	42.3	0.87	0.4	0.73
December	33.4	0.74	0.74	0.00
Annual	**54.7**	**7.69**	**4.2**	**39.87**

1 Western Regional Climatic Center - monitoring station Bruneau (1981 – 2010) (www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?id1195).
2 Western Regional Climatic Center - monitoring station Parma (1922 – 2005) (www.wrcc.dri.edu/htmlfiles/westevap.final.html)
Modified by comparing ET rates for Parma and Bruneau (www.data.kimberly,uidaho,edu/ETIdaho) and applying evaporation pan coefficients for mean monthly temperatures.

2.2.4 Plants, Animals and Natural Communities

Plants and animals in the Bruneau area are typical of those found in south central Idaho. Vegetation consists of a variety of trees, shrubs and grasses. Trees common to the area include evergreen, birch, maple, locust, poplar, russian olive and willows. The dominant vegetation in the area is sagebrush, fescue and wheatgrass.

Migratory wildlife, many of which are avian species, use the area seasonally. Common upland game birds in the area include pheasants, partridge, quail and Sage Grouse. Waterfowl such as geese and ducks are often found concentrated along the surface water bodies. Raptors such as hawks, eagles and owls are also found in the area.

Animals commonly found in the vicinity of the District include squirrels, rock chuck, fox, skunks and coyote. Big game habitat is found near the Planning Area within the undeveloped sagebrush rangeland. Deer, antelope, and a limited number of elk have been sited in the area. Fish common to the area include trout, bass, perch, catfish and crappie.

Endangered species listed under the Endangered Species Act of 1973 for Owyhee County include the Columbia Spotted frog, Greater Sage-Grouse, Yellow-Billed Cuckoo, Bull trout, Bruneau Hot Springsnail, Snake River Physa snail and Slickspot peppergrass.

2.2.5 Air Quality and Noise

EPA has developed standards for monitoring and protecting air quality. IDEQ is responsible for implementing, monitoring and enforcing the air quality standards within Idaho. An area that exceeds the air quality standards is considered to be a "non-attainment area" (NAA) for a particular component, or total air quality. There are currently four NAAs in Idaho, the closest being the Northern Ada County and Portneuf Valley NAAs. As such, the Bruneau Planning Area is currently not located within a NAA.

Residents in Bruneau generally feel that air quality is excellent and cite this amenity as one of the area's quality of life factors. Bruneau is well removed from any major urbanized areas and there are very few sources of pollution in the immediate vicinity. Local automobile emissions, agricultural activities, light commercial and industrial processing are the primary contributors to air quality degradation. Additionally, high levels of particulate matter may be experienced during certain weather events, or during certain times of the agricultural season due to farming practices.

The U.S. Department of Housing and Urban Development (HUD) has developed criteria to assess noise levels and degree of undesirability. For analytical purposes, HUD uses the day night sound level (LDN) system. The LDN describes the cumulative noise exposure from all events over a 24-hour period, weighted by the addition of 10 decibels for noise events occurring between 10 p.m. and 7 a.m. This provides a measurement of the overall noise climate of an area. Areas with an LDN below 65 decibels (dBA) are considered to be acceptable for residential land use. Within the Bruneau Planning Area, State Highway 51/78 is an area that may potentially be subject to an LDN assessment.

2.2.6 Energy Consumption and Production

A majority of the population in the Planning Area consumes energy in the form of electricity, propane and/or fuel oil. A few residents may also use wood or pellet stoves for heating purposes. There is no known energy producing facilities within the Planning Area. The nearest electrical production facilities are the hydroelectric facilities at the C.J. Strike Dam and Swan Falls Dam on the Snake River.

2.2.7 Land Use and Development

Land use within the Planning Area is predominantly residential, with smaller areas of commercial development. Residential areas are located throughout the Planning Area, while commercial areas are primarily located along State Highway 51/78. The Bruneau School teaches kindergarten through 6th grade and is within the Planning Area.

The area surrounding the City and Planning Area is predominantly used for agricultural purposes. The fertile soils combined with irrigation water from the Buckaroo Ditch allow for the production of a wide

variety of crops, including small grains, corn, dry beans, sugar beets, potatoes, melons, irrigated pasture and alfalfa. The dry rangeland is used for sheep and cattle grazing.

2.2.8 Cultural Resources

The townsite of Bruneau was created in the early 1880's to serve the ranch operations that began in the area in the 1860's and 1870's. The Historic Preservation Office (HPO) of the Idaho State Historical Society was consulted regarding cultural resources in Bruneau. One building is listed on the HPO's National Register of Historic Places in Idaho for the Bruneau Planning Area which is the Bruneau Episcopal Church located off of Highway 51.

It is anticipated that prior to the upgrade of the wastewater system, Native American tribes with historical ties to the Planning Area (i.e., Shoshone-Paiute Tribe, Shoshone-Bannock Tribe, etc.) will be consulted regarding Native American cultural resources in the area.

2.2.9 Economic and Social Profile

The area's economy is based primarily on the agricultural and service industries. Some of the businesses located within the Planning Area include restaurants, gas stations and convenience stores. A large agricultural fertilizer and chemical dealer facility is located west of the Planning Area along Highway 78. The area also provides for various recreational opportunities that support the local economy, including boating, fishing, swimming, water-skiing, hunting, camping and hiking. The U.S. Census Bureau does not provide data for the District alone. The Census data for the Bruneau CCD, which is the Owyhee County subdistrict where the Sewer and Water District is located, should be representative of the District information. **Table 2-3** summarizes a social profile for the Bunreau CCD.

2.2.10 Public Utilities and Services

The District is serviced by a full complement of public utilities and services. These services are intended for permanent and seasonal residents of Bruneau and the immediate surrounding county residents. Some of the public utilities and services offered within the area include:

- Water
- Fire and Police Protection
- Communication Systems
- Post Office
- Power/Electric Services
- Solid Waste Disposal
- Health Care Facilities
- Public Schools
- Meeting Facilities
- Transportation Services
- Recreational Facilities
- Government

2.2.11 Flood Plains and Wetlands

The Federal Emergency Management Agency (FEMA) flood zone map website (www.gis1.fema.gov/servlet/com.esri.esrimap) indicates that the Bruneau area has not been mapped.

The U.S. Fish and Wildlife Service's National Wetlands Inventory provides mapping of wetlands across the United States. The basic criteria that define wetland types are water depth and permanence, water chemistry, life form of vegetation and dominant plant species. As shown in **Figure 2-4**, there is one small wetland area in the Planning Area that has resulted from surface irrigation and drainage in the area. The area along the Bruneau River located south and west of the District is classified as freshwater emergent, freshwater forested/shrub and riverine wetlands.

Table 2-3. Social Profile[1]

Parameter	Value
Sex	
Male	335
Female	294
Total Population	629
Age	
Under 5 Years	63
5 to 9 Years	32
10 to 14 Years	40
15 to 19 Years	42
20 to 24 Years	31
25 to 34 Years	85
35 to 44 Years	67
45 to 54 Years	73
55 to 59 Years	51
60 to 64 Years	39
65 to 74 Years	69
75 to 84 Years	29
85 Years and Over	8
Median Age	37.6
Race	
White alone	436
Hispanic or Latino	164
African-American alone	0
American Indian and Alaska Native alone	16
Some other race alone	5
Two or more races	8
Housing	
Total Housing Units	353
Occupied Housing Units	243
Vacant Housing Units	110
Home Owner Vacancy Rate (%)	0.0
Rental Vacancy Rate (%)	1.9
Average Household Size (People/Household)	2.41

1. Data from 2010 U.S. Census.

2.2.12 Wild and Scenic Rivers

The Wild and Scenic Rivers Act, as promulgated by Congress on October 2, 1968, states that "…certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values, shall be protected for the benefit and enjoyment of present and future generations." None of the surface water bodies within the Bruneau Planning Area are currently classified as wild and/or scenic under this Act.

2.2.13 Prime Agricultural Lands

Prime farmland, as defined by the 1978 EPA Policy to Protect Environmentally Significant Agricultural Lands, has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops, and is available for these uses. According the NRCS, soils within the Bruneau area that may be considered "prime or unique" farmland if irrigated include Bram silt loam (11), Garbutt silt loam (65) and Mazuma fine sandy loam (100) (**see Figure 2-3**).

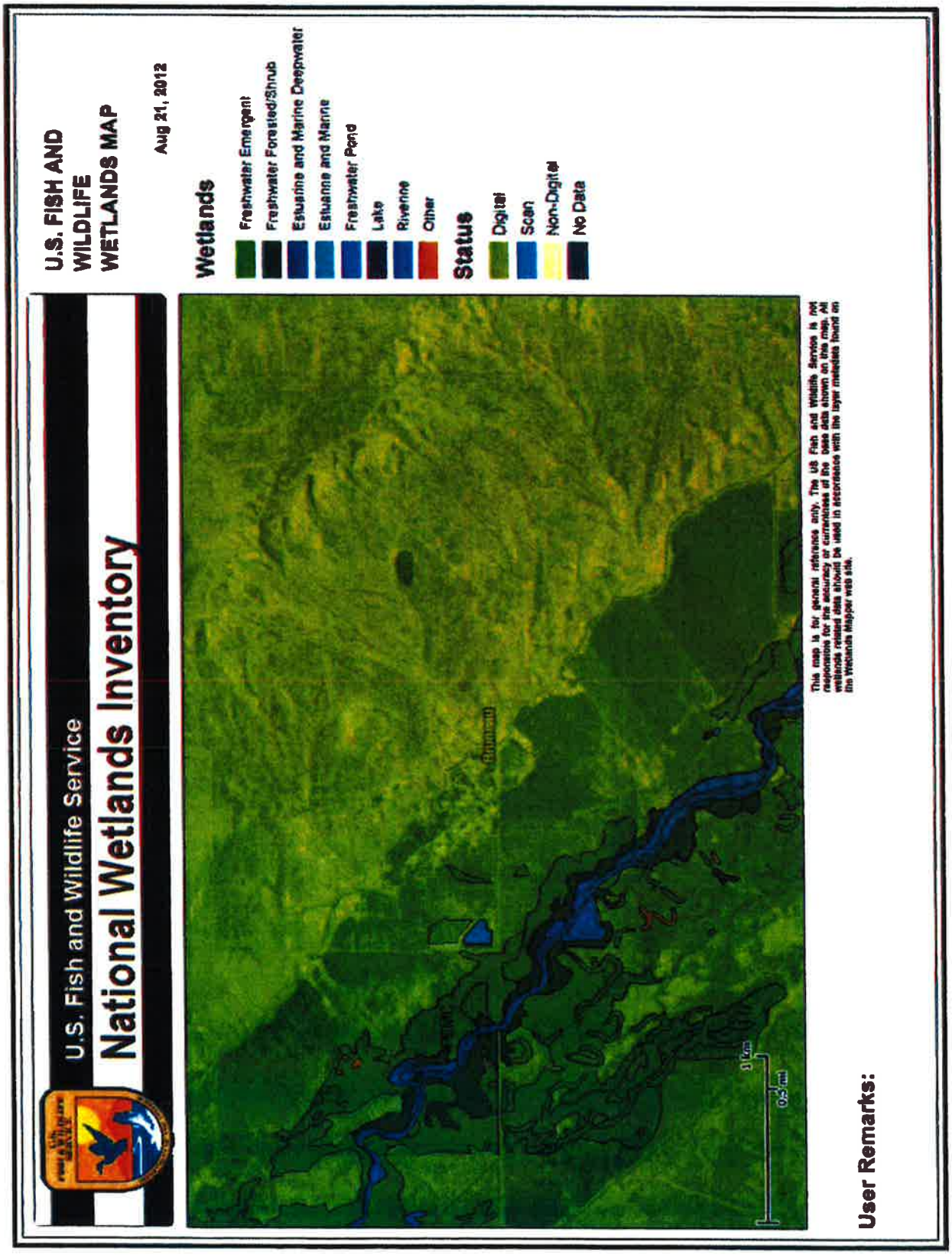


Figure 2-4. U.S. Fish & Wildlife National Wetlands Inventory Map

2.2.14 Proximity to a Sole Source Aquifer

The Sole Source Aquifer program was established under Section 1424(e) of the Safe Drinking Water Act of 1974. The program allows individuals and organizations to petition the EPA to designate aquifers as the "sole or principal" source of drinking water for an area. To meet the sole source criteria, an aquifer must supply at least 50 percent of the drinking water consumed in the area overlying the aquifer. The EPA guidelines also stipulate that these areas can have no alternative drinking water source(s) that could physically, legally and economically supply all those who depend upon the aquifer for drinking water. Region X of EPA has not designated the Bruneau-Grandview groundwater system as a sole source aquifer. This aquifer currently supplies all of the drinking water for the Bruneau Water and Sewer District.

2.2.15 Public Health Considerations

In general, the Bruneau Planning Area has minimal public health issues related to the wastewater system. However, as discussed later in the report, there are some potential public health and safety risks associated with the existing wastewater facilities.

2.2.16 Environmental Justice

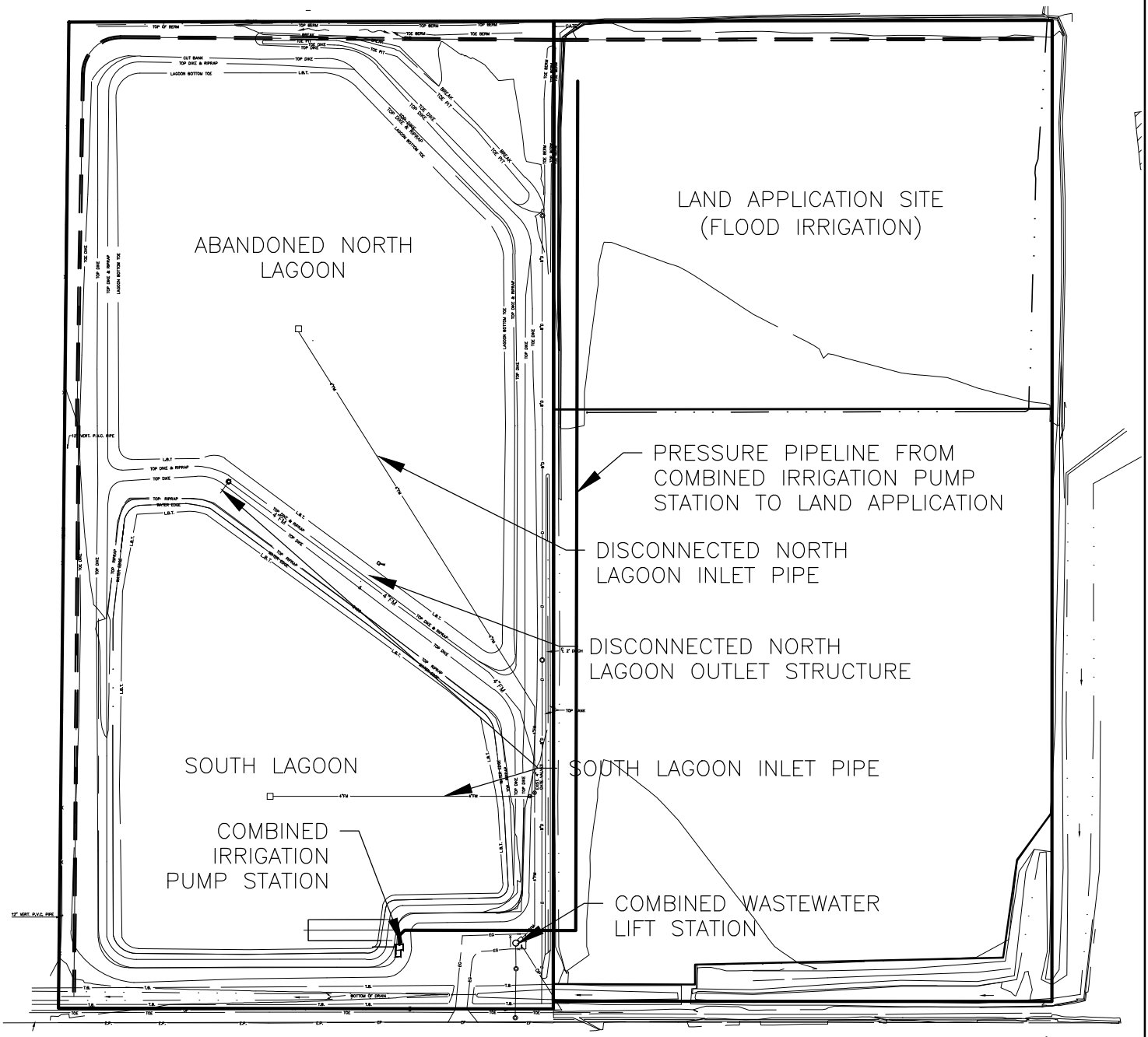
It appears that no disadvantaged group will be adversely affected by a project to improve the existing wastewater facilities. In addition, it is not expected that any specific population segment will benefit from the recommended improvements. However, the community in general will reap some benefits by improvements to the wastewater facilities.

2.3 EXISTING WASTEWATER COLLECTION SYSTEM

The Bruneau Water and Sewer District's current collection system serves all the areas within the District that are occupied. The collection system consists of 12,640 linear feet of 8" gravity collection mains and one lift station at the treatment plant. The WTP discharge dumps into the wastewater collection system near the Buckeroo Ditch crossing on Ruth Street.

2.4 EXISTING WASTEWATER TREATMENT FACILITIES

The existing wastewater treatment system consists of one lagoon with a surface area of 5.54 acres and a net capacity of 4.2 million gallons, an irrigation pump station with chlorination equipment, and a 5.66 acre land application site. A sketch of the system is shown in **Figure 2.5**. The system originally included a 6.55 acre lagoon with a net capacity of 5.30 million gallons located north of the one that is currently in operation. Shallow groundwater resulting from agricultural irrigation on the surrounding farm ground, caused the north bank of this lagoon to fail and the liner to be compromised. The north lagoon was abandoned in 1992 when the land application system was constructed.



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Date Created:6/20/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CADSHEET\FIGURE 2-5.DWG

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WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 2-5
EXISTING WASTEWATER TREATMENT SYSTEM

SHEET 1

2.5 EXISTING FLOWS AND WASTE LOADS

2.5.1 General

The District wastewater flows were measured in a manhole near the wastewater treatment facility (WWTF) from July 31, 2012 to August 14, 2012. The flow is made of two waste streams: normal domestic sewage and process waste from the District's potable water treatment plant. The measured flow data showed a large variability between the period of time the District's water treatment plant was operating and when only normal sewer flows were running in the line.

Additionally, in a system the size of Bruneau's, influent flows and waste loads may vary over the course of a typical day. Curves describing the magnitude of the variations over time are generally diurnal in shape, peaking in the late morning and evening. Variations are generally most noticeable in residential flows, which increase or decrease in response to the community's daily routine. However, infiltration and inflow (I/I) and commercial flows and waste loads may also contribute to these variations. The measured flows were typically much higher during the morning hours while the water treatment plant was in operation.

Depending on the goal of the analysis, different flow and waste load factors that reflect these variations should be used. For example, it is standard to use a peak hourly flow when evaluating the hydraulic capacity requirements for pumps and piping. However, most treatment units (i.e., lagoons, aeration basins, etc.) have the ability to absorb peak flows without sacrificing treatment efficiency, so average day loading factors are appropriate.

Since there is no wastewater sampling data for the District, many of the factors required for the analysis (i.e., load variations, loading factors, etc.) were not readily available and were estimated.

2.5.2 Existing Flows

Flows from the water treatment plant (WTP) vary seasonal with water usage and are difficult to estimate. The average daily flow to the lagoons including the WTP discharges for the period of August 1 to August 13 was 50,588 gpd. For this period, a steady concentrate flow of 55 gpm during the entire period of operation was assumed and a flow of 160 gpm for 20 minutes for the backflush of each of two greensand filters. The average period of high flow (WTP discharge) was 548 minutes which provided 30,165 gpd at 55 gpm. Therefore, based on the difference between these two flows, the average daily domestic sewage flow was 20,422 gpd. With an estimated population of 210, the average per capita domestic sewage flow is approximately 98 gallons. Wastewater flows for further analysis were estimated based on the following:

- Average day domestic sewage flows were calculated using a per-capita value of 98 gpcd and a sewered population of approximately 210 people in January 2013 (see Chapter 3).

- Average day commercial flows were approximated based on standard design per-unit values with consideration of the type of entity and employee numbers.

- Peak hour flows were estimated by applying a peaking factor of 4.0 to the average day flows.

- Infiltration to a new collection system from groundwater is expected to be minimal since groundwater levels in the area are typically below the level of the collection system lines. Inflow

to the system may occur following precipitation events. According to *10 State Standards*, the per-capita value of 98 gpcd and peaking factor of 4.0 include an allowance for normal I/I into the collection system.

For the purposes of alternative comparison and calculating future flows, the conservative estimate calculated above for the WTP flows of 30,165 gpd was used. However, the system operator estimated a more common, year-round operating scenario would be 6,000 gallons every 5 days for the greensand flush plus a concentrate flow of 50 gpm for 2 hours every day in the winter and for 5 hours every day in the summer. Converting these estimates to an average annual daily flow equates to 11,700 gpd. This value can be used as a lower estimate for calculating average annual design volumes of WTP flows.

Table 2-4 summarizes the estimated existing wastewater flows for the City of Bruneau.

Table 2-4. Existing Wastewater Flows

Parameter	Unit	Influent Flow
Average Day Residential	Gpd	17,546
Average Day Commercial	Gpd	2,876
Average Day School Flow	Gpd	1,900
Total Average Day Domestic Sewage Flow	Gpd	20,422
Total Average Day Influent to WWTF	Gpd	50,588
Water Treatment Plant Waste	Gpd	30,165
Peak Hour Domestic Sewage Flow[1]	Gpd	81,689
Peak Hour Flow with WT Plant Waste[2]	Gpd	237,689
Average Day Per-Capita Sewer Flow[3]	Gpcd	98
Aver. Day Per-Capita Flow with WT Plant Waste	Gpcd	241
Total Annual Volume Sewer	Mgal	7.45
Total Annual Vol. with WT Plant Waste	Mgal	18.46

1 Based on a peaking factor of 4.0 (Figure 1, Recommended Standards for Wastewater Facilities, 2004 ed., p. 10-6).
2. Based on sewage peaking factor of 4.0 and water treatment flow of 55 gpm concentrate flow plus 160 gpm green sand filter backwash for 20 minutes for a total of 156,000 gpd.
3 Based on an estimated sewered population of 210 in 2013 (see Chapter 3).

The overall average day per-capita domestic wastewater flow of 98 gallons per capita per day (gpcd) is typical of the values for a community the size of Bruneau in southern Idaho (i.e., 100 to 125 gpcd).

2.5.3 Existing Waste Loads

Since there is no current sampling data regarding the wastewater quality, typical design concentrations for various waste load components were estimated. The concentrations were estimated based on standard design values reported in the literature and wastewater quality for similar communities in southern Idaho with no significant industrial dischargers. It was assumed that the water treatment plant waste is potable water with higher than normal concentrations of fluoride and arsenic and will not contribute additional sewer constituent loads. Average day waste loads were then calculated by multiplying the assumed influent concentrations by the estimated average day flows shown in **Table 2-4. Table 2-5** summarizes the estimated existing waste concentrations for the District.

Table 2-5. Existing Waste Loads for Domestic Sewage Only

Parameter	Units	Waste Load
Biochemical Oxygen Demand (BOD_5)	mg/L	275
	lbs/d	47
	ppcd[1]	0.22
Total Suspended Solids (TSS)	mg/L	275
	lbs/d	47
	ppcd[1]	0.22
Total Kjeldahl Nitrogen (TKN)	mg/L	45
	lbs/d	7.7
	ppcd[1]	0.037
Nitrate-Nitrogen	mg/L	2.0
	lbs/d	0.34
	ppcd[1]	0.0016
Total-Phosphorus	mg/L	9.0
	lbs/d	1.53
	ppcd[1]	0.007

1 Pounds per capita per day (ppcd) based on an estimated sewered population of 210 in 2013 (see Chapter 3).

Table 2-6 summarizes the estimated waste concentrations with the combined sewer and water treatment plant influent flow.

Table 2-6. Existing Waste Loads for Overall Influent to WWTF

Parameter	Units	Waste Load
Biochemical Oxygen Demand (BOD_5)	mg/L	111
	lbs/d	47
	ppcd[1]	0.22
Total Suspended Solids (TSS)	mg/L	111
	lbs/d	47
	ppcd[1]	0.22
Total Kjeldahl Nitrogen (TKN)	mg/L	18
	lbs/d	7.7
	ppcd[1]	0.037
Nitrate-Nitrogen	mg/L	0.81
	lbs/d	0.34
	ppcd[1]	0.0016
Total-Phosphorus	mg/L	3.6
	lbs/d	Less than 1.53
	ppcd[1]	0.007

1 Pounds per capita per day (ppcd) based on an estimated sewered population of 210 in 2013 (see Chapter 3).

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

CHAPTER 3: FUTURE CONDITIONS

3.0 FUTURE CONDITIONS

3.1 FUTURE PLANNING AREA

The Bruneau Planning Area represents a geographical area and population base that the District can reasonably be expected to serve within the 20-year design period from 2013 to 2033 (**see Figure 2-2**). Sufficient land has been included in the Planning Area to accommodate the forecasted residential, commercial and industrial growth, and to allow some flexibility in the future development of the community.

3.2 FUTURE LAND USE AND DEVELOPMENT

Residential and commercial land uses are predominant in the Planning Area. Continued development and population growth is anticipated during the 20-year planning period due to the relatively low land costs in the area, the proximity to larger cities in the area, and the accessibility to State Highway 51. The District generally supports future development in those areas that are consistent with similar land uses.

There is an interest in the development of single-family residential lots in and around the Bruneau area. This may be attributable to local businesses attracting people to the area and to a rising trend of people desiring to live in "bedroom communities" that allow them a rural lifestyle while maintaining the ability to commute to work in larger cities. As such, the District expects that future growth will consist primarily of single-family residential developments within vacant areas of the existing District limits and Planning Area. A majority of the growth is expected to be lower to middle class wage earners that require affordable housing.

The District also expects some commercial development to accompany the residential growth. Development of commercial businesses will typically occur in areas with good ingress and egress to major arterials to minimize traffic conflicts and maintain smooth circulation.

There are no known new industrial developments projected to be developed in the 20-year planning period. New commercial or industrial operations with significant water requirements could affect the City's ability to collect and treat wastewater.

3.3 20-YEAR POPULATION PROJECTIONS

Population projections for the District were developed over the 20-year planning period. These projections provide the basis for forecasting wastewater flows and waste loads, and for evaluating the need for future wastewater system facilities.

3.3.1 Historical Population Growth

As shown in **Table 3-1**, data from the U.S. Census Bureau indicates that the population of Owyhee County has generally increased over the past 40 years. From 1960 to 1970, the population increased slightly from 6,375 to 6,422, representing an average annual increase of approximately 0.70 percent per year. During the following 10 year period, the population grew at 2.52 percent annually to 8,272. Over the next 10 years, the population increased slightly to 8,392. From 1990 to 2000, the County population grew by 2.37 percent to 10,644. The most recent U.S. Census survey in 2010 estimated the population to be 11,526 people. The U.S. Census for Owyhee County is further broken down into sub-districts. The

Bruneau Water and Sewer District is located in the Bruneau CCD. The population of the sub-district declined from 728 in 2000 to 629 in 2010. The Owyhee County survey estimated 2.76 people per household. In 2013, 76 houses were occupied in the Bruneau Water and Sewer District which would equate to a population of 210.

Table 3-1. Historical Population Data

Year	Population[1]	Average Annual Percent Change
1960	6,375	-
1970	6,422	0.70%
1980	8,272	2.52%
1990	8,392	0.14%
2000	10,644	2.37%
2010	11,526	0.80%

1 Data from U.S. Census Bureau.

3.3.2 Population Forecast

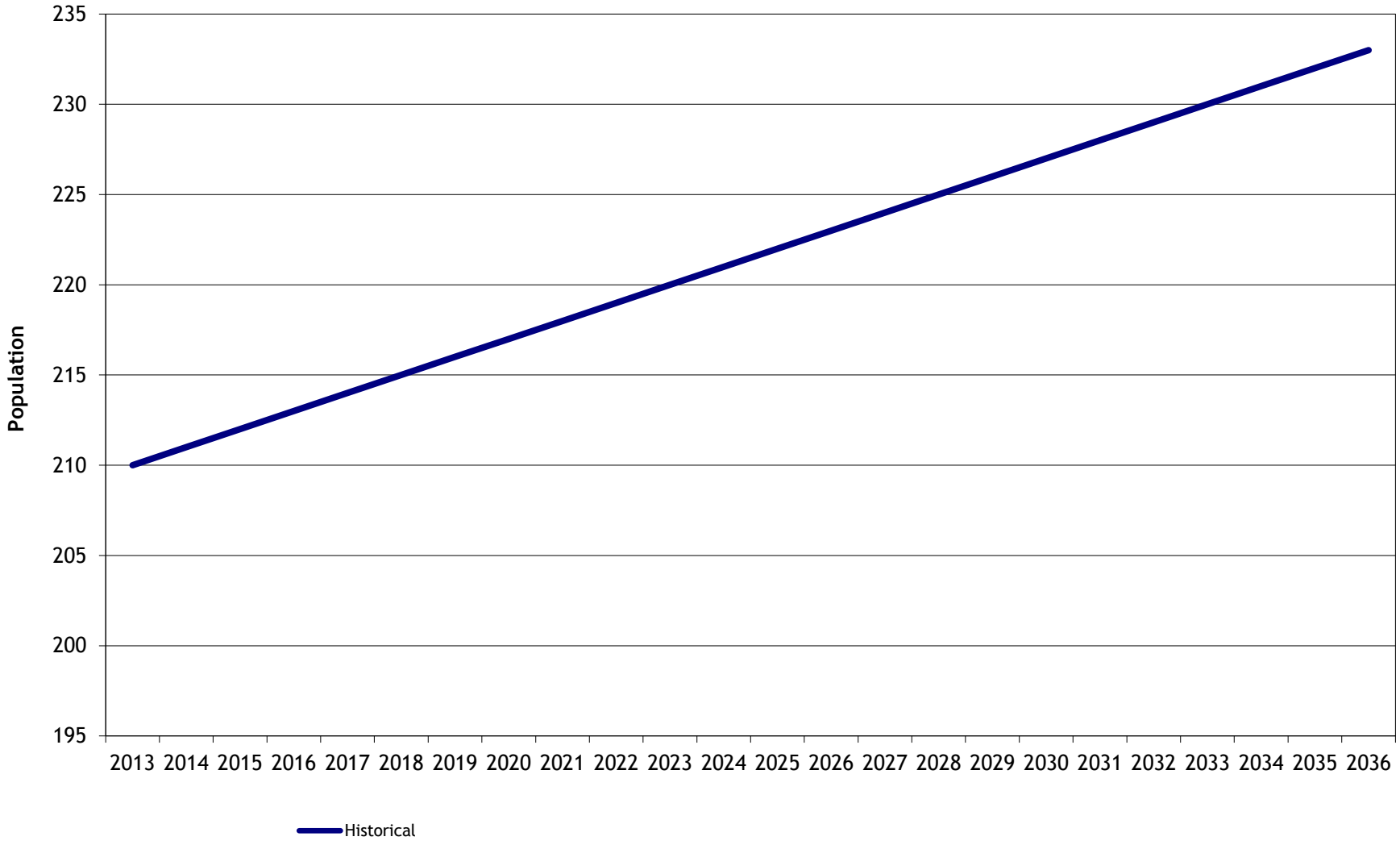
Population growth projections were estimated based on discussions with the District, historical growth trends, a review of current land use and development patterns in the area, and projections from Idaho Power's *2003 Idaho State and County Economic Forecast*. Based on these sources, it is anticipated that future growth in the Bruneau Water and Sewer District will remain sluggish with a low growth rate of 0.50%. As such, this growth rate was applied to the District's population to project a 20-year population.

Table 3-2 and **Figure 3-1** summarize the projected population growth for the Bruneau Water and Sewer District over the 20-year planning period.

Table 3-2. Project Population Growth

Year	Bruneau Water and Sewer District Population
2013	210
2014	211
2015	212
2016	213
2017	214
2018	215
2019	216
2020	217
2021	218
2022	219
2023	220
2024	221
2025	222
2026	223
2027	224
2028	225
2029	226
2030	227
2031	228
2032	229
2033	230
2034	231
2035	232

Figure 3-1. Projected Population Growth



3.3.3 Population Factors

The 2010 U.S. Census reported that the average number of people per household in Owyhee County Bruneau CCD sub-district is approximately 2.59. This value is similar to the values reported for Owyhee County (2.76) and Idaho (2.69). Given a total acreage within the existing City limits of approximately 262.5 acres, the average number of people per acre is approximately 0.87. The Planning Area experiences little, if any, seasonal population fluctuations due to migrant workers and/or the influx and exodus of retired people.

3.3.4 Planning Area Forecast

The proposed Planning Area should contain sufficient acreage to accommodate the anticipated future growth. Using the population forecasts in **Table 3-2**, a population density of 1.14 people per acre will be necessary to accommodate the estimated population of 230 in 2033. The existing sewered acreage within the District limits is approximately 262.5 acres which is the proposed Planning Area depicted in **Figure 2-2**.

3.4 FUTURE FLOWS AND WASTE LOADS

3.4.1 Projected Flows

The Bruneau Water and Sewer District influent flow to the treatment plant consists of 2 components: domestic sewage (residential and commercial) and water treatment plant waste. Influent flows were projected over the 20-year planning period based on the following:

- Average day residential flows were forecast by multiplying the measured per-capita value of 98 gpcd by the projected population.
- Average day commercial flows were assumed to increase at the same rate as the general population (0.5 percent annually).
- Discharge water from the potable water treatment plant was assumed to increase at the same rate as the general population.
- Peak hour flows were forecast by applying a peaking factor of 4.0 to the projected average day residential and commercial flows. The water treatment plant discharge peak hour flow is a combination of the normal 55 gpm concentrate flow and the green sand filter backwash of 160 gpm for 20 minutes for a peak of 6,500 gph.
- Maximum Month flows were forecast by applying a peaking factor of 1.30 to the projected average day residential, commercial and water treatment flows.
- In accordance with *10 State Standards*, it was assumed that normal I/I is accounted for in the domestic sewage per-capita value of 98 gpcd and peaking factor of 4.0.

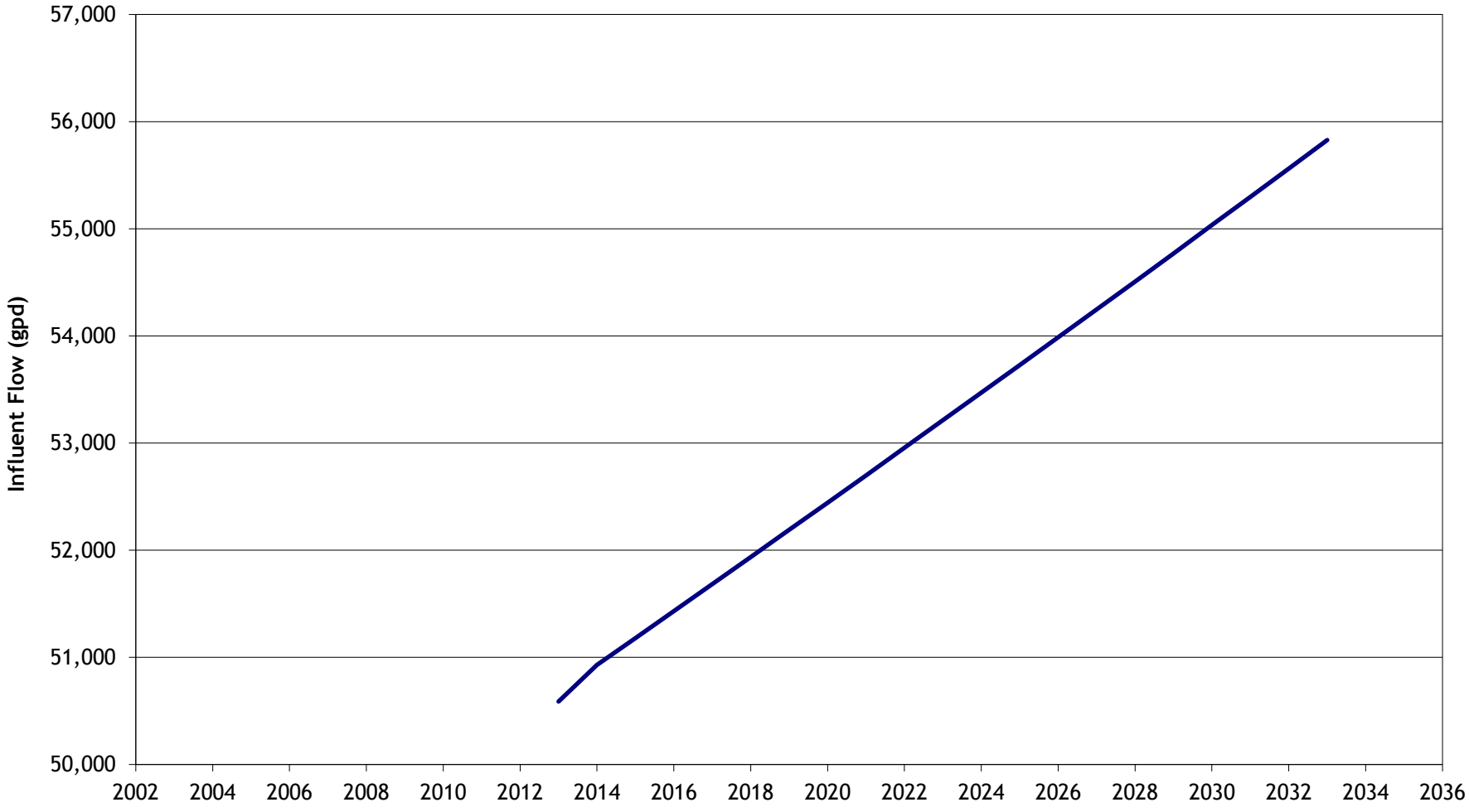
Table 3-3 and **Figure 3-2** summarize the 20-year projected influent flows.

Table 3-3. Projected Wastewater Flows

Parameter	Unit	Influent Flow
Average Day Residential	Gpd	19,404
Average Day Commercial	Gpd	3,178
Average Day Water Treatment	Gpd	33,330
Total Average Day without WT Plant Waste	Gpd	22,498
Total Average Day with WT Plant Waste	Gpd	55,828
Peak Hour without WT Plant Waste[1]	Gpd	89,992
Peak Hour with WT Plant Waste	Gpd	245,992
Maximum Month without WT Plant Waste[2]	Gpd	29,377
Maximum Month with WT Plant Waste[2]	Gpd	72,923
Average Day Per-Capita without WT Plant Waste[3]	Gpd	98
Average Day Per-Capita with WT Plant Waste[3]	Gpd	243
Total Annual Volume without WT Plant	Mgal	8.21
Total Annual Vol. with WT Plant Waste	Mgal	20.38

1 Based on a peaking factor of 4.0 applied to residential and commercial flows only. Peak flow for the water treatment plant is a combination of 55 gpm concentrate flow plus 160 gpm green sand filter backwash. (Figure 1, Recommended Standards for Wastewater Facilities, 2004 ed., p. 10-6).
2 Based on a peaking factor of 1.3 over average day flows.
3 Based on an estimated sewered population of 230 in 2033.

Figure 3-2. Projected Average Day Influent Flow



3.4.2 Projected Waste Loads

As stated in Section 2.5.3, the waste load contributed by the water treatment discharge has not been determined. The discharge results from two different processes: the concentrate flow and the green sand filter backwash. As a result, the water treatment discharge waste load will be assumed to not contribute any domestic sewage constituents. Residential and commercials waste loads were projected over the 20-year planning period based on the following:

- Average day organic (BOD_5) loadings were forecast by multiplying the existing per-capita value of 0.22 pounds per capita per day (ppcd) by the projected population.
- Average day solids (TSS) loadings were forecast by multiplying the existing per-capita value of 0.22 ppcd by the projected population.
- Average day total kjeldahl nitrogen (TKN) loadings were forecast by multiplying the existing per-capita value of 0.037 ppcd by the projected population.
- Average day nitrate-nitrogen loadings were forecast by multiplying the existing per-capita value of 0.0016 ppcd by the projected population.
- Average day total-phosphorus loadings were forecast by multiplying the existing per-capita value of 0.007 ppcd by the projected population.

Table 3-4 summarizes the projected 20-year influent waste loads. **Figures 3-3** and **3-4** show the projected average day waste loads over the 20-year planning period.

Table 3-4. Projected Waste Loads

Parameter	Units	Waste Load
Biochemical Oxygen Demand (BOD_5)	mg/L	111
	lbs/d	51.6
	ppcd	22
Total Suspended Solids (TSS)	mg/L	111
	lbs/d	51.6
	ppcd	0.22
Total Kjeldahl Nitrogen (TKN)	mg/L	18
	lbs/d	8.44
	ppcd	0.037
Nitrate-Nitrogen	mg/L	0.81
	lbs/d	0.38
	ppcd	0.0016
Total-Phosphorus	mg/L	3.63
	lbs/d	1.69
	ppcd	0.007

Figure 3-3. Projected Average Day Influent BOD_5 and TSS Mass Loadings

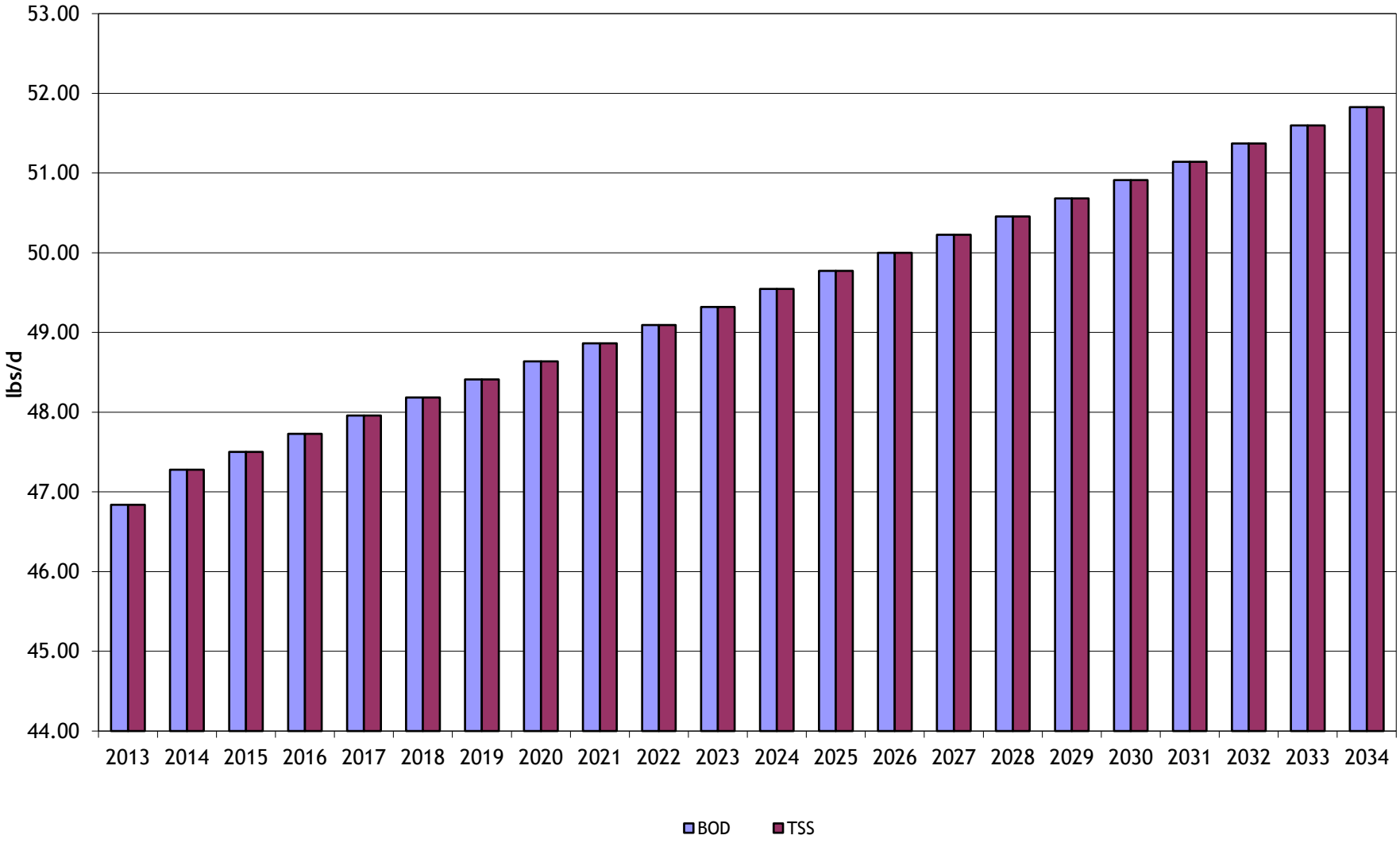
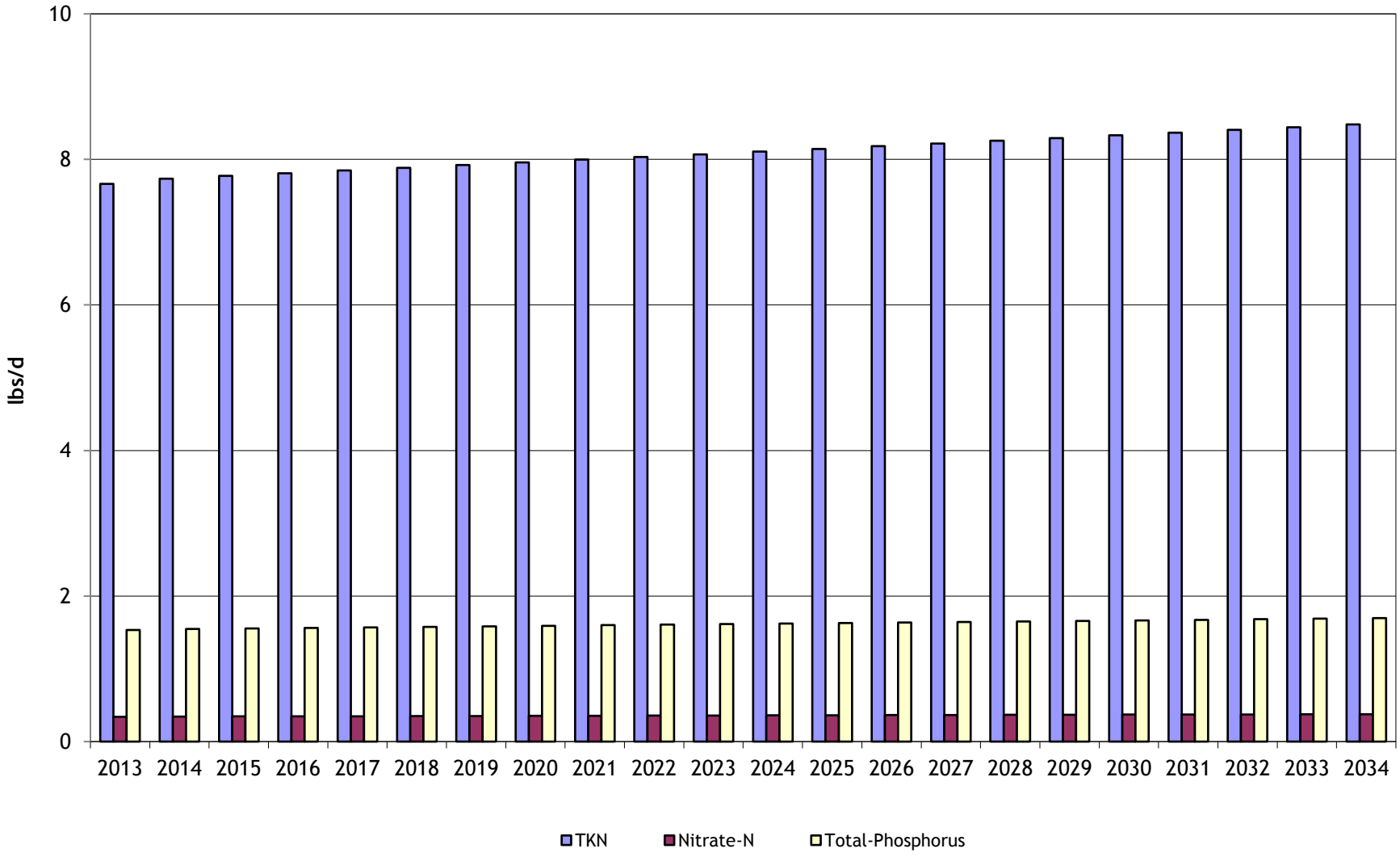


Figure 3-4. Projected Average Day Influent Nutrient Mass Loadings



BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

CHAPTER 4: EVALUATION OF EXISTING FACILITIES

4.0 EVALUATION OF EXISTING FACILITIES

4.1 COLLECTION SYSTEM CONSIDERATIONS

The wastewater collection system was constructed in the early 1980's utilizing 8" PVC pipe and 4' diameter concrete manholes. A visual inspection of the manholes was provided for the report. No deterioration was noted in any of the manholes. The apparent depth of flow in the pipes indicated that there is sufficient design capacity in the system for at least a 20 year growth period. No upgrades to the collection system are necessary at this time.

Infiltration and inflow (I/I) to the collection system can contribute significantly to the volume of effluent that must be handled at the treatment plant. An I/I study was not conducted on the system. DEQ considers a high rate of I/I to be over 120 gpcd. The total measured sewer effluent flow for the system was 98 gpcd, therefore there is not an excessive I/I problem with the collection system.

4.2 TREATMENT PLANT HEADWORKS

The existing Bruneau Water and Sewer District Sewer Treatment system is illustrated in **Figure 4-1**. The treatment system headworks consist of a duplex lift station lifting the influent to the treatment lagoon. The lift station was constructed in the early 1980's and includes a 6' diameter wet well with two submersible pumps. The pump outlets are piped to a subsurface concrete valve vault where the pipes are combined to one 4" pipe to the lagoon. The electrical pump controls include elapsed time meters for each pump.

Recently the District replaced the pumps and the elapsed time meters. This work was completed as a part of normal maintenance activities. The lift station is now in good working order. The capacity of the lift station was estimated as part of the 2010 south lagoon seepage test. A drawdown test was conducted on both pumps and the average rate was calculated to be 150 gpm. A theoretical flow rate of 190 gpm was determined based on the pump capacity information supplied by the manufacturer. The estimated peak hourly flow rate for the 20 year planning period is 248,472 gpd (173 gpm) for the combined total flow and 89,992 gpd (63 gpm) for the domestic wastewater flow only. Since the peak hourly flow must be met with the largest pump out of service, the lift station should be upgraded when the total peak hourly flow exceeds 150 gpm. If the WTP flow is separated from the total flow, the lift station should have adequate capacity for the 20 year design flows.

4.3 LAGOON TREATMENT

4.3.1 Lagoon Condition and Regulatory Compliance

The Bruneau WWTF consists of one non–aerated, facultative lagoon (the south lagoon) with a capacity of 4.2 million gallons and 5.54 acres of surface area. IDAPA 58.01.16 requires three lagoons for parallel or series operated lagoon treatment systems. Two lagoons may be allowed for a system with less than 50,000 gallons per day flow.

When the District pumped the north lagoon down to fill and seepage test it in 2008, the liner was visible near the north edge of the lagoon. It appeared the liner was bubbled up by groundwater beneath it so the north lagoon was abandoned. The operable lagoon (south) was seepage tested in 2010 and the results did not indicate any leakage through the liner. Groundwater intrusion under the liner could threaten the integrity of the liner in the future. The liner was installed during the initial system construction in the early 1980's. The PVC liner material has been in place for approximately 30 years.

No studies of buried PVC liner life expectancy have been conducted. The Geosynthetic Research Institute (GRI) conducted accelerated test of exposed PVC liners and determined that the half-life of an exposed PVC liner with a North American formulation is 18 years (GRI White Paper #6). The bubbled up portion of the lagoon liner no longer has a soil cover and may be more susceptible to degradation as an exposed liner. In an exposed environment, the PVC lagoon liner is approaching its expected useable life.

4.3.2 Lagoon Treatment Capacity

No analysis of the wastewater effluent from the lagoon has been conducted in the past several years. Typical effluent concentrations for a lagoon treatment system in Southern Idaho will be used for this analysis. **Table 4-1** summarizes average removal efficiencies for each parameter based on average influent and effluent concentrations.

Table 4-1. Average Removal Efficiencies

Parameter	Ranges	Removal Efficiency (%)
BOD_5	275 mg / l	94.4
TSS	275 mg / l	90.3
TKN	45 mg / l	87.0
Nitrate-N	2 mg / l	-69.9 [1]
Total-Phosphorus	9 mg / l	57.0

[1]Untreated municipal wastewater is typically low in nitrate-N. Organic nitrogen and ammonia nitrogen (measured as TKN) are present in raw wastewater and are converted to nitrate-N in the lagoon system (nitrification process). The negative removal in Table 4-1 implies the effluent nitrate-N is higher than the raw wastewater nitrate-N, which is typical of a lagoon system.

4.3.3 Sludge Accumulation

A portion of the settleable solids in the influent will be removed from suspension within a few hours of entering the lagoons. Additional biological solids will be formed and precipitated in the lagoons as treatment occurs. Algae growth and subsequent die-off may also result in the formation of settable solids in the lagoons. As the solids settle to the bottom of the lagoons, they form a sludge layer. A portion of these solids undergo anaerobic degradation and are released back into the wastewater as various gases, solids, and soluble organics. Solids accumulation can be variable due to variations in degradation rates and the formation of algae. Excessive solids may result in potential treatment problems, including:

- A reduction in the operating volume and hydraulic retention time (HRT).
- Increased oxygen demand from the release of soluble organics during degradation.
- Elevated effluent TSS and BOD5 levels from the release of solids and excessive algal growth triggered by the release of nutrients during sludge stabilization.
- High effluent ammonia due to anaerobic conditions during sludge stabilization.

The District reports that the solids have not been removed from the lagoon since their original construction in the early 1980's. The District has drawn down the level of the lagoon to provide winter storage volume. No significant sludge accumulation has been visible after those drawdowns.

4.3.4 Hydraulic Retention Time (HRT)

The treatment performance of the lagoon partially depends on providing an adequate HRT. The HRT is a function of the influent flow rate, cell operating volume and climatic conditions. During cold weather conditions, microbial activity is reduced by approximately one-half for every 10ºC decrease in the temperature. As a result, a longer HRT is generally required to maintain a removal efficiency equivalent to that observed during warm weather conditions.

Hydraulic retention times for the District's lagoons were calculated at the existing and projected maximum month flows. The HRTs for existing and future conditions were calculated based on the effective operating volume of 4.2 million gallons due to an estimated 1.5 feet of solids accumulation. **Table 4-2** summarizes the lagoon HRTs under current and future maximum month flow conditions.

Table 4-2. Hydraulic Retention Times at Maximum Month Flows

Lagoon Influent Flow Condition	Existing HRT[a] (days)	Future HRT[b] (days)
Without Water Treatment Flow	158	143
With Water Treatment Flow	64	58

a. Based on a maximum month flow of 0.026 MGD without water treatment and 0.066 MGD with water treatment flow
b. Based on a maximum month flow of 0..030 MGD without water treatment and 0.073 MGD with water treatment flow

The minimum HRT recommended facultative lagoons typically ranges from approximately 20 to 180 days with values up to 200 days in areas with cold weather climates. As shown in the table, the existing and future HRTs estimated for Cell #1 appear to meet this criteria. As such, it appears that adequate retention time is provided for treatment and settling of solids. The relatively long HRT required for facultative lagoons may promote the growth of algae, which are relied upon for aeration through photosynthesis. However, algae blooms can often lead to increased levels of BOD_5, TSS and pH in the effluent.

4.3.5 Lagoon Seepage

The existing lagoon reportedly has a PVC liner with a 6" soil cover. Seepage tests were performed on the lagoon during the summer of 2010 to estimate seepage rates and to determine compliance with current permit requirements. The lagoon remained in operation during the seepage test period; therefore, the inflow had to be estimated to calculate the seepage rate. The seepage rate results were reported based on two influent pumping rates from the lift station filling the lagoon. A summary of the seepage test result is shown in **Table 4-3**.

Table 4-3. Lagoon Seepage Rate

Influent Pump Rate (gpm)	Seepage Rate (in/day)
150	-0.0756
190	-0.0482

The District's current wastewater reuse permit specifies a maximum allowable seepage rate of 0.25 in/day for existing lagoons or 0.125 in/day for new lagoons.

Based on recent revisions in their policy and guidance documents, IDEQ presently recommends a maximum allowable seepage rate of 0.125 in/day. It is anticipated that the District's allowable seepage rate may be reduced to 0.125 in/day during the next permitting cycle beginning in 2014. Based on the seepage test results shown in **Table 4-3**, it appears that the lagoon will meet this more stringent criterion.

4.4 DISINFECTION SYSTEM

A sodium hypochlorite disinfection system was constructed south of the lagoon in 1992. An 11 to 12 percent sodium hypochlorite solution is injected into the effluent in the lagoon at the beginning of a 100 foot long chlorine contact channel separated from the main lagoon by a berm. The effluent travels through the channel to the irrigation pump station inlet at the north end. Based on an estimated pumping capacity of 200 gpm with both of the existing irrigation pumps in operation, the contact channel provides for a contact time of approximately 170 minutes. IDEQ currently requires a minimum contact period of 30 minutes at the maximum rate of pumping. As such, the existing disinfection system appears adequate for the current pumping conditions. If the pumping conditions change in the future, the contact time provided by the current contact channel should be re-evaluated.

The current metering pump is capable of injecting approximately 24 gpd of an 11 percent sodium hypochlorite solution. Assuming an average chlorine dose of 10 mg/L, the estimated average daily sodium hypochlorite volume requirement to disinfect effluent from the lagoon system is approximately 24 gpd. As such, it appears that the existing metering pump is adequately sized for future flow conditions.

4.5 IRRIGATION PUMP STATION

The existing 7.5 hp irrigation pumps in the Pump Station were designed to be capable of producing 100 gpm. As discussed later in Chapter 5, the projected pumping capacity required in the future is approximately 100 gpm. As such, it appears that the existing irrigation pump is adequate for the future flow conditions.

The existing irrigation pump was installed during the 1992 upgrades to the treatment facilities and is approximately 20 years old. The estimated useful life for an irrigation pump is 20 years. However, land application of effluent has not been necessary and the pumps have had little use.

4.6 WASTEWATER REUSE SYSTEM

4.6.1 Lagoon Storage and Irrigated Land Area Requirements

The District can discharge its wastewater to the 5.66 acre reuse site during the growing season (April through October) and they are required to store most of the wastewater in the lagoon during the non-growing season.

The amount of irrigated acreage required for slow rate land application is governed by the type of crop and hydraulic, nutrient (i.e., nitrogen and phosphorus) and/or organic loading rates. The growing season hydraulic application rate should be commensurate to the seasonal crop water requirement. Nutrients should be applied to the reuse site at a rate that is comparable to the uptake rate of the crop to minimize potential impacts on the soil and groundwater. The District's current reuse permit allows a nutrient loading rate of up to 150 percent of the crop uptake.

To evaluate the lagoon storage volume and irrigated acreage requirements, an iterative water balance was conducted around the lagoons and reuse site under current and future loading conditions. The water balance accounted for the crop irrigation water requirement, allowable nutrient and organic loadings, and gains or losses in the system, including precipitation, evaporation, and seepage. Assumptions used in the water balance include:

- Current and future average day flows were used.
- Alfalfa would be grown on all reuse sites.
- For existing conditions:
  - All 5.66 acres in the current reuse system are available for irrigation.
  - Seepage losses from the lagoons were based on recent seepage test results.
- No effluent will be discharged during the non-growing season.

The water balance spreadsheets are included in **Appendix A.**

Table 4-4 summarizes the water balance results at current and future loadings.

Table 4-4. Reuse System Water Balance Results

Parameter	Units	Existing Loading Conditions w/o Water Treatment	Existing Loading Conditions w/ Water Treatment	Future Loading Conditions w/o Water Treatment	Future Loading Conditions w/ Water Treatment
Limiting Loading Factor	-	Phosphorus	Hydraulic	Phosphorus	Hydraulic
Total Irrigated Acreage Required	acres	1.5	3.7	1.5	4.3
Existing Irrigated Acreage	acres	5.66	5.66	5.66	5.66
Additional Irrigated Acreage Required	acres	0	0	0	0
Total Lagoon Volume Required	Mgal	1.30	5.62	1.64	6.35
Existing Effective Lagoon Storage Volume	Mgal	4.20	4.20	4.20	4.20
Additional Lagoon Storage Volume Required	Mgal	0	1.42	0	2.15

As shown in the table, additional lagoon storage volume is required for both the existing and future loading conditions with the water treatment discharge included in the sewer flow.

4.6.2 Buffer Zones

The District's reuse permit outlines buffer zone requirements for the reuse sites. The setback distances for the buffer zones are dependent on the level of disinfection provided, as measured by median total coliform levels in the effluent. Buffer zones are outlined for the following median probable number (MPN) of total coliform levels:

- 2.2 MPN/100 mL (smallest buffer zones).
- 23 MPN/100 mL (intermediate buffer zones).
- 230 MPN/100 mL (largest buffer zones).

The reuse permit requires disinfection to provide a median total coliform level in the effluent of less than 230 MPN/100 mL, the buffer zone distances required in the permit are:

- 300 feet from areas accessible to the public for sprinkler irrigation.
- 50 feet from areas accessible to the public for flood irrigation.
- 500 feet from inhabited dwellings for sprinkler irrigation.
- 300 feet from inhabited dwellings for flood irrigation.
- 50 feet from irrigation ditches and canals.
- 100 feet to surface waters.
- 500 feet from private water sources.
- 1,000 feet from public water sources.

Figure 4-2 shows the approximate buffer zones required for the Land Application Site. As shown in the figure, the District is unable to fully utilize the permitted acreage for irrigation and provide the required buffer zones. **Table 4-5** summarizes the available acreage if the buffer zones are met for each irrigation application method.

Table 4-5. Existing Reuse Site Acreage with Buffer Zones

Irrigation Method	Total Acreage (acres)	Reduced Acreage With Buffer Zones (acres)
Flood	5.66	5.62
Sprinkler	5.66	1.66

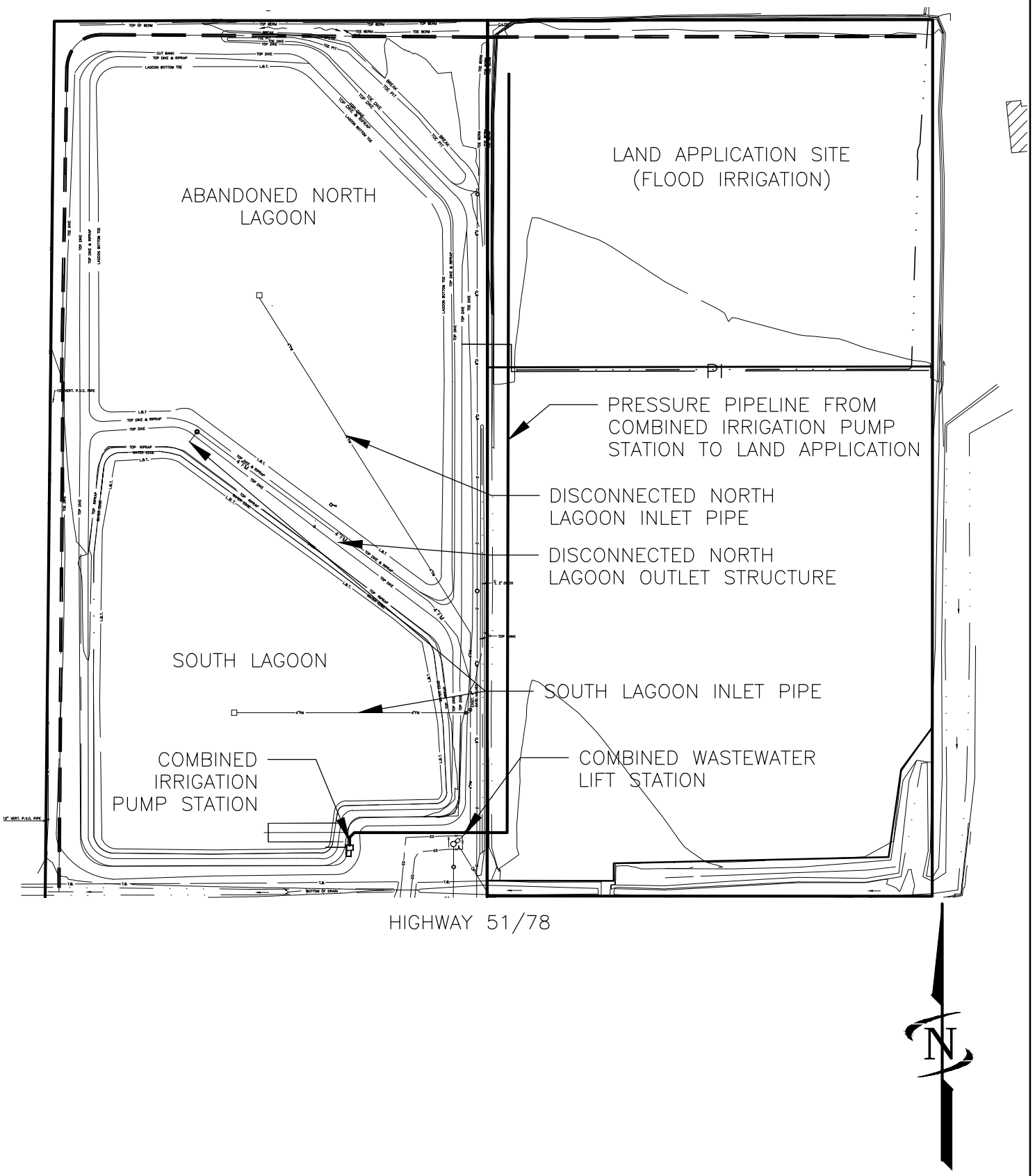
As shown in the table, the available acreage for irrigating the lagoon effluent is significantly reduced if the buffer zones are provided. As such, the District is unable to comply with the buffer zones and meet the hydraulic and nutrient loading requirements outlined in the permit. This situation will be exacerbated in the future and continue to result in non-compliance conditions with the reuse permit.

4.6.3 Wastewater Reuse Permit

The District's current permit expires June 14, 2014. It is required that the District submit their permit renewal application at least 180 days prior to the expiration date. Additionally, the District must submit a request for modifications to the permit for any significant changes to the treatment lagoons and/or reuse sites. The District's permit outlines a compliance schedule of required activities for the reuse system. **Table 4-6** summarizes the status of the compliance activities.

Table 4-6. Status of Compliance Activities

Compliance Activity	Compliance Date	Status
Plan of Operation CA-129-01	June 11, 2010	The Operation and Maintenance Manual for the existing facilities was prepared in 1992. The manual has not been updated or resubmitted to DEQ.
Seepage Testing Plan CA-129-02	Testing Plan Prior to Conducting Testing Seepage Testing Results June 11, 2010	The Seepage Testing Plan was submitted and approved on July 9, 2009 and a revised testing plan approved on June 16, 2010. The seepage tests were completed in August and September 2010 with seepage results of less than 0.25 inches per day.
Permit Renewal Application CA-129-03	December 11, 2013	



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Date Created:6/20/2013 \\T:\WINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CADSHEET\FIGURE 4-1.DWG

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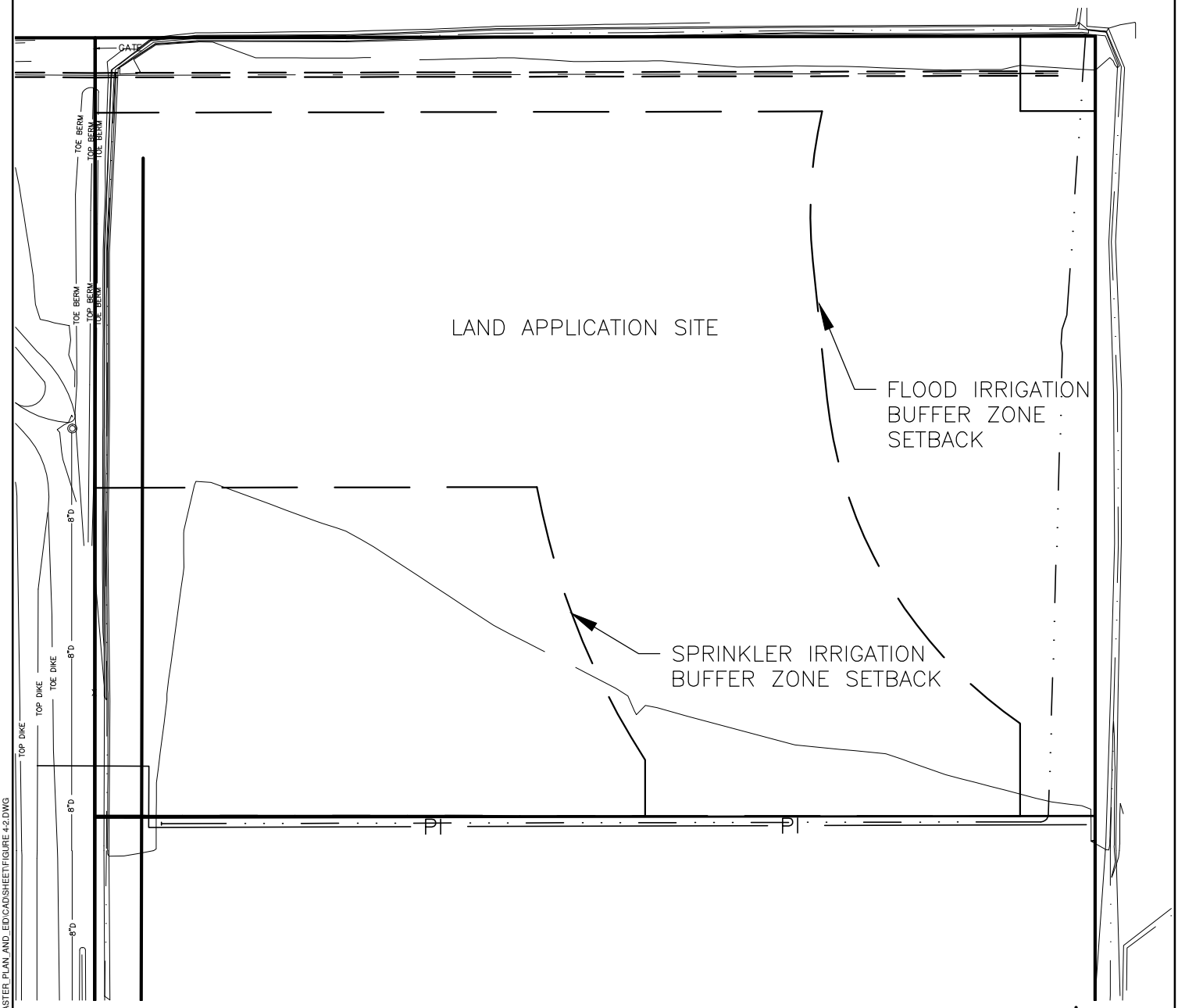
WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 4-1
EXISTING WASTEWATER TREATMENT SYSTEM

SHEET
1



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Date Created:6/20/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 4-2.DWG

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WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 4-2
EXISTING LAND APPLICATION AREA SET BACKS

SHEET
1

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

CHAPTER 5: IMPROVEMENT ALTERNATIVES

5.0 IMPROVEMENT ALTERNATIVES

This chapter is intended to outline the improvement alternatives that are available to meet the needs for wastewater collection and treatment. Several alternatives were evaluated to identify those that will provide the greatest benefit to the Bruneau Water and Sewer District over the 20-year planning period. The District's ability to obtain financing and judgment and policy decisions will dictate the extent of the improvements and the order in which they are implemented.

5.1 GRAVITY SEWER LINE IMPROVEMENT

The gravity sewer collection system is adequate in capacity and service area to provide service for the 20-year planning period and beyond. The District should continue to provide routine maintenance, observe the flow conditions and repair any problems that may develop. **Figure 5-1** illustrates the existing sewer collection system.

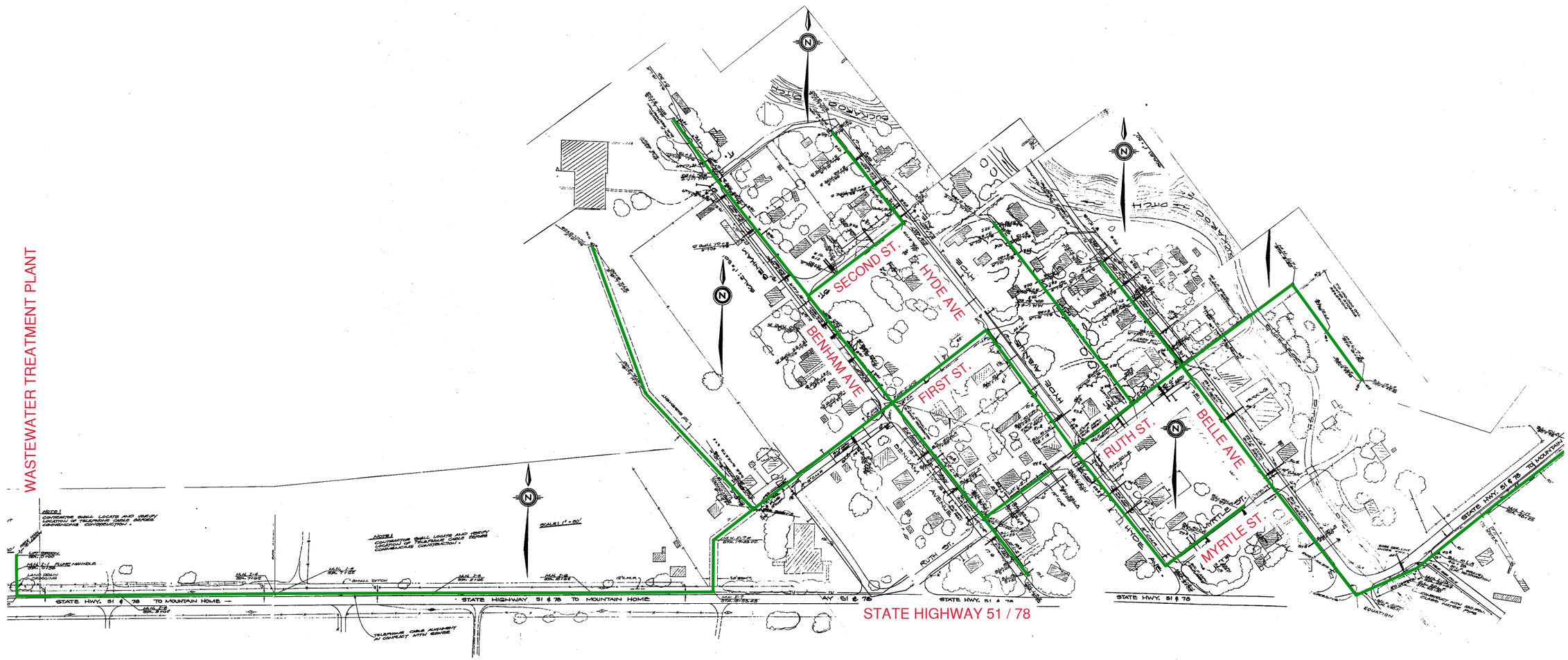
5.2 SEWER LIFT STATION AT THE WASTEWATER LAGOON

The sewer lift station at the lagoons does not have adequate capacity to provide service through the 20-year planning period unless the WTP flow is separated. The pumps will need to be monitored to determine that they are pumping at or near the design capacity and be rebuilt or replaced when necessary. Section 440.01.h of IDAPA 58.01.16 requires suitable methods of measuring wastewater be installed at all pumping stations. The pump elapsed time meters were replaced in 2011. The recorded run time can be combined with the estimated pump flow rate to estimate the flow volume. A magnetic flow meter is recommended to be installed on the lift station pump discharge line with electronic data recording. This will allow the District to monitor average and peak influent flows for system evaluation. It is assumed the recording device will be located on the existing electrical control panel structure.

5.3 WASTEWATER TREATMENT FACILITY IMPROVEMENTS

5.3.1 Introduction

As discussed in Chapter 4, the existing wastewater treatment lagoons and reuse sites are unable to meet the requirements of the District's current wastewater reuse permit under the existing and projected 20 year flow and waste load conditions. This has not resulted in a Notice of Violation (NOV) or fine for non-compliance with the permit to date but it is a possibility in the future. As such, it is necessary for the District to consider improvement alternatives that will allow the wastewater treatment facilities to comply with the requirements of the permit and address the population growth of the community. The original treatment design was as an evaporative system without discharge. The slow-rate land application disposal system was added in 1992 after the north bank of the north lagoon failed and it was abandoned. However, the system flow was low enough the treatment continued as an evaporative system and the land application system was seldom needed. In 2007, the District began operation of the potable water treatment plant and the flush water from it was discharged to the waste treatment plant. The total flow to the lagoon now exceeds the evaporative capacity and the land application system had to be reinstated. The water treatment plant discharge is not required to be treated as sewer effluent. Therefore, the wastewater treatment facility improvements options will consider the two influent options: sewer flow without the water treatment plant discharge and sewer flow combined with the water treatment plant discharge.



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J-U-B ENGINEERS, INC.

WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-1
EXISTING COLLECTION SYSTEM

5.3.2 Effluent Discharge Considerations

A key component of any treatment alternative is identifying a discharge option for the effluent. **Table 5-1** presents potential discharge alternatives and the permits required for each alternative.

Table 5-1. Effluent Discharge Alternatives and Required Permits

Effluent Discharge Alternative	Required Permits
Total Containment with no discharge	No Permits Required
Slow-rate land application	Wastewater Reuse Permit
Surface water discharge	NPDES Permit
Rapid infiltration basins/groundwater recharge	Wastewater Reuse Permit
Infiltrative basins for groundwater recharge	Wastewater Reuse Permit
Direct reuse[a]	Wastewater Reuse Permit

a. Irrigation of residential lawns and parks, fire control, dust suppression, industrial process water, etc.

As previously discussed, the District currently employs slow-rate land application under a Wastewater Reuse Permit issued by IDEQ. The other reuse options outlined in **Table 5-1** would require a similar reuse permit. The recharge options would likely not be feasible in the current facility location due to the high groundwater condition. A preliminary review of factors involved in applying for and obtaining a National Pollutant Discharge Elimination System (NPDES) permit for surface water discharge appear to be restrictive. The complications include:

- If lagoons are used for treatment, they will likely be unable to consistently and reliably meet the probable NPDES permit limits.

- The surface waters in the area drain to the Bruneau River and ultimately drain to the Snake River, which already has a waste load allocation for point source discharges under the Middle-Snake River and Upper-Snake River TMDLs. The District currently does not have waste load allocations for suspended solids and phosphorus as part of those TMDLs. Based on discussions with IDEQ, it is likely that the District would receive very low or no waste load allocations for suspended solids and phosphorus with a new NPDES permit.

As such, it appears that wastewater reuse through slow-rate land application or direct reuse are the most feasible effluent discharge options for the District. It is not uncommon for communities to utilize more than one effluent discharge method to provide reliability or to minimize winter storage requirements. In the event the District elects one of the reuse options, they may want to consider pursuing an NPDES permit at some point in the future.

5.3.3 General Wastewater Reuse Considerations

Wastewater reuse is being used with increasing regularity to meet a variety of water needs, particularly in areas of the country where water supplies are constrained. Wastewater reuse projects are beginning to be implemented in Idaho due in part to:

- A realization that reclaimed wastewater may be a valuable resource to offset potable water demands for uses like irrigation of residential lawns and parks, industrial process water, etc. This realization is most apparent where new water sources are difficult or expensive to locate.

- High levels of regulatory protection for surface waters or aquifers, which in some cases are sole source aquifers, where water quality impacts are not allowed.

- Public awareness of water as a finite resource that should be managed and possibly "reclaimed" rather than "disposed of".

The relative benefits and concerns of implementing a reclaimed wastewater reuse system are summarized in **Table 5-2**.

Table 5-2. Relative Benefits and Concerns of Wastewater Reuse

Benefits	Concerns
• Effluent flow from the treatment plant is relatively constant and reliable. • Effluent from a treatment plant designed for reuse is typically of higher quality, providing flexibility for multiple reuse opportunities. • Reclaimed wastewater may be reused to offset drinking water demands and associated costs. • Reclaimed wastewater is considered part of the District's consumptive drinking water right, minimizing potential water rights issues. • Reuse of wastewater to offset drinking water demands may delay or minimize the need to secure additional drinking water sources, which are becoming limited.	• Public perception and concerns related to wastewater reuse can be difficult to overcome. • Treatment plant complexity generally increases as a higher quality of effluent is produced for reuse. • Additional infrastructure may be required to reuse wastewater (i.e., winter storage, distribution systems, recharge facilities, etc.). • Reuse in Idaho is relatively new and regulations governing reuse are still in their infancy. • Matching the reclaimed water supply to the demand may be difficult (i.e., storage during low demand periods).

Direct reuse of effluent requires willing property owner(s) that need irrigation water. However, the lawn areas in the Bruneau District are small and the water is normally supplied from the Buckaroo Ditch. With the limited availability of application area and high cost and complexity of additional treatment required, the Direct Reuse option of domestic wastewater discharge is not a feasible option and is eliminated from further consideration.

5.3.4 Wastewater Treatment Plant Improvement Alternatives

Considering the District's needs to address issues at the existing treatment facilities and plan for future growth, the following alternatives for wastewater treatment were evaluated:

- **Alternative 1 – No Action Alternative:** Produce Class C reclaimed wastewater by maintaining the lagoon system in its current operation and configuration.
- **Alternative 2 – Regional Treatment:** Partner with local communities to provide a regional wastewater treatment system. The quality of the effluent and who retains ownership of the effluent would require additional discussion.

In addition, the following treatment plant alternatives summarized in Table 5-2a and described below were considered and analyzed for two influent conditions: domestic sewer flow only without the water treatment discharge (Alternative "xa") and domestic sewer flow with the water treatment discharge (Alternative "xb"). An alternative discharge location will be required for the water treatment plant discharge under Alternative "xa" if the existing sewer treatment plant will still be used (Alternatives 3a and 4a). The existing treatment plant can be used to store and dispose of the water treatment plant discharge for the alternatives that include relocation of the sewer treatment plant (Alternatives 5a and 6a).

Table 5-2a. Summary of Alternatives

	Domestic WW		WTP Discharge		Combined Discharge		Location	
Alternative	**Class C Reuse**	**Total Containment**	**Land Application**	**Total Containment**	**Class C Reuse**	**Total Containment**	**At Existing Facility**	**At New Site**
3a	x		x				x	
3b					x		x	
4a		x	x				x	
4b						x	x	
5a	x		x				WTP Disch	Dom WW
5b					x			x
6a		x	x				WTP Disch	Dom WW
6b						x		x

- **Alternative 3a – Reinstate a Portion of the North Lagoon, Upgrade South Lagoon and Upgrade Land Application System without Discharge from the Water Treatment Plant Included in the Treatment and Land Application. Construct a Separate WTP Discharge Pipeline, Storage Lagoon and Land Application System:** Produce Class C reclaimed wastewater by upgrading the existing lagoon and reinstating a portion of the north lagoon, providing two lagoons for domestic wastewater and upgrading the slow-rate land application system. Water treatment plant discharge would be piped to the facility separately, stored in a separate lagoon within the existing north lagoon area and land applied through a separate pump station.

- **Alternative 3b – Reinstate and Divide the North Lagoon, Upgrade South Lagoon and Upgrade Land Application System with Influent from the Water Treatment Plant:** Produce Class C reclaimed wastewater by upgrading the existing lagoon and reinstating and dividing the north

lagoon, providing three lagoons and additional winter storage, and upgrading the slow-rate land application system. Water treatment discharge would be included with the domestic wastewater in the treatment, storage, and land application process.

- **Alternative 4a – Reinstate a Portion of the North Lagoon and Upgrade the South Lagoon to Provide Sufficient Storage to Operate as an Evaporative System Without Discharge From the Water Treatment Plant Included in the Treatment and Land Application. Construct a Separate WTP Discharge Pipeline, Storage Lagoon and Land Application System:** Upgrade the existing lagoon and reinstate a portion of the north lagoon, providing two lagoons and sufficient lagoon surface area and volume to operate as a total containment evaporative system for the domestic wastewater. Water treatment plant discharge would be piped to the facility separately, stored in a separate lagoon within the existing north lagoon area, and land applied through a separate pump station.

- **Alternative 4b – Reinstate the North Lagoon, Upgrade the South Lagoon and Construct Additional Lagoons to Provide Sufficient Storage to Operate as an Evaporative System With Influent From the Water Treatment Plant:** Upgrade the existing lagoon, reinstate the north lagoon and construct a third lagoon providing three lagoons and sufficient lagoon surface area and volume to operate as a total containment evaporative system. Water treatment discharge would be included with the domestic wastewater in the process.

- **Alternative 5a – Construct a New Two Lagoon Facility at a Location without Shallow Groundwater with a Land Application System:** Construct a new two lagoon sewer treatment facility in a new location without shallow groundwater and a new land application system. Existing facilities would be abandoned or utilized for storage and disposal of the water treatment plant discharge.

- **Alternative 5b – Construct a New Three Lagoon Facility at a Location without Shallow Groundwater with a Land Application System:** Construct a new three lagoon sewer treatment facility in a new location without shallow groundwater and a new land application system. Water treatment discharge would be included with the domestic wastewater in the process. Existing facilities would be abandoned.

- **Alternative 6a – Construct a New Two Lagoon Total Containment Facility at a Location without Shallow Groundwater:** Construct a new two lagoon sewer treatment facility in a new location without shallow groundwater with sufficient lagoon surface area and volume to operate as a total containment evaporative system. Existing facilities would be abandoned or utilized for storage and disposal of the water treatment plant discharge. Water treatment plant discharge would be disposed of at a different location.

- **Alternative 6b – Construct a New Three Total Containment Lagoon Facility at a Location without Shallow Groundwater:** Construct a new three lagoon sewer treatment facility in a new location without shallow groundwater with sufficient lagoon surface area and volume to operate as a total containment evaporative system. Water treatment discharge would be included with the domestic wastewater in the process. Existing facilities would be abandoned.

Copies of the lagoon and land application area preliminary sizing spreadsheets for Alternatives 3a, 3b, 4a, and 4b are included in **Appendix A.** Copies of the preliminary sizing spreadsheets for Alternatives 5a, 5b, 6a, and 6b are included in **Appendix B.**

5.3.5 Alternative 1 – No Action Alternative

For this alternative, the District would not implement any improvements to the wastewater treatment facilities. This option is not recommended due to the following:

- The treated effluent volume is insufficient to provide sufficient irrigation water to grow a harvestable crop. Therefore, the District cannot operate the slow rate land application system in compliance with their Wastewater Reuse Permit. The non-compliance situation will likely continue in the future unless supplemental irrigation water is applied. This may result in fines or other penalties.

- The available land application area is insufficient to allow the use of the existing sprinkler system with the setbacks required in the Wastewater Reuse Permit even if the water treatment plant discharge is eliminated from the treatment plant inflow. If the water treatment plant inflow is included, the land application area is not sufficient based on the allowable phosphorus loading.

- The treatment facility has only one operating lagoon which is not in compliance with IDAPA 58.01.16.08. Two lagoons are required for the existing average daily flow and three lagoons will be required within the 20 year growth period after the influent exceeds 50,000 gpd.

- The existing lagoon does not provide sufficient storage for the non-growing season. The lagoon volume necessary for the estimated current influent flow is 5.62 Mgal. The operational volume of the existing lagoon is 4.2 Mgal.

- Effluent quality from the lagoons will most likely continue to worsen in the future as the treatment facilities are overloaded.

- Future residential, commercial and industrial growth may be restricted unless the improvements are implemented. This may result in a loss of businesses and reduced property values.

Based on these issues, this alternative is not recommended and was not considered any further in this report.

5.3.6 Alternative 2 - Regional Treatment

Wastewater from the Bruneau District could potentially be combined with wastewater from one or more surrounding communities at a centralized location for regional treatment. Communities located near Bruneau that may potentially be involved in regional treatment include the City of Mountain Home (20 miles) and City of Grandview (19 miles). Each of these communities has existing treatment facilities.

Wastewater from one or more of the communities could be pumped to one of the existing treatment plants or to a new regional treatment plant. This would likely require large pump stations and transmission lines from the participating communities to the regional treatment plant, resulting in extensive capital costs and increased operation and maintenance requirements.

The existing treatment facilities within the surrounding communities are generally adequate to handle their own loads and would more than likely require extensive upgrades to accommodate the loads from other communities. As such, the surrounding communities may not favor regional treatment. It is also often challenging to develop user agreements between communities for regional treatment. Additionally, it will be more cost effective for the Bruneau Water and Sewer District to upgrade their own treatment facilities rather than implement upgrades at a neighboring treatment plant or to construct a new regional treatment plant.

Due to concerns regarding participation by neighboring communities and cost-effectiveness, this alternative was not considered any further in this report.

5.3.7 Alternative 3a – Reinstate a Portion of the North Lagoon, Upgrade South Lagoon and Upgrade Land Application System without Discharge from the Water Treatment Plant Included in the Treatment and Land Application. Construct a Separate WTP Discharge Pipeline, Storage Lagoon and Land Application System:

The following sections outline the required improvements to the existing treatment lagoons and land application system. The resulting reclaimed wastewater would be suitable for Class C uses. The construction items for this alternative are illustrated in **Figure 5-2**.

5.3.7.1 Reinstatement of a Portion of the North Lagoon for Wastewater Treatment

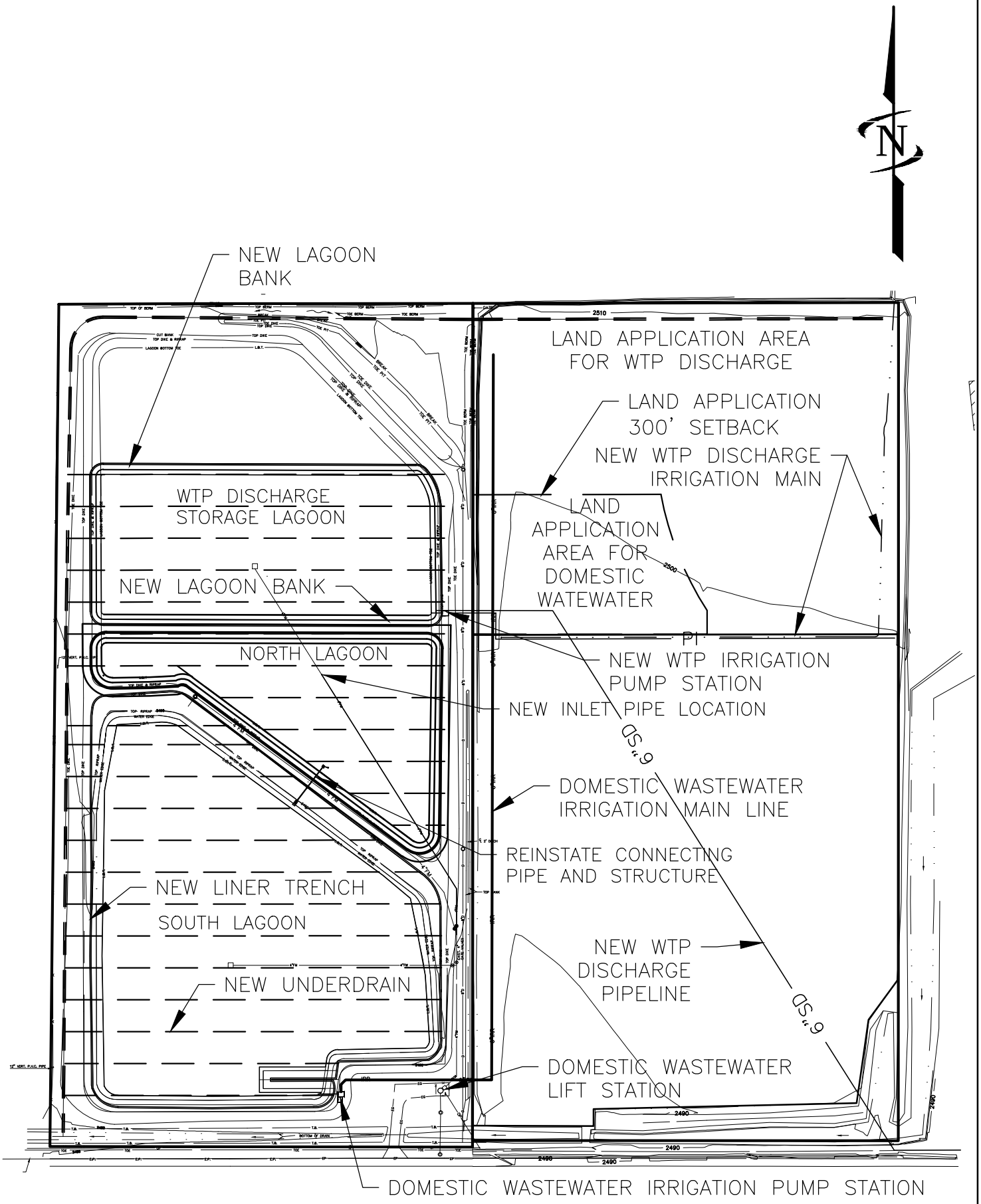
For this alternative, a portion of the north lagoon would be reinstated to provide a second wastewater lagoon. The total lagoon volume required in 2033 without the water treatment plant discharge and continuing to utilize the land application system is 1.64 Mgal. This volume is based on a lagoon surface area of 5.54 acres and a land application area of 1.50 acres. The recommended improvements to reinstate a portion of the north lagoon are to remove the existing liner, construct an underdrain system to prevent groundwater buildup under the liner, construct a new north bank, install a new liner and reconnect the transfer structures and pipelines that were disconnected in 1992. The volume of the reinstated north lagoon should be at least 1.64 Mgal. With an operating depth of 2.5 feet, the surface area required is 2.06 acres.

5.3.7.2 Reinstatement of a Portion of the North Lagoon for WTP Discharge Storage

A portion of the north lagoon would be reinstated to provide a storage lagoon for the WTP discharge. The WTP discharge would be delivered to the lagoon by a new gravity pipeline. The total lagoon volume required in 2033 for the water treatment plant discharge is 4.4 Mgal. This volume is based on a lagoon surface area of 2.70 acres and a land application area of 6.0 acres. The recommended improvements to reinstate a portion of the north lagoon are to remove the existing liner, construct an underdrain system to prevent groundwater buildup under the liner, construct a new north bank, install a new liner and construct a new transfer structure, irrigation pump station and land application sprinkler system.

5.3.7.3 Upgrade South Lagoon

As discussed in Chapter 4, the existing lagoon liner bubbled up near the north bank of the lagoon when the level of the lagoon was reduced. This bubble likely resulted from groundwater intrusion beneath the liner. The upgrade of the south lagoon includes removal of the existing liner, construction of an underdrain system and installation of a new liner.



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Date Created:2/12/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE WATER SYSTEM_MASTER PLAN_AND_EID\CAD\SHEET\FIGURE 5-2.DWG

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BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-2
ALTERNATIVE 3a SITE IMPROVEMENTS

SHEET
1

5.3.7.3 Construct a "Deer Proof" Fence Around the Lagoons

The barb wire fence that surrounds the existing property is sufficient to keep domestic livestock off the property. However, deer are often found on the property. The existing liner has a soil cover and rock rip-rap along the bank slopes that protect it from damage. The proposed new liner will be an uncovered HDPE liner that is susceptible to damage from deer hoofs. The liner surface is also slick, so animals that enter the lagoon will have difficulty getting out of it. An eight foot high "deer proof" fence will be installed around the lagoons to provide a barrier to deer and other large animals that could damage the liner.

5.3.7.4 Upgrade Land Application System

As shown in **Table 4-5**, the useable area of the current land application site is 5.62 acres with flood irrigation and 1.66 acres with sprinkler irrigation. This alternative requires 1.50 acres of land application; therefore, the existing sprinkler irrigation system could be utilized.

5.3.7.5 Supplemental Irrigation Water

Supplemental canal water may be required to grow a healthy crop since phosphorus is the limiting factor that controls the land area requirements. **Table 5-3** summarizes the estimated supplemental irrigation water requirements for alfalfa based on the results of the water balance.

Table 5-3. Supplemental Canal Water Requirements

Parameter	Unit	Existing	Future
Annual Volume	MGal	2.27	1.90
Max Monthly Volume	MGal	0.67	0.64
Max Monthly Diversion Rate[a]	Gpm	25	24

a. Assuming 25 irrigation days per month, 18 hours run time per day.

For future flow conditions, there is a greater amount of effluent generated from the lagoons. As such, less supplemental irrigation water is required to meet the crop water requirement. For existing flow conditions, the volume of effluent is relatively low. Therefore, more supplemental irrigation water is required to meet the crop water requirement. Irrigation water in the Bruneau area is provided from the Buckhorn Ditch which is diverted from the Bruneau River. There are no storage reservoirs along the Bruneau River, so water is limited to normal flows which can be quite low in mid to late summer when the irrigation demand is the highest.

5.3.7.6 Disinfection System

As stated in Chapter 4, the existing disinfection system is adequate for the maximum pumping rate of the existing pump station of 200 gpm.

5.3.7.7 Irrigation Pump Station

Based on the water balance analysis, the maximum monthly amount of water to be irrigated on the proposed reuse site is approximately 0.67 million gallons. Assuming 25 days of irrigation during the month and 18 hours of run-time per day, this equates to a maximum pumping capacity of approximately 25 gpm. As such, the existing 7.5 hp irrigation pump, which is rated at approximately 100 gpm, has sufficient capacity to supply the required flows.

5.3.7.8 Alternative 3a – Lagoons and Reuse Site Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 3a improvements is shown in **Tables 5-4, 5-5 and 5-6**, respectively. For the life-cycle costs, the inflation rate was assumed to be 3% and equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-4. Opinion of Alternative 3a Lagoon and Reuse Site Capital Costs

Lagoon Headworks	$0
Lagoons	$679,234
Water Treatment Discharge Storage and Land Appl.	$488,259
Irrigation Pump Station	$0
Irrigation Pressure Main	$0
Disinfection System	$0
Yard Piping	$0
Site Fencing	$68,000
Site Power	$0
Groundwater Monitor Wells	$0
Irrigation System	$0
Gravel Access Road	$0
Supplemental Irrigation Water	$20,000
Water Treatment Discharge Pipeline	$0
Sub-Total Construction Costs	**$1,255,493**
Contractor Admin, Ins, Bond (10%)	$125,549
Contractor Mob/Demob (5%)	$62,775
Contingencies (20%)	$251,099
Land Acquistion	$0
Total Construction Costs	**$1,694,916**

Engineering & Const. Mngt. (20%)	$338,983
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$2,128,899**

Table 5-5. Opinion of Alternative 3a Lagoon and Reuse Site Annual O&M Costs

Labor	$14,560
Power	$1,910
Chemicals	$506
Seepage Test	$600
Sampling	$4,000
Equipment/Repairs	$15,000
Professional Services	$500
Sub-Total Annual O&M Costs	**$37,076**
Contingencies (20%)	$7,415
Short Lived Asset Reserve	$1,000
Total Annual O&M Costs	**$45,491**

Table 5-6. Opinion of Alternative 3a Lagoon and Reuse Site Life Cycle Costs

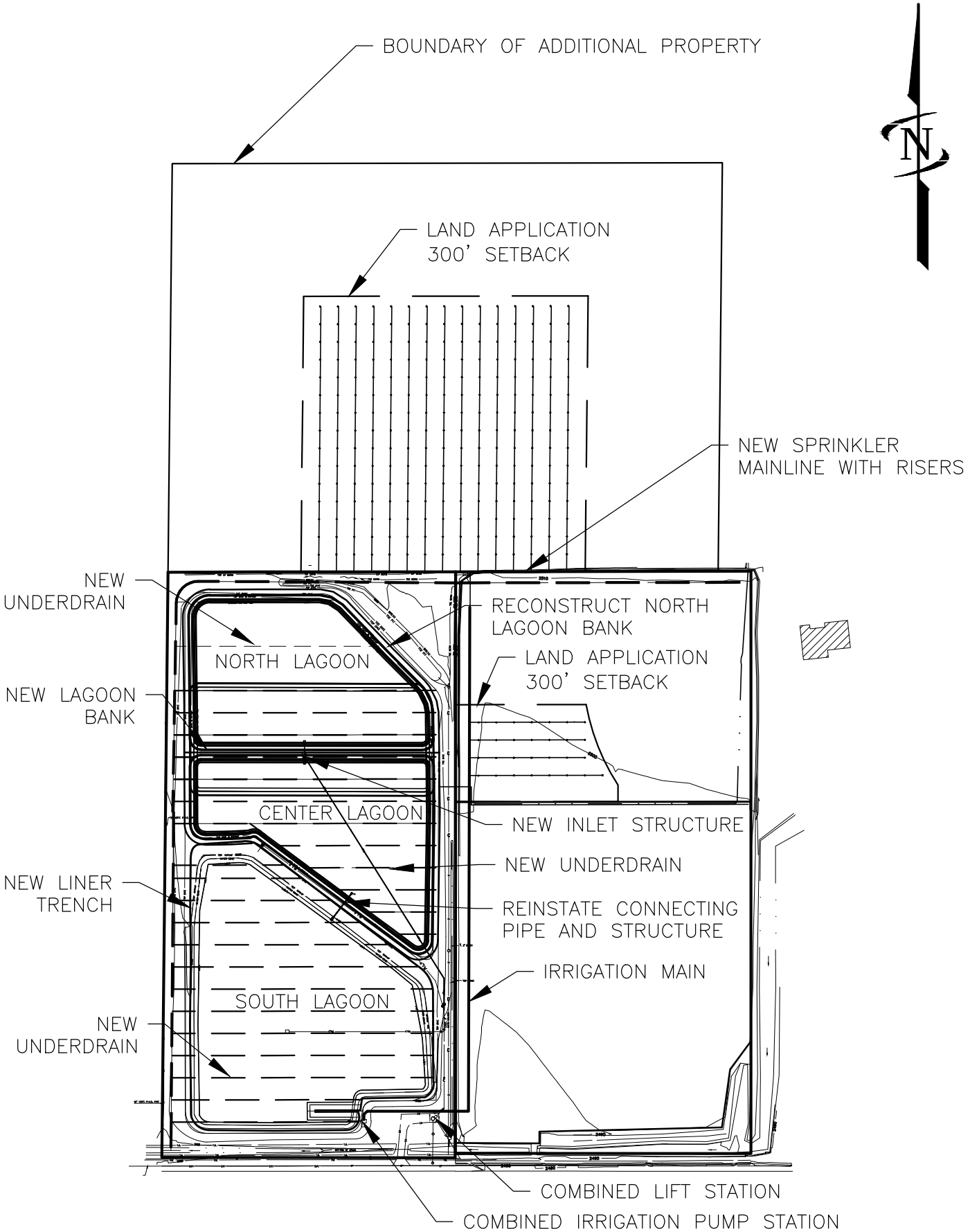
Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.91
Present Worth of Capital Costs	$1.62
Total Life Cycle Costs	**$2.53**

5.3.8 Alternative 3b – Reinstate and Divide the North Lagoon, Upgrade South Lagoon and Upgrade Land Application System with Influent from the Water Treatment Plant:

The following sections outline the required improvements to the existing treatment lagoons and land application system. The resulting reclaimed wastewater would be suitable for Class C uses. The construction items for this alternative are illustrated in **Figure 5-3**.

5.3.8.1 Reinstatement of a Portion of the North Lagoon

For this alternative, the north lagoon would be reinstated and divided to provide two additional lagoons. The total lagoon volume required in 2033 with the water treatment plant discharge and continuing to utilize the land application system is 6.35 Mgal. This volume is based on a lagoon surface area of 6.78 acres and a land application area of 4.3 acres. The recommended improvements to reinstate and divide the north lagoon are to remove the existing liner, construct an underdrain system to prevent groundwater buildup under the liner, construct a new bank through the middle to divide the lagoon, reconstruct the north bank, install a new liner and reconnect the transfer structures and pipelines that were disconnected in 1992. The volume of the reinstated and divided north lagoon will be at least 5.29 Mgal. With an operating depth of 2.5 feet, the surface area will be 6.49 acres.



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Date Created:2/4/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 5-3.DWG

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BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-3
ALTERNATIVE 3b SITE IMPROVEMENTS

SHEET
1

5.3.8.2 Upgrade South Lagoon

As discussed in Chapter 4, the existing lagoon liner bubbled up near the north bank of the lagoon when the level of the lagoon was reduced. This bubble likely resulted from groundwater intrusion beneath the liner. The upgrade of the south lagoon includes removal of the existing liner, construction of an underdrain system and installation of a new liner.

5.3.8.3 Construct a "Deer Proof" Fence Around the Lagoons

The requirement to construct a "deer proof" fence was discussed in Section 5.3.7.3. An eight foot high "deer proof" fence will be installed around the lagoons to provide a barrier to deer and other large animals that could damage the liner.

5.3.8.4 Upgrade Land Application System

As shown in **Table 4-5**, the useable area of the current land application site is 5.62 acres with flood irrigation and 1.66 acres with sprinkler irrigation. This alternative requires 4.3 acres of land application; therefore, no additional land application site would be required for flood irrigation and 2.64 acres (useable area) would be required for sprinkler irrigation.

5.3.8.5 Supplemental Irrigation Water

Supplemental canal water may be required to grow a healthy crop since phosphorus is the limiting factor that controls the land area requirements. **Table 5-7** summarizes the estimated supplemental irrigation water requirements for alfalfa based on the results of the water balance.

Table 5-7. Supplemental Canal Water Requirements

Parameter	Unit	Existing	Future
Annual Volume	MGal	1.39	1.45
Max Monthly Volume	MGal	0.70	0.77
Max Monthly Diversion Rate[a]	Gpm	26	29

a. Assuming 25 irrigation days per month, 18 hours run-time per day.

For future flow conditions, there is a greater amount of effluent generated from the lagoons; however, additional land is required due to accommodate the phosphorus load. As such, more supplemental irrigation water is required to meet the crop water requirement. Irrigation water in the Bruneau area is provided from the Buckhorn Ditch which is diverted from the Bruneau River. There are no storage reservoirs along the Bruneau River, so water is limited to normal flows which can be quite low in mid to late summer when the irrigation demand is the highest.

5.3.8.6 Disinfection System

As stated in Chapter 4, the existing disinfection system is adequate for the maximum pumping rate of the existing pump station of 200 gpm.

5.3.8.7 Irrigation Pump Station

Based on the water balance analysis, the maximum monthly amount of water to be irrigated on the proposed reuse site is approximately 2.0 million gallons. Assuming 25 days of irrigation during the

month and 18 hours run-time per day, this equates to a maximum pumping capacity of approximately 74 gpm. As such, the existing 7.5 hp irrigation pump, which is rated at approximately 100 gpm, has sufficient capacity to supply the required flows.

5.3.8.8 Alternative 3b – Lagoons and Reuse Site Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 3b improvements is shown in **Tables 5-8, 5-9 and 5-10**, respectively. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-8. Opinion of Alternative 3b Lagoon and Reuse Site Capital Costs

Lagoon Headworks	$0
Lagoons	$1,020,054
Water Treatment Discharge Storage and Land Appl.	
Irrigation Pump Station	$0
Irrigation Pressure Main	$44,210
Disinfection System	$0
Yard Piping	$0
Site Fencing	$81,350
Site Power	$0
Groundwater Monitor Wells	$0
Irrigation System	$39,315
Gravel Access Road	$0
Supplemental Irrigation Water	$170,000
Water Treatment Discharge Pipeline	$0
Sub-Total Construction Costs	**$1,354,929**
Contractor Admin, Ins, Bond (10%)	$135,493
Contractor Mob/Demob (5%)	$67,746
Contingencies (20%)	$270,986

Land Acquistion	$132,150
Total Construction Costs	**$1,961,304**
Engineering & Const. Mngt. (20%)	$392,261
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$2,448,565**

Table 5-9. Opinion of Alternative 3b Lagoon and Reuse Site Annual O&M Costs

Labor	$14,560
Power	$1,759
Chemicals	$633
Seepage Test	$900
Sampling	$4,000
Equipment/Repairs	$15,000
Professional Services	$500
Sub-Total Annual O&M Costs	**$37,351**
Contingencies (20%)	$7,470
Short Lived Asset Reserve	$1,000
Total Annual O&M Costs	**$45,821**

Table 5-10. Opinion of Alternative 3b Lagoon and Reuse Site Life Cycle Costs

Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.92
Present Worth of Capital Costs	$1.86
TOTAL LIFE CYCLE COSTS	**$2.77**

5.3.9 Alternative 4a – Reinstate a Portion of the North Lagoon and Upgrade the South Lagoon to Provide Sufficient Storage to Operate as an Evaporative System Without Discharge From the Water Treatment Plant Included in the Treatment and Land Application. Construct a Separate WTP Discharge Pipeline, Storage Lagoon and Land Application System:

The following sections outline the required improvements to the existing treatment lagoons. There would be no effluent discharge with this alternative. The construction items for this alternative are illustrated in **Figure 5-4**.

5.3.9.1 Reinstatement of a Portion of the North Lagoon

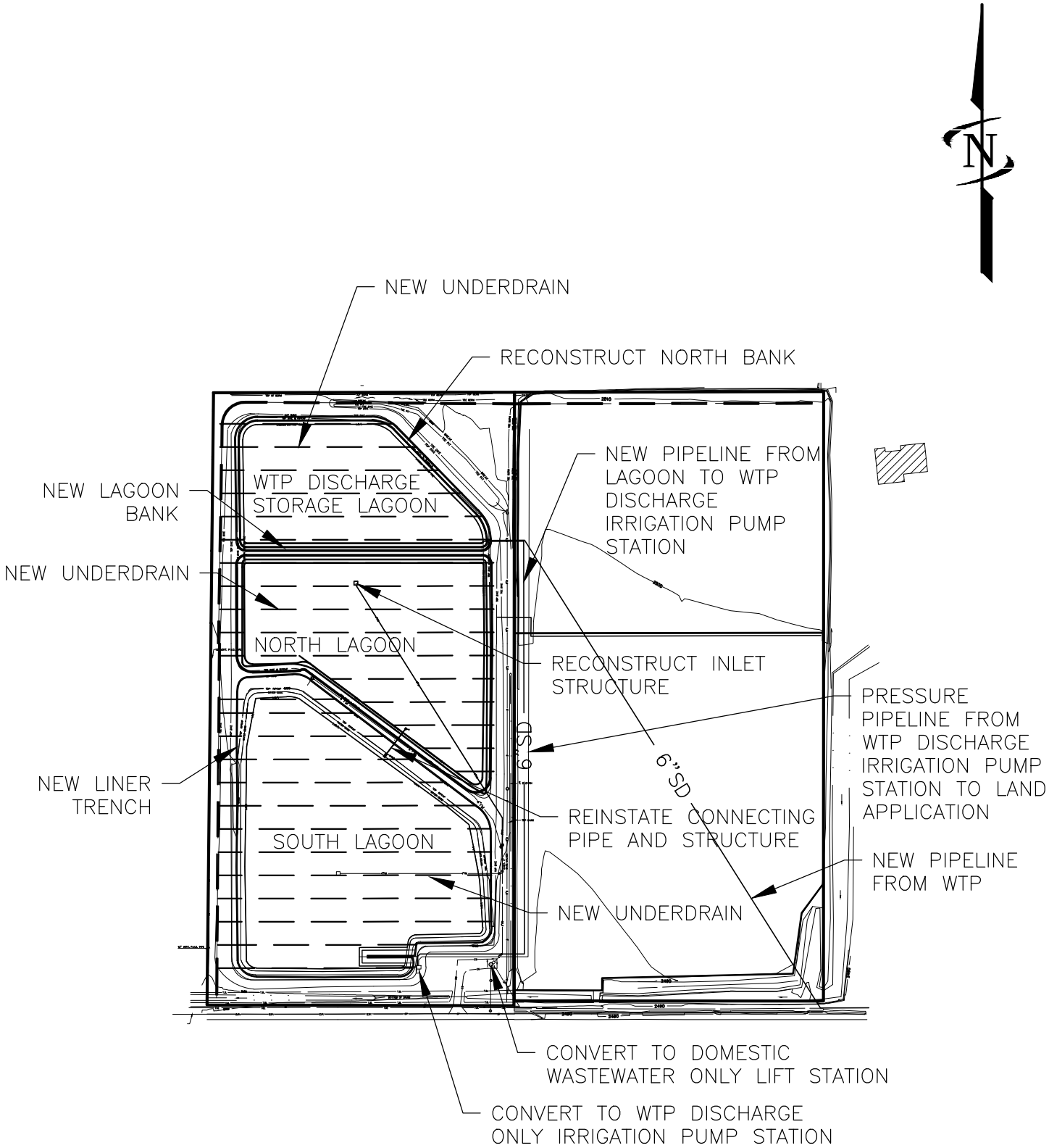
For this alternative, a portion of the north lagoon would be reinstated to provide a second lagoon with sufficient surface area to provide a total containment evaporative lagoon system for the domestic wastewater. The total lagoon volume required in 2033 without the water treatment plant discharge is 3.85 Mgal with a minimum surface area of 9.2 acres. The recommended improvements to reinstate a portion of the north lagoon are to remove the existing liner, construct an underdrain system to prevent groundwater buildup under the liner, construct a new north bank, install a new liner and reconnect the transfer structures and pipelines that were disconnected in 1992. The surface area of the reinstated north lagoon should be at least 4.0 acres. With an operating depth of 2.5 feet, the lagoon volume would be 3.26 Mgal.

The preliminary lagoon design for this alternative is summarized as follows:

- Lagoon Surface Area
    - Required = 9.20 acres total
    - Preliminary Design = 5.54 acres (south lagoon) + 4.07 acres (reinstated southern end of north lagoon) = 9.61 acres total
- Lagoon Volume
    - Required = 3.85 MGal total
    - Preliminary Design = 4.2 MGal (south lagoon) + 3.26 MGal (reinstated southern end of north lagoon) = 7.46 MGal total

As shown above, the preliminary design provides an additional 0.41 acres of surface area. This extra surface area will account for the reduction in water surface area that occurs due to the sloping embankments when the lagoon is operated at lower water levels.

The water balance calculations for the preliminary design assumed “average” weather conditions for evaporation and precipitation. However, the lagoons must be sized to store additional water during “wet” years when evaporation is reduced and precipitation is increased. Historical climate data for Bruneau indicates that the highest annual rainfall occurred in 1970 when 12.84 inches fell. The water balance calculations were re-run using this annual high value for precipitation. The results indicate that for the future design conditions, approximately 1.27 Mgal of additional water would remain in the lagoons at the end of the evaporative season (i.e., October). Since the preliminary design provides an additional 3.61 Mgal of storage volume, the lagoons could accommodate several years of historically high precipitation before overflowing. As long-term repetition of these conditions would be highly unlikely, the preliminary design should be adequate.



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Date Created:2/4/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 5-4.DWG

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FIGURE 5-4
ALTERNATIVE 4a SITE IMPROVEMENTS

SHEET
1

5.3.9.2 Reinstatement of a Portion of the North Lagoon for WTP Discharge Storage

A portion of the north lagoon would be reinstated to provide a storage lagoon for the WTP discharge. The WTP discharge would be delivered to the lagoon by a new gravity pipeline. The total lagoon volume required in 2033 for the water treatment plant discharge is 4.4 Mgal. This volume is based on a lagoon surface area of 2.70 acres and a land application area of 6.0 acres. The recommended improvements to reinstate a portion of the north lagoon are to remove the existing liner, construct an underdrain system to prevent groundwater buildup under the liner, reconstruct the north bank of the north lagoon, install a new liner and construct a new transfer structure, irrigation pump station and land application sprinkler system.

5.3.9.2 Upgrade South Lagoon

As discussed in Chapter 4, the existing lagoon liner bubbled up near the north bank of the lagoon when the level of the lagoon was reduced. This bubble likely resulted from groundwater intrusion beneath the liner. The upgrade of the south lagoon includes removal of the existing liner, construction of an underdrain system and installation of a new liner.

5.3.9.3 Construct a "Deer Proof" Fence Around the Lagoons

The requirement to construct a "deer proof" fence was discussed in Section 5.3.7.3. An eight foot high "deer proof" fence will be installed around the lagoons to provide a barrier to deer and other large animals that could damage the liner.

5.3.9.4 Alternative 4a – Lagoons Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 4a improvements is shown in **Tables 5-11, 5-12 and 5-13**, respectively. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-11. Opinion of Alternative 4a Lagoons Site Capital Costs

Lagoon Headworks	$0
Total Containment Lagoons	$781,181
Yard Piping	$0
Site Fencing	$68,000
Gravel Access Road	$0
Lift Station	$0
Water Treatment Discharge Storage and Piping	$448,661
Sub-Total Construction Costs	$1,297,841
Contractor Mob/Demob (5%)	$64,892
Contractor Bonding, Administration and Insurance (10%)	$129,784
Contingencies (20%)	$259,568
Total Construction Costs	**$1,752,085**
Land Acquisition	$0
Engineering & Const. Mngt. (20%)	$350,417
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$2,197,503**

Table 5-12. Opinion of Alternative 4a Lagoons Annual O&M Costs

Labor/Administration	$16,380
Lift Station Power	$303
Irrigation Pump Station Power WTP	$1,741
Chemicals	$500
Lagoon Seepage Testing	$600
Sampling	$0
Professional Services	$1,000
Miscellaneous Equipment/Repairs	$3,000
Sub-Total Annual O&M Costs	$23,524
Contingencies (20%)	$4,705
Short Lived Asset Reserve	$1,400
Total Annual O&M Costs	**$29,629**

Total Annualized Costs	**$141,744**

Table 5-13. Opinion of Alternative 4a Lagoons Life Cycle Costs

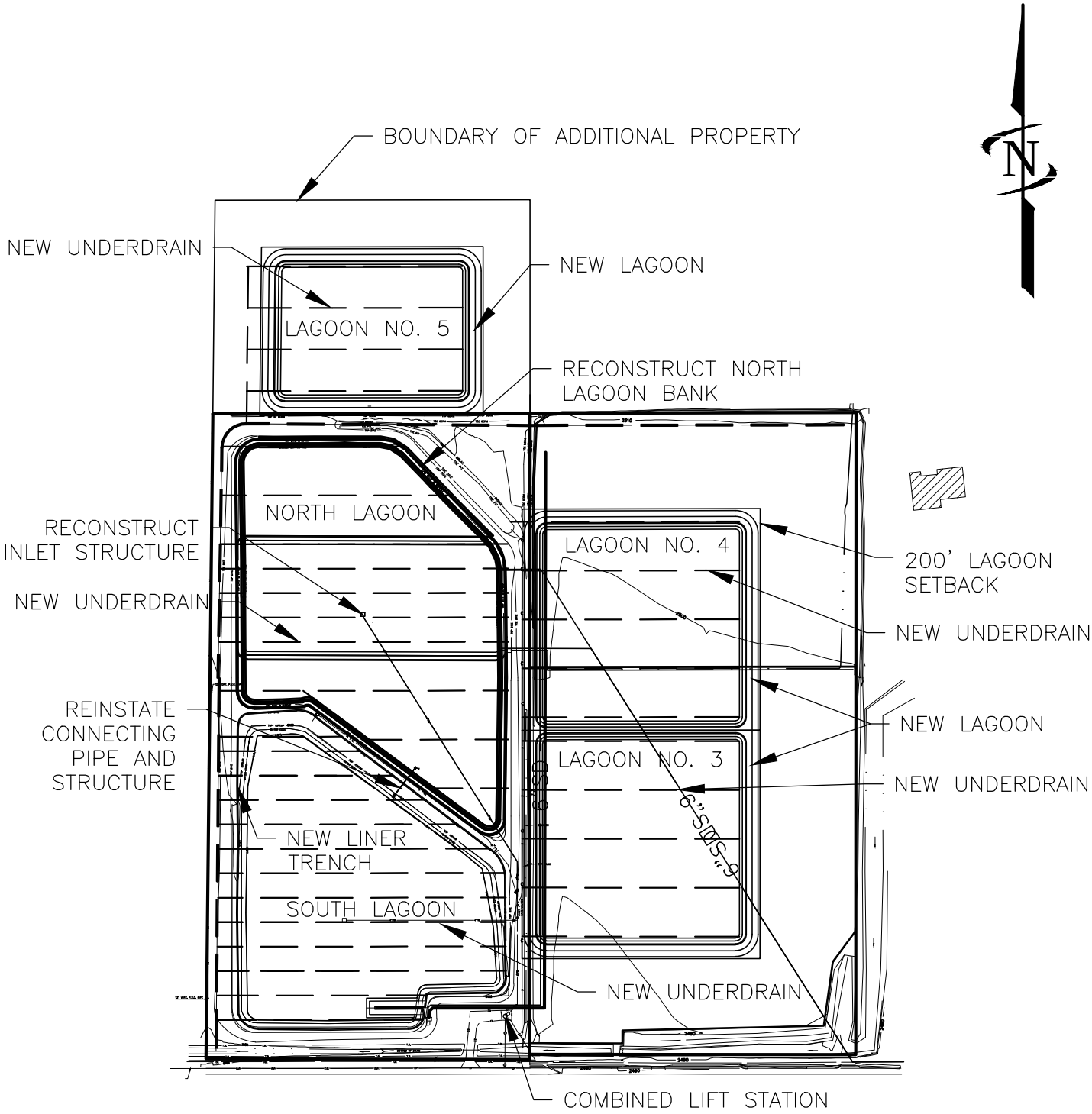
Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.59
Present Worth of Capital Costs	$1.67
TOTAL LIFE CYCLE COSTS	**$2.26**

5.3.10 Alternative 4b – Reinstate the North Lagoon, Upgrade the South Lagoon and Construct Additional Lagoons to Provide Sufficient Storage to Operate as an Evaporative System With Influent From the Water Treatment Plant:

The following sections outline the required improvements to the existing treatment lagoons and construction of new lagoons. There would be no effluent discharge with this alternative. The construction items for this alternative are illustrated in **Figure 5-5**.

5.3.10.1 Reinstatement of the North Lagoon

For this alternative, the north lagoon would be reinstated to provide a second lagoon to increase the storage volume and surface area towards providing a total containment evaporative lagoon system. The total lagoon volume required in 2033 with the water treatment plant discharge is 9.57 Mgal with a minimum surface area of 22.80 acres. The recommended improvements to the north lagoon are to remove the existing liner, construct an underdrain system to prevent groundwater buildup under the liner, reconstruct the north bank, install a new liner and reconnect the transfer structures and pipelines that were disconnected in 1992. The surface area of the reinstated north lagoon will be 7.0 acres. With an operating depth of 2.5 feet, the lagoon volume would be 5.70 Mgal. The south lagoon has a surface area of 5.54 acres and a volume of 4.20 Mgal for a total surface area with both lagoons of 12.54 acres and a total volume of 9.9 Mgal. Therefore, new lagoons with a minimum surface area of 10.26 acres will be necessary to provide sufficient surface area for a total containment evaporative solution.



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Date Created:2/4/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 5-5.DWG

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FIGURE 5-5
ALTERNATIVE 4b SITE IMPROVEMENTS

SHEET
1

5.3.10.2 Construction of New Lagoons

The recommended construction of the new lagoons includes excavation / embankment to shape the new lagoon(s), construction of an underdrain system to prevent groundwater buildup under the liner, installation of a new liner and construction of transfer structures and pipelines to supply effluent to the new lagoons. The surface area of the new lagoons will be 10.26 acres. With an operating depth of 2.5 feet, the lagoon volume would be 8.36 Mgal.

5.3.10.3 Upgrade South Lagoon

As discussed in Chapter 4, the existing lagoon liner bubbled up near the north bank of the lagoon when the level of the lagoon was reduced. This bubble likely resulted from groundwater intrusion beneath the liner. The upgrade of the south lagoon includes removal of the existing liner, construction of an underdrain system and installation of a new liner.

5.3.10.4 Construct a "Deer Proof" Fence Around the Lagoons

The requirement to construct a "deer proof" fence was discussed in Section 5.3.7.3. An eight foot high "deer proof" fence will be installed around the lagoons to provide a barrier to deer and other large animals that could damage the liner.

5.3.10.5 Alternative 4b – Lagoons Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 4b improvements is shown in **Tables 5-14, 5-15 and 5-16**, respectively. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-14. Opinion of Alternative 4b Lagoons Capital Costs

Lagoon Headworks	$0
Total Containment Lagoons	$1,764,267
Yard Piping	$8,960
Site Fencing	$123,450
Gravel Access Road	$25,200
Lift Station	$134,358
Water Treatment Discharge Storage and Piping	$0
Sub-Total Construction Costs	$2,056,235
Contractor Mob/Demob (5%)	$102,812
Contractor Bonding, Administration and Insurance (10%)	$205,624
Contingencies (20%)	$411,247
Total Construction Costs	**$2,775,918**
Land Acquisition	$250,000

Engineering & Const. Mngt. (20%)	$555,184
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$3,676,102**

Table 5-15. Opinion of Alternative 4b Lagoons Annual O&M Costs

Item	O&M Costs
Labor/Administration	$16,380
Lift Station Power	$0
Irrigation Pump Station Power WTP	
Chemicals	$500
Lagoon Seepage Testing	$1,500
Sampling	$0
Professional Services	$1,000
Miscellaneous Equipment/Repairs	$3,000
Sub-Total New O&M Costs	**$22,380**
Contingencies (20%)	$4,476
Short Lived Asset Reserve	$1,400
TOTAL ANNUAL O&M COSTS	**$28,256**
TOTAL ANNUALIZED COSTS	**$215,808**

Table 5-16. Opinion of Alternative 4b Lagoons Life Cycle Costs

Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.57
Present Worth of Capital Costs	$2.79
TOTAL LIFE CYCLE COSTS	**$3.36**

5.3.11 Alternative 5a – Construct a New Two Lagoon Facility at a Location without Shallow Groundwater with a Land Application System:

The following sections outline the required improvements to construct new treatment lagoons and a slow rate land application system at a new location where shallow groundwater does not intrude beneath the lagoons. The water treatment plant discharge would not be included in the sewer effluent. Supplemental irrigation water will be very difficult to obtain at this site; therefore, the land application irrigation period will be from April to June with corresponding reduction in the crop yield.

5.3.11.1 Purchase of Property for a New Treatment Plant

Purchase of new property would be required at a new location where shallow groundwater does not intrude beneath the lagoons. Most of the area that is lower than the Buckaroo Ditch has shallow

groundwater at least a portion of the year and would not be suitable for construction of a new treatment plant. The area immediately north and east of the ditch is too steep for economical construction of sewer lagoons. There is property located approximately 3/8 mile north of the District boundaries that is owned by the U.S. Bureau of Land Management that is relatively flat, should not have shallow groundwater, appears to have adequate soil depth, and is isolated from residences. The location of this property is illustrated in **Figure 5-6**. There is also privately owned ground just north of the BLM property that has similar slope, groundwater and soil characteristics that may be easier to purchase. Approximately 39 acres would be required for this alternative with a 300 foot setback from the property line to the land application area and 200 foot setback to the lagoons. The entire property will be enclosed with a "deer proof" fence. The construction items for this alternative are illustrated in **Figure 5-7.**

5.3.11.2 Construction of Two New Lagoons

The total lagoon volume required in 2033 without the water treatment plant discharge is 3.19 Mgal with a minimum surface area of 1.85 acres. The recommended construction of the new lagoons includes a lift station and pipeline to deliver the sewer effluent to the site, excavation / embankment to shape the new lagoons, installation of a new liner and construction of transfer structures and pipelines to supply effluent to the new lagoon. The maximum operating depth of the lagoons will be 5 feet. The total depth of the lagoons will be 8 feet to allow 1 feet for sludge accumulation and 2 feet of freeboard.

5.3.11.3 Construction of a Lift Station and Pressure Sewer from the Sewer Collection System to the New Treatment Site

This alternative would require the construction of a new lift station and a pressure sewer to the new site. The lift station would be located near Highway 51/78 below the last sewer service connection. The new treatment plant site was described in Section 5.3.11.1. The lift station would require duplex 10 horsepower pumps to deliver 80 gallons a minute to the treatment plant through a 6800 linear feet 4" pressure main. The elevation difference from the lift station to the new treatment plant is estimated to be 175 feet.

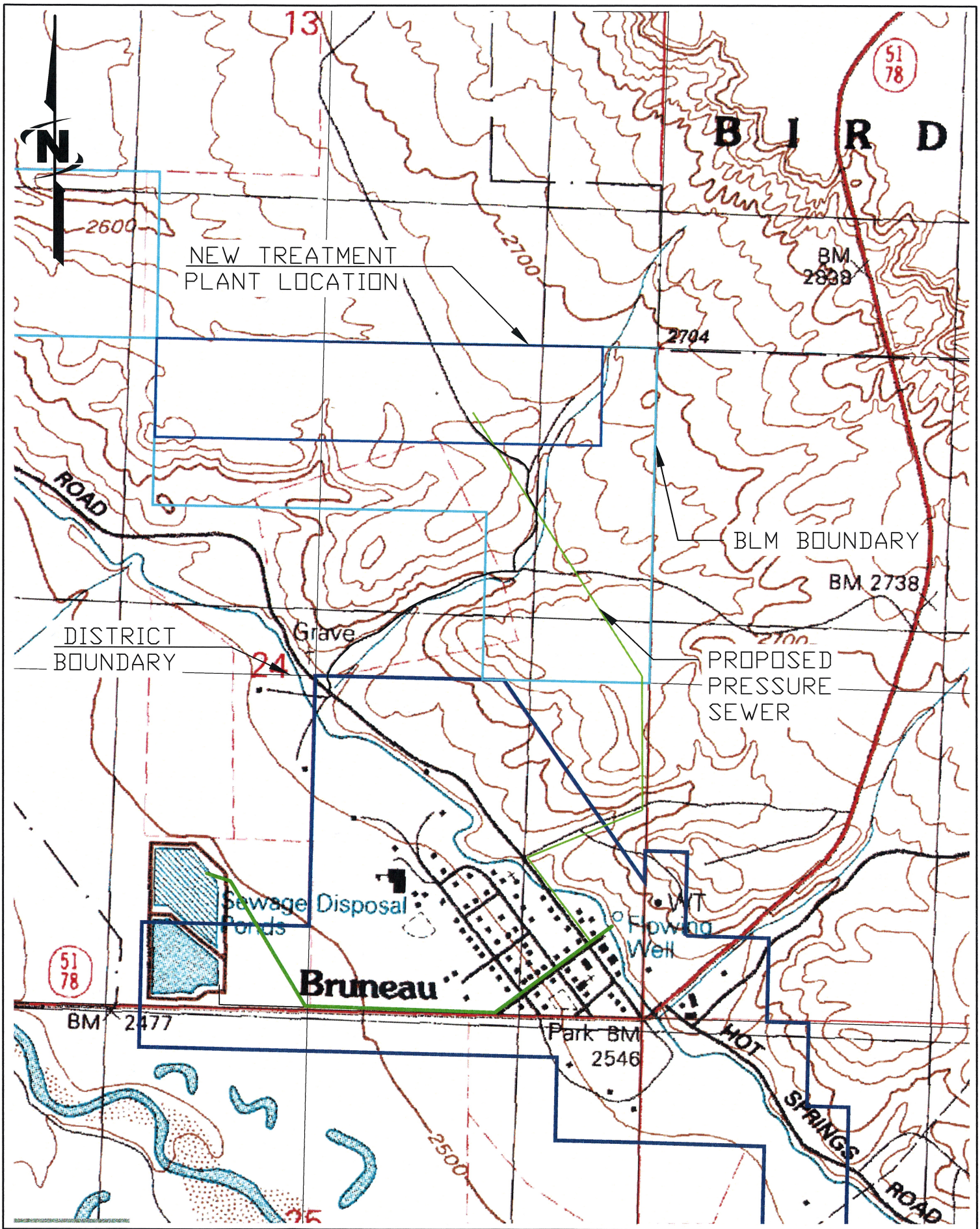
5.3.11.4 Construction of a Pipeline to Deliver the Water Treatment Discharge to the Existing Lagoon and Land Application Site

The existing water treatment discharge could be delivered to the existing sewer treatment system to be stored and land applied using the south lagoon or evaporated using both lagoons. The maximum flow from the treatment plant is approximately 215 gpm which could be transported with a 4 inch diameter pipe. The pipe will connect to the existing discharge near the Buckaroo Ditch and will gravity flow to the existing treatment plant lagoons. The pipe could be installed inside the existing 8" sewer along State Highway 51/78 to save cost of excavation and backfill. The lift station at the existing lagoons could be bypassed since the new pipeline would have sufficient elevation at the beginning to gravity flow into the lagoons.

5.3.11.5 Construction of an Disinfection System, Irrigation Pump Station and Sprinkler System

Relocating the treatment plant will require the construction of a chlorine contact chamber, irrigation pump station and sprinkler irrigation system. The irrigation pumping rate is estimated to be 87 gpm to apply 2.34 Mgal over a 25 day period with 18 hours run-time per day. A volume of 2610 gallons will be required for the chlorine contact chamber for a 30 minute contact time. This contact time can be

accomplished by running the pumped effluent through 450 linear feet of 12” pipe prior to delivery to the land application site.



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WASTEWATER MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-6
NEW TREATMENT PLANT LOCATION

SHEET
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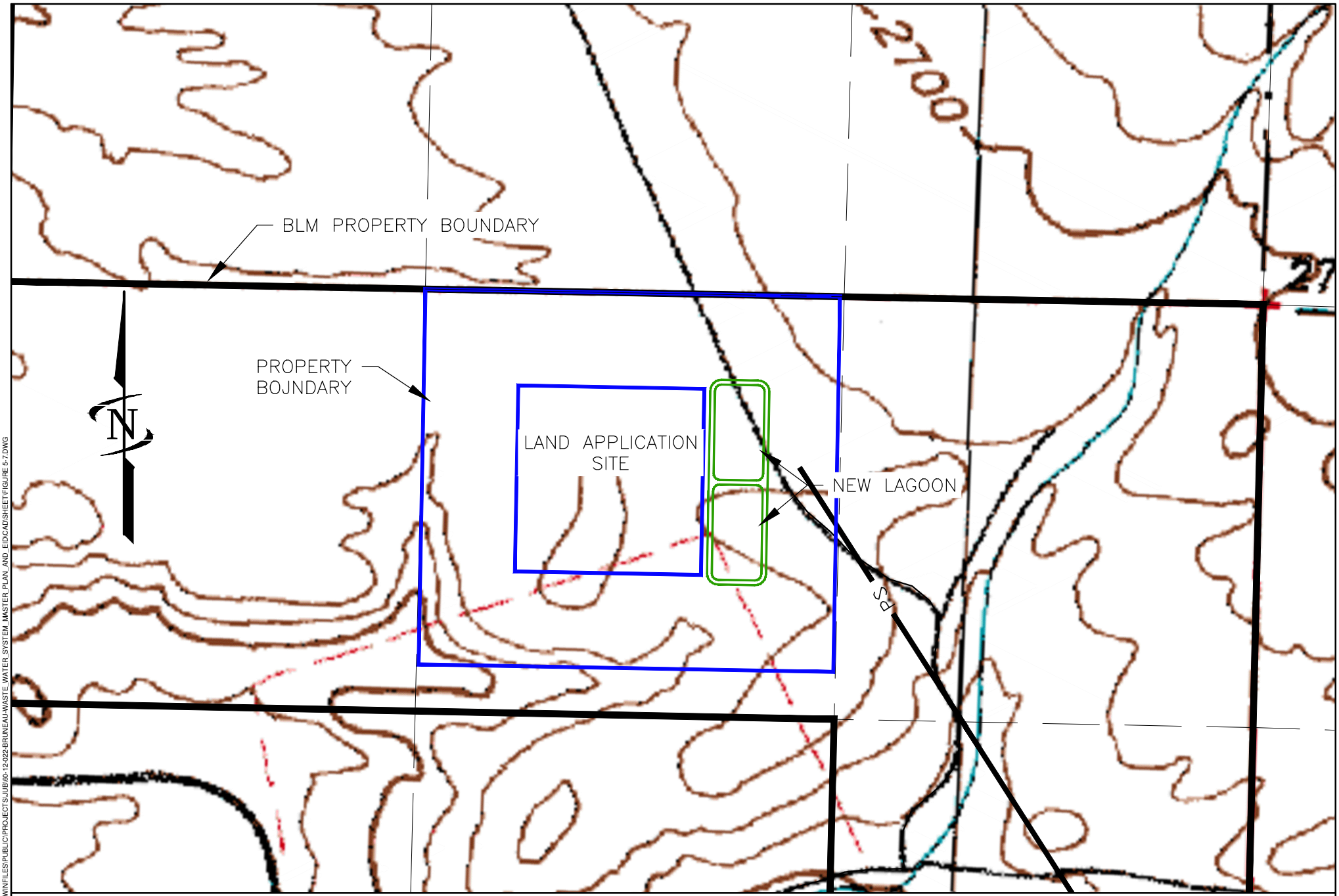


WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-7
ALTERNATIVE 5a IMPROVEMENTS

J-U-B ENGINEERS, INC.

LAST UPDATE: 12/14/2015
PLOT DATE: 12/14/2015
FILE: FIGURE 5-7

Plot Date:12/14/2015 4:40 PM Plotted By: Jordan Parker
Date Created:2/4/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 5-7.DWG

5.3.11.6 Alternative 5a – Lagoons, Land Application and Water Treatment Pipeline Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 5a improvements is shown in **Tables 5-17, 5-18 and 5-19**, respectively. In addition to the new operation and maintenance costs associated with the improvements, there are several items in the existing budget which were accounted for in the total annual operation and maintenance costs. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-17. Opinion of Alternative 5a Lagoons and Land Application Site Capital Costs

Lagoon Headworks	$30,600
Lagoons	$306,132
Water Treatment Discharge Storage and Land Appl.	
Irrigation Pump Station	$106,144
Irrigation Pressure Main	$40,326
Disinfection System	$37,805
Yard Piping	$89,500
Site Fencing	$105,200
Site Power	$195,000
Groundwater Monitor Wells	$42,000
Irrigation System	$28,750
Gravel Access Road	$25,200
Supplemental Irrigation Water	$0
Water Treatment Discharge Pipeline	$143,690
Sub-Total Construction Costs	**$1,006,657**
Contractor Admin, Ins, Bond (10%)	$100,666
Contractor Mob/Demob (5%)	$50,333
Contingencies (20%)	$201,331
Land Acquistion	$196,350

Total Construction Costs	**$1,555,337**
Engineering & Const. Mngt. (20%)	$311,067
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$1,961,404**

Table 5-18. Opinion of Alternative 5a Lagoons and Land Application Annual O&M Costs

Labor	$14,560
Power	$2,299
Chemicals	$601
Seepage Test	$600
Sampling	$4,000
Equipment/Repairs	$15,000
Professional Services	$500
Sub-Total Annual O&M Costs	**$37,560**
Contingencies (20%)	$7,512
Short Lived Asset Reserve	$1,880
Total Annual O&M Costs	**$46,952**

Table 5-19. Opinion of Alternative 5a Lagoons and Land Application Life Cycle Costs

Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.94
Present Worth of Capital Costs	$1.49
TOTAL LIFE CYCLE COSTS	**$2.43**

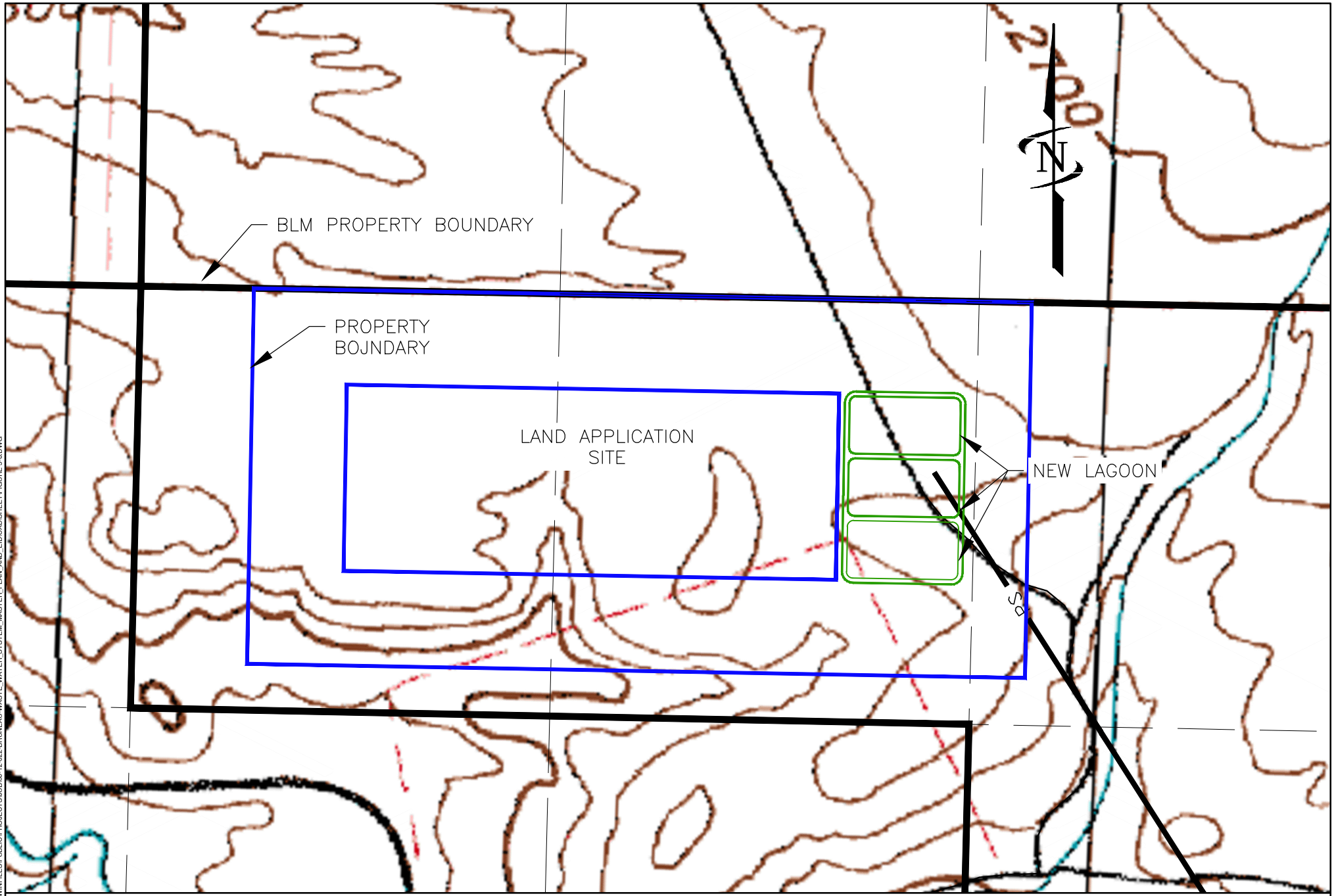
5.3.12 Alternative 5b – Construct a New Three Lagoon Facility at a Location without Shallow Groundwater with a Land Application System:

The following sections outline the required improvements to construct three new treatment lagoons and a slow rate land application system at a new location where shallow groundwater does not intrude beneath the lagoons. The water treatment plant discharge would be included in the sewer effluent. Supplemental irrigation water will be difficult to obtain at this site; therefore, the land application

irrigation period will be from April to June with corresponding reduction in the crop yield. The construction items for this alternative are illustrated in **Figure 5-8**.

5.3.12.1 Purchase of Property for a New Treatment Plant

One proposed location of the construction of a new treatment system is outlined in Section 5.3.11.1. Approximately 64 acres would be required for this alternative to accommodate the 300 foot setback from the property line to the land application site and the 200 foot setback from the property line to the lagoons. The entire property will be enclosed with a “deer proof” fence.



WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-8
ALTERNATIVE 5b IMPROVEMENTS

J-U-B ENGINEERS, INC.

LAST UPDATE: 12/14/2015
PLOT DATE: 12/14/2015
FILE: FIGURE 5-8

Plot Date:12/14/2015 4:38 PM Plotted By: Jordan Parker
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5.3.12.2 Construction of a Three New Lagoons

The total lagoon volume required in 2033 with the water treatment plant discharge is 7.33 Mgal with a minimum surface area of 4.24 acres. The recommended construction of the new lagoons includes a lift station and pipeline to deliver the sewer effluent to the site, excavation / embankment to shape the new lagoons, installation of a new liner and construction of transfer structures and pipelines to supply effluent to the new lagoon. The maximum operating depth of the lagoons will be 8.42 feet. The total depth of the lagoons will be 11.42 feet to allow 1 feet for sludge accumulation and 2 feet of freeboard.

5.3.12.3 Construction of a Lift Station and Pressure Sewer from the Sewer Collection System to the New Treatment Site

This alternative would require the construction of a new lift station and a pressure sewer to the new site. The lift station would be located near Highway 51/78 below the last sewer service connection. The new treatment plant site was described in Section 5.3.11.1. The lift station will require duplex 20 horsepower pumps to deliver the peak hour flow of 190 gallons a minute to the treatment plant through a 6800 linear feet 6” pressure main. The elevation difference from the lift station to the new treatment plant is estimated to be 175 feet.

5.3.12.4 Construction of an Disinfection System, Irrigation Pump Station and Sprinkler System

Relocating the treatment plant will require the construction of a chlorine contact chamber, irrigation pump station and sprinkler irrigation system. The irrigation pumping rate is estimated to be 199 gpm to apply 5.38 Mgal over a 25 day period with 18 hours run-time per day. A volume of 5,970 gallons will be required for the chlorine contact chamber for a 30 minute contact time. This contact time can be accomplished by running the pumped effluent through 254 linear feet of 24” pipe prior to delivery to the land application site.

5.3.12.5 Alternative 5b – Lagoons, Land Application and Water Treatment Pipeline Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 5b improvements is shown in **Tables 5-20, 5-21 and 5-22**, respectively. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-20. Opinion of Alternative 5b Lift Station, Lagoons and Land Application Site Capital Costs

Lagoon Headworks	$30,600
Lagoons	$565,187
Water Treatment Discharge Storage and Land Appl.	
Irrigation Pump Station	$116,144
Irrigation Pressure Main	$51,858
Disinfection System	$31,490
Yard Piping	$89,500
Site Fencing	$133,360
Site Power	$195,000
Groundwater Monitor Wells	$42,000
Irrigation System	$28,750
Gravel Access Road	$25,200
Supplemental Irrigation Water	$0
Water Treatment Discharge Pipeline	$0
Sub-Total Construction Costs	**$1,309,089**
Contractor Admin, Ins, Bond (10%)	$130,909
Contractor Mob/Demob (5%)	$65,454
Contingencies (20%)	$261,818
Land Acquistion	$318,200
Total Construction Costs	**$2,085,470**
Engineering & Const. Mngt. (20%)	$417,094
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$2,597,564**

Table 5-21. Opinion of Alternative 5b Lift Station, Lagoons and Land Application Annual O&M Costs

Labor	$14,560
Power	$3,792
Chemicals	$731
Seepage Test	$900
Sampling	$4,000
Equipment/Repairs	$15,000
Professional Services	$500
Sub-Total Annual O&M Costs	**$39,483**
Contingencies (20%)	$7,897
Short Lived Asset Reserve	$2,630
Total Annual O&M Costs	**$50,010**

Table 5-22. Opinion of Alternative 5b Lift Station, Lagoons and Land Application Life Cycle Costs

Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$1.00
Present Worth of Capital Costs	$1.97
TOTAL LIFE CYCLE COSTS	**$2.97**

5.3.13 Alternative 6a – Construct a New Two Lagoon Total Containment Facility at a Location Without Shallow Groundwater:

The following sections outline the required improvements to construct new lift station and two total containment treatment lagoons at a new location where shallow groundwater does not intrude beneath the lagoons. The water treatment plant discharge would not be included in the sewer effluent. The construction items for this alternative are illustrated in **Figure 5-9**.

5.3.13.1 Purchase of Property for a New Treatment Plant

One proposed location of the construction of a new treatment system is outlined in Section 5.3.11.1. Approximately 24 acres would be required for this alternative to accommodate the 300 foot setback from the property line to the land application site and the 200 foot setback from the property line to the lagoons. The entire property will be enclosed with a “deer proof” fence.

5.3.13.2 Construction of a Two New Lagoons

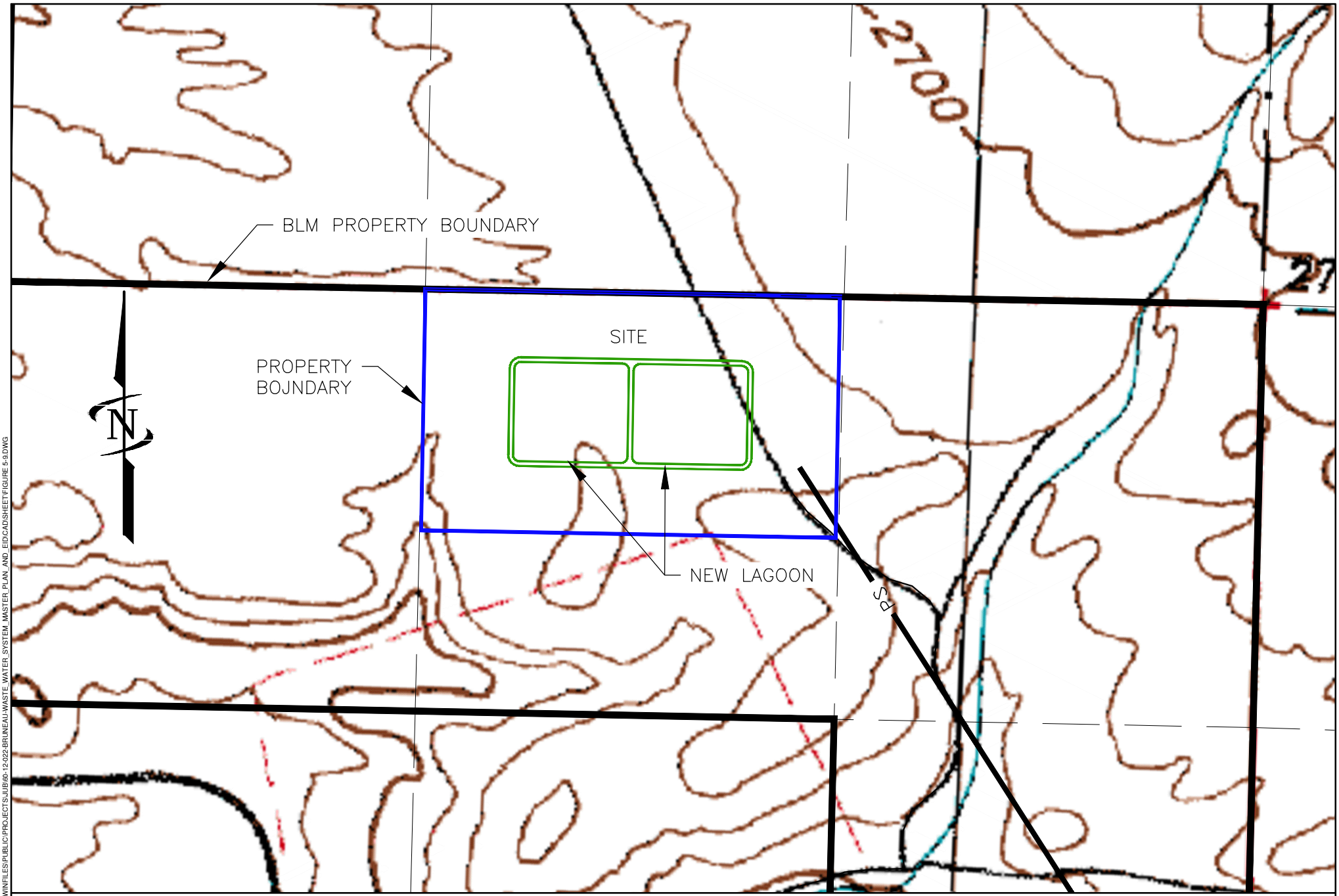
The total lagoon volume required in 2033 without the water treatment plant discharge is 3.86 Mgal with a minimum surface area of 9.50 acres. The recommended construction of the new lagoons includes a lift station and pipeline to deliver the sewer effluent to the site, excavation / embankment to shape the new lagoons, installation of a new liner and construction of transfer structures and pipelines to supply effluent to the new lagoon. The maximum operating depth of the lagoons will be 3.80 feet. The total depth of the lagoons will be 6.80 feet to allow 1 feet for sludge accumulation and 2 feet of freeboard.

5.3.13.3 Construction of a Lift Station and Pressure Sewer from the Sewer Collection System to the New Treatment Site

This alternative would require the construction of a new lift station and a pressure sewer to the new site. The lift station would be located near Highway 51/78 below the last sewer service connection. The new treatment plant site was described in Section 5.3.11.1. The lift station will require duplex 10 horsepower pumps to deliver 80 gallons a minute to the treatment plant through a 6800 linear feet 4” pressure main. The elevation difference from the lift station to the new treatment plant is estimated to be 175 feet.

5.3.13.4 Construction of a Pipeline to Deliver the Water Treatment Discharge to the Existing Lagoon and Land Application Site

The existing water treatment discharge could be delivered to the existing sewer treatment system to be stored and land applied using the south lagoon or evaporated using both lagoons. The maximum flow from the treatment plant is approximately 215 gpm which could be transported with a 4 inch diameter pipe. The pipe would connect to the existing discharge near the Buckaroo Ditch and gravity flow to the existing treatment plant lagoons. The pipe could be installed inside the existing 8” sewer along State Highway 51/78 to save cost of excavation and backfill. The lift station at the existing lagoons could be bypassed since the new pipeline would have sufficient elevation at the beginning to gravity flow into the lagoons.



WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-9
ALTERNATIVE 6a IMPROVEMENTS

J-U-B ENGINEERS, INC.

LAST UPDATE: 2/4/2013
PLOT DATE: 12/14/2015
FILE: FIGURE 5-9

Plot Date:12/14/2015 3:14 PM Plotted By: Jordan Parker
Date Created:2/4/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 5-9.DWG

5.3.13.5 Alternative 6a – Lagoons, Land Application and Water Treatment Pipeline Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 6a improvements is shown in **Tables 5-23, 5-24 and 5-25**, respectively. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.

Table 5-23. Opinion of Alternative 6a Lift Station and Lagoons Capital Costs

Lagoon Headworks	$38,900
Total Containment Lagoons	$453,069
Yard Piping	$27,216
Site Fencing	$88,680
Gravel Access Road	$34,500
Lift Station	$444,888
Water Treatment Discharge Storage and Piping	$63,180
Sub-Total Construction Costs	$1,150,433
Contractor Mob/Demob (5%)	$57,522
Contractor Bonding, Administration and Insurance (10%)	$115,043
Contingencies (20%)	$230,087
Total Construction Costs	**$1,553,085**
Land Acquisition	$117,700
Engineering & Const. Mngt. (20%)	$310,617
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$2,076,402**

Table 5-24. Opinion of Alternative 6a Lift Station and Lagoons Annual O&M Costs

Labor/Administration	$16,380
Lift Station Power	$759
Irrigation Pump Station Power WTP	
Chemicals	$1,000
Lagoon Seepage Testing	$600
Sampling	$0
Professional Services	$1,000
Miscellaneous Equipment/Repairs	$3,000

Sub-Total Annual O&M Costs	$22,739
Contingencies (20%)	$4,548
Short Lived Asset Reserve	$2,280
Total Annual O&M Costs	**$29,567**
Total Annualized Costs	**$135,503**

Table 5-25. Opinion of Alternative 6a Lift Station and Lagoons Life Cycle Costs

Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.59
Present Worth of Capital Costs	$1.58
TOTAL LIFE CYCLE COSTS	**$2.17**

5.3.14 Alternative 6b – Construct a New Three Total Containment Lagoon Facility at a Location Without Shallow Groundwater:

The following sections outline the required improvements to construct a new lift station and three new treatment lagoons at a new location where shallow groundwater does not intrude beneath the lagoons. The water treatment plant discharge would be included in the sewer effluent. The construction items for this alternative are illustrated in **Figure 5-10**.

5.3.14.1 Purchase of Property for a New Treatment Plant

One proposed location of the construction of a new treatment system is outlined in Section 5.3.12.1. Approximately 63 acres would be required for this alternative to accommodate the 200 foot setback from the property line to the lagoons. The entire property will be enclosed with a “deer proof” fence.

5.3.14.2 Construction of a Three New Lagoons

The total lagoon volume required in 2033 with the water treatment plant discharge is 9.57 Mgal with a minimum surface area of 22.8 acres. The recommended construction of the new lagoons includes a lift station and pipeline to deliver the sewer effluent to the site, excavation / embankment to shape the new lagoons, installation of a new liner and construction of transfer structures and pipelines to supply effluent to the new lagoon. The maximum operating depth of the lagoons will be 5.58 feet. The total depth of the lagoons will be 8.58 feet to allow 1 feet for sludge accumulation and 2 feet of freeboard.

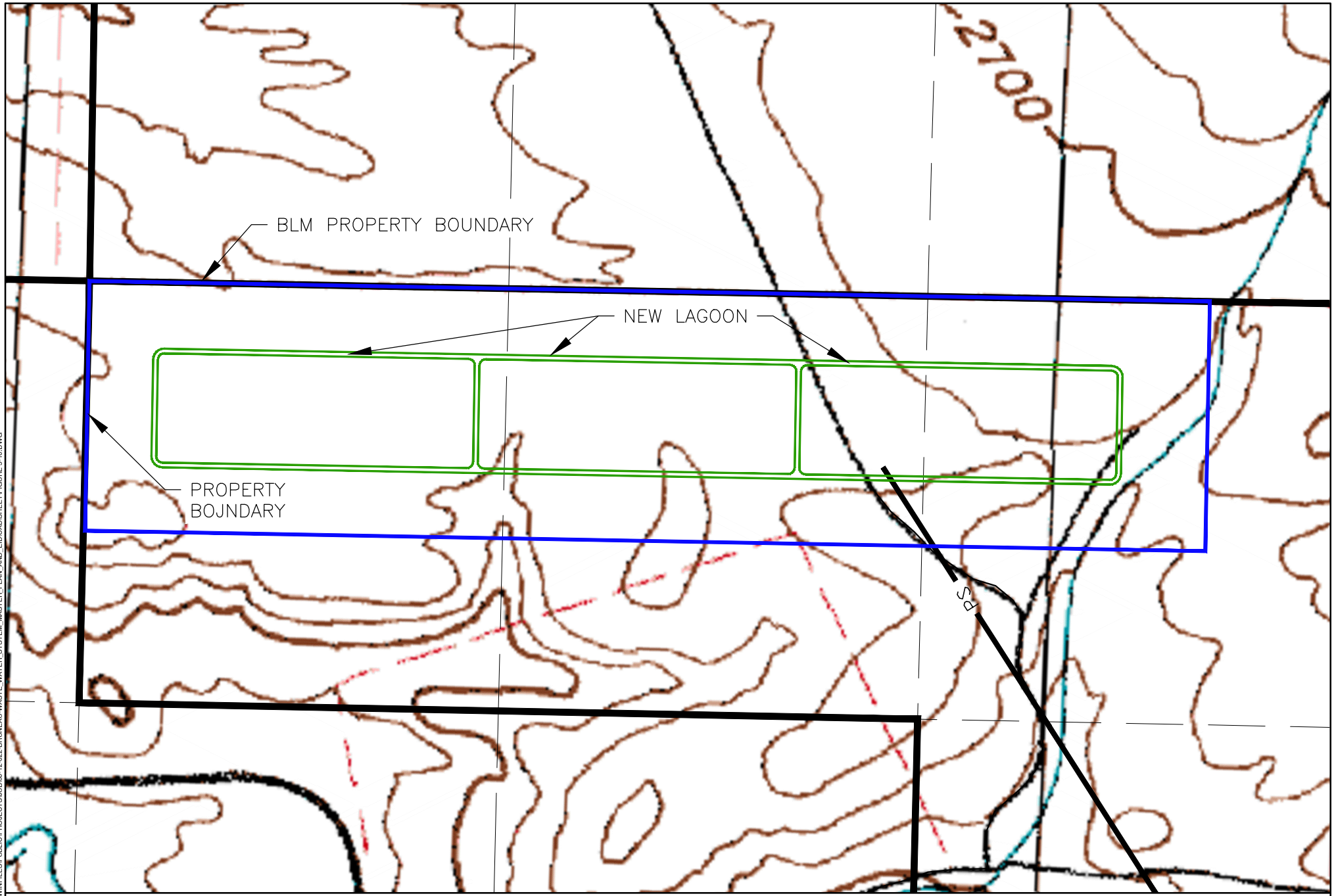
5.3.14.3 Construction of a Lift Station and Pressure from the Sewer Collection System to the New Treatment Site

This alternative would require the construction of a new lift station and a pressure sewer to the new site. The lift station would be located near Highway 51/78 below the last sewer service connection. The new treatment plant site was described in Section 5.3.11.1. The lift station will require duplex 20 horsepower pumps to deliver 190 gallons a minute peak hourly flow to the treatment plant through a

6800 linear feet 6” pressure main. The elevation difference from the lift station to the new treatment plant is estimated to be 175 feet.

5.3.14.4 Alternative 6b – Lagoons and Water Treatment Pipeline Improvement Costs

An opinion of the probable capital, annual operation and maintenance, and life-cycle costs in 2015 dollars for the Alternative 6b improvements is shown in **Tables 5-26, 5-27 and 5-28**, respectively. For the life-cycle costs, the inflation rate was assumed to be equal to the interest rate over the 20-year planning period. Detailed cost estimates can be found in **Appendix C**.



WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 5-10
ALTERNATIVE 6b IMPROVEMENTS

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Date Created:2/4/2013 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022-BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 5-10.DWG

Table 5-26. Opinion of Alternative 6b Lift Station and Lagoons Capital Costs

Lagoon Headworks	$38,900
Total Containment Lagoons	$1,689,368
Yard Piping	$47,376
Site Fencing	$161,960
Gravel Access Road	$34,500
Lift Station	$515,688
Water Treatment Discharge Storage and Piping	$0
Sub-Total Construction Costs	$2,487,792
Contractor Mob/Demob (5%)	$124,390
Contractor Bonding, Administration and Insurance (10%)	$248,779
Contingencies (20%)	$497,558
Total Construction Costs	**$3,358,519**
Land Acquisition	$317,100
Engineering & Const. Mngt. (20%)	$671,704
Admin, Legal, and Publications	$95,000
Total Project Capital Costs	**$4,442,323**

Table 5-27. Opinion of Alternative 6b Lift Station and Lagoons Annual O&M Costs

Labor/Administration	$16,380
Lift Station Power	$2,808
Irrigation Pump Station Power WTP	
Chemicals	$1,000
Lagoon Seepage Testing	$900
Sampling	$0
Professional Services	$1,000
Miscellaneous Equipment/Repairs	$3,000
Sub-Total Annual O&M Costs	$25,088
Contingencies (20%)	$5,018
Short Lived Asset Reserve	$3,030
Total Annual O&M Costs	**$33,136**

Total Annualized Costs	**$259,780**

Table 5-28. Opinion of Alternative 6b Lift Station and Lagoons Life Cycle Costs

Item	Life Cycle Costs ($M)
Present Worth of Annual O&M Costs	$0.66
Present Worth of Capital Costs	$3.37
TOTAL LIFE CYCLE COSTS	**$4.03**

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

CHAPTER 6: IMPLEMENTATION OF IMPROVEMENT PROJECT

6.0 IMPLEMENTATION OF IMPROVEMENT PROJECT

6.1 SELECTION AND IMPLEMENTATION OF IMPROVEMENT PROJECTS

This Wastewater System Master Plan identifies two areas of concern related to wastewater treatment in the Bruneau Water and Sewer District:

1. The existing wastewater treatment system does not currently meet regulatory requirements in regards to number and capacity of the lagoon system and will have difficulty meeting the future needs of the community.

2. There is not sufficient treated effluent to grow a harvested crop to remove nutrients from the land application site.

At the time of this Master Plan, some of the known findings include:

- The current collection system is adequate for the Bruneau Districts wastewater collection needs.

- The current treatment facilities are not in compliance with IDEQ requirements.

Chapter 5 outlined a number of alternatives to treat, store and dispose of the District's sewer effluent and water treatment plant discharge. The chapter included the estimated costs to construct and provide the operation and maintenance for the alternatives. Other non-monetary factors also need to be considered in the decision of which alternative is preferred. These factors include:

1. Alternatives 3a and 3b include land application of the treated effluent. The land application area is based on the nutrient loading in the effluent. Additional irrigation water is necessary to grow a crop with sufficient yield to remove the nutrients that are applied in the effluent. The financial analysis included a cost for the purchase of that additional water. However, the Bruneau River has limited water available for irrigation and it is likely that additional irrigation water is not available. These two options are not viable without the additional irrigation water.
2. Alternatives 5a, 5b, 6a and 6b require the purchase of additional property and easements for the wastewater treatment and delivery of the wastewater to the treatment facility. The location illustrated in the figures is owned by Federal Government and managed by the U.S. Bureau of Land Management. Obtaining property from the BLM can be lengthy process with considerable cost beyond the actual purchase price. The District also desires to continue to use the existing facilities for their wastewater treatment.
3. Alternatives 3a, 3b, 5a and 5b include land application for the disposal of the treated effluent. The land application process requires testing and close monitoring to assure the effluent disinfection is sufficient and the applied nutrient loading does not exceed crop uptake. The trained and qualified operators for the system are often out of the area for work and will not always be available to conduct the land application.
4. Alternatives 4a, 4b, 6a and 6b rely on evaporation to dispose of the treated effluent. This effluent disposal option requires less man hours to operate than land application. It also allows more flexibility in the timing of monitoring required.
5. Alternative 4a does include land application of the water treatment plant discharge; however, the discharge will be kept separate from the wastewater effluent. This land application will not

be restricted in regards to setbacks, crops and application volumes and will not require a licensed wastewater operator to monitor it.

Table 6-1 summarizes the costs and other non-monetary criteria for each alternative. The information in this table was presented to the community and District Board.

Table 6-1. Matrix of Upgrade Alternatives

	ALTERNATIVE*							
Parameter	3a	3b	4a	4b	5a	5b	6a	6b
Water Treatment Plant Discharge Included in Influent	No	Yes	No	Yes	No	Yes	No	Yes
Amount of Additional Property Required (acres)	0	0	0	0	0	0	0	0
Total Project Capital Costs (Million)	$2.13	$2.45	$2.20	$3.68	$1.96	$2.60	$2.08	$4.44
Annualized Capital Costs	$108,615	$124,924	$112,115	$187,552	$100,069	$132,526	$105,936	$226,644
Annual Operation and Maintenance	$45,491	$45,821	$29,629	$28,256	$46,952	$50,010	$29,567	$33,136
Total Annual Cost - First Year	$154,106	$170,745	$141,744	$215,808	$147,022	$182,535	$135,503	$259,780
Capital Cost Present Worth (Million)	$1.62	$1.86	$1.67	$2.79	$1.49	$1.97	$1.58	$3.37
Operation and Maintenance Present Worth (Million)	$0.91	$0.92	$0.59	$0.57	$0.94	$1.00	$0.59	$0.66
Total Present Worth (Million)	$2.53	$2.77	$2.26	$3.36	$2.43	$2.97	$2.17	$4.03

*3a Land Application At Current Site With Water Treatment Plant Discharge Land Applied Separately
3b Land Application At Current Site With Water Treatment Plant Discharge
4a Total Containment At Current Site With Water Treatment Plant Discharge Land Applied Separately
4b Total Containment At Current Site With Water Treatment Plant Discharge
5a Land Application At New Site With Water Treatment Plant Discharge to Existing Lagoons for Evaporation
5b Land Application At New Site With Water Treatment Plant Discharge
6a Total Containment At New Site With Water Treatment Plant Discharge to Existing Lagoons for Evaporation
6b Total Containment At New Site With Water Treatment Plant Discharge

As shown in Table 6-1, the three alternatives with the lowest total present worth are 4a, 5a, and 6a. Of these three alternatives, 4a is the only alternative that will not require the acquisition of additional property and all the associated risks and challenges associated with that issue. After consideration of the above information and discussion with the District, IDWR and IDEQ, the preferred alternative is 4a.

Construction of the Alternative 4a improvements includes:

- Separation of the Wastewater and Water Treatment Plant discharge.
- Reconstruction of the north lagoon in to two lagoons, one for wastewater and one for WTP discharge.
- Total containment of wastewater with evaporative disposal.
- Land application of the WTP discharge utilizing the existing irrigation pump station.

6.2 COST ESTIMATES

Overall capital and operation and maintenance costs were developed for the recommended improvements. In addition to the construction costs outlined in Chapter 5, capital costs were included for:

- Engineering and construction management (including geotechnical investigations);

- Grant application preparation and writing;
- Funding administration;
- Legal and bonding; and
- Audits, publications and miscellaneous.

An opinion of the probable total capital costs for the Alternative 4a recommended improvements is summarized in **Table 5-11**. A detailed breakdown of costs is included in **Appendix C**.

Note that the capital costs presented in Table 5-11 or Table 6-4 later in this report do not include:

- Davis-Bacon Prevailing Wage Compliance, which may be required for some funding sources (see Section 6.4 later in this report)
- American Iron and Steel Compliance, which may be required for some funding sources (see Section 6.4 later in this report)
- Inflation beyond Year 2015
- Loan or asset reserve costs
- Interim financing costs

An opinion of the probable total operation and maintenance costs for the recommended improvements is summarized in **Table 6-2**.

Table 6-2. Opinion of Probable Total Operation and Maintenance Costs

Item	O&M Costs
Existing Wastewater Operation and Maintenance Budget	$18,360
Additional Operation and Maintenance Cost for the New Construction	$11,269
TOTAL PROJECT OPERATION AND MAINTENANCE COSTS	**$29,629**

The annual cost of the system must include a reserve to provide funds to replace short lived assets as needed. A summary of the short lived assets and the annual reserve required is shown in **Table 6-3**.

Table 6-3. Short Lived Asset Reserve

	Replacement Cost	Service Life (years)	Remaining Life (years)	Cost per Year	Cost per Month
Lift Station Pumps	$10,000	10	0	$1,000	$83
Influent Flow Meter	$4,000	10	0	$400	$33
TOTAL SHORT-LIVED ASSET RESERVE				**$1,400**	**$117**

6.3 PHASED CONSTRUCTION OF THE RECOMMENDED ALTERNATIVE

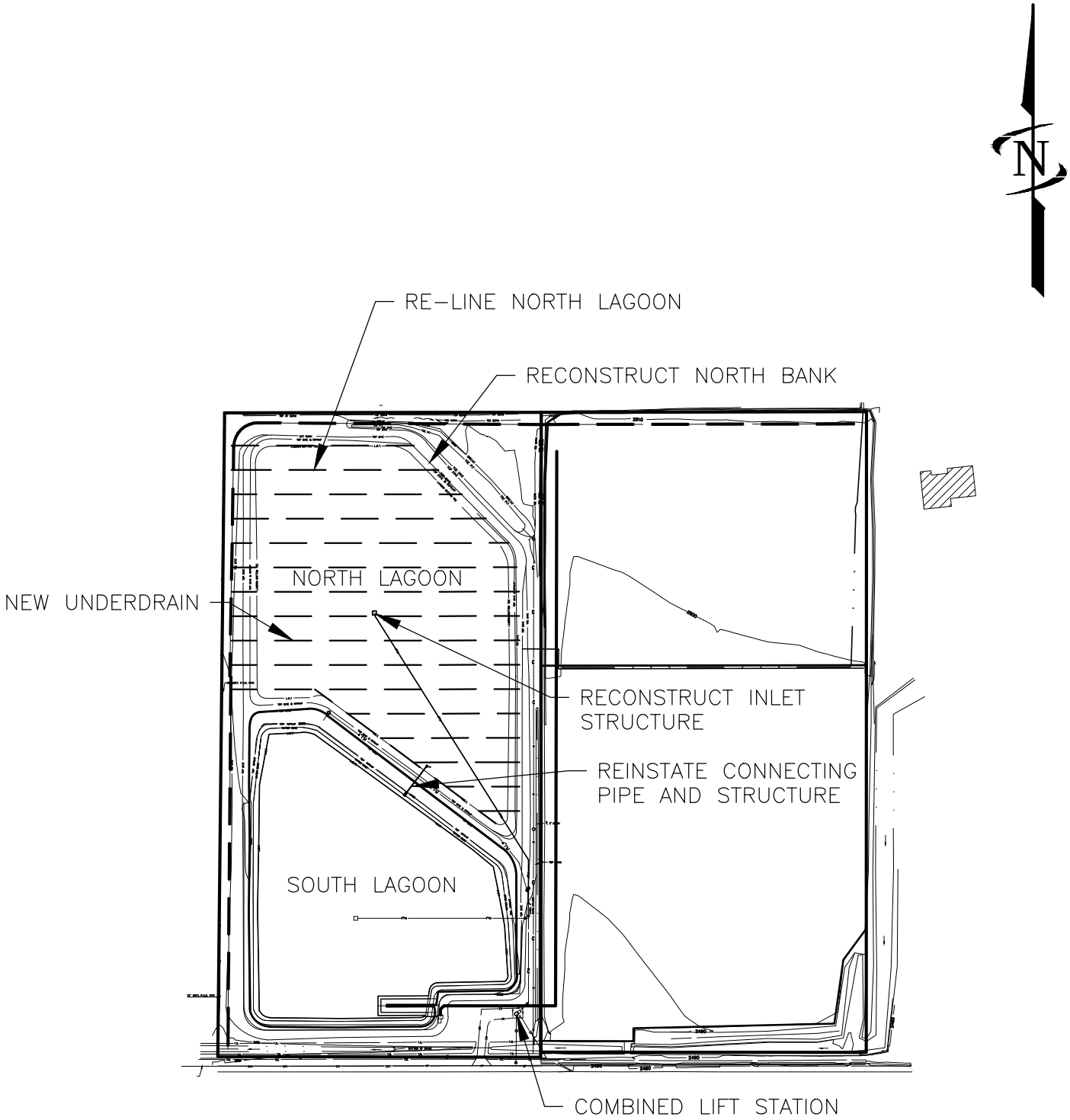
The estimated capital cost for the entire project may be a financial burden to the limited number of users of the Bruneau Water and Sewer District wastewater system. An alternative to completing the construction in one big project is to complete smaller portions as the financing is available and the facility upgrades are deemed necessary. Possible phases for the recommended alternative include:

- **Phase 1:** Reconstruction of the north lagoon including bank repair and re-lining to provide additional storage volume and evaporation capacity for the combined domestic wastewater and WTP discharge.
- **Phase 2:** Construction of a pipeline from the WTP to allow segregation of the WTP discharge, dividing a portion of the north lagoon as necessary to create separate storage volume for WTP discharge, and modification of the existing irrigation pump station to land apply the WTP discharge.
- **Phase 3:** Construction of a new underdrain system and liner in the south lagoon.

Phase 1 is the immediate need of the District which includes the reconstruction of the north lagoon to provide additional storage and evaporation capacity and a second lagoon for redundancy. Until the combined wastewater and WTP discharge volume approaches the evaporative capacity of both lagoons, the system can operate with evaporative disposal. At that time, the Phase 2 improvements can be completed to separate the WTP discharge from the domestic wastewater and provide separate storage and irrigation facilities for the WTP discharge. (Also, an alternative disposal method for the WTP discharge may be available for consideration at that time that would be less expensive.) Although the seepage test on the south lagoon did not exceed allowable seepage rates when it was performed in 2011, the Phase 3 improvements may eventually be needed due to the effects of suspected groundwater intrusion under the liner. However, the construction of the new underdrain system beneath the north lagoon as part of Phase 1 may ease or eliminate that concern which would allow Phase 3 to be delayed until the south lagoon liner is past its functional life.

For existing flows, using the WTP flow estimates provided by the system operator for average annual conditions plus domestic wastewater (32,100 gpd), the 12.09 acres of surface area provided by both existing lagoons after the Phase 1 project should provide adequate evaporative capacity if the seepage rate is over 0.01 inch/day. For future 2033 flows (35,400 gpd total), the seepage rate would need to be greater than 0.02 inch/day. Seepage rates are difficult to predict and may vary over time, but for comparison, the maximum seepage rate allowed by DEQ is much greater than these values at 0.125 inch/day.

Figure 6-1 depicts the improvements associated with Phase 1.



Plot Date:12/14/2015 4:31 PM Plotted By: Jordan Parker
Date Created:12/14/2015 \\TWINFILES\PUBLIC\PROJECTS\JUB\60-12-022\BRUNEAU-WASTE_WATER_SYSTEM_MASTER_PLAN_AND_EID\CAD\SHEET\FIGURE 6-1.DWG

REUSE OF DRAWINGS
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NO.	REVISION DESCRIPTION	BY	APR.	DATE

FILE: FIGURE 6-1
JUB PROJ. #:60-12-022
DRAWN BY: RLH
DESIGN BY: RLH
CHECKED BY: KCK
LAST UPDATED: 12/14/2015

J-U-B ENGINEERS, INC.

WASTEWATER SYSTEM MASTER PLAN
BRUNEAU WATER AND SEWER DISTRICT

FIGURE 6-1
PHASE 1 OF ALTERNATIVE 4a SITE IMPROVEMENTS

SHEET
1

An opinion of the probable total capital costs for the recommended improvements is summarized in **Table 6-4**. See Section 6.2 for items not included in this estimate.

Table 6-4. Opinion of Probable Total Capital Costs – Phased Construction

Item	Construction Costs
PHASE 1	
North Wastewater Treatment and Storage Lagoon Reconstruction Costs	$547,484
Site Fencing	$68,000
Contractor Mob/Demob, Bonding, Admin and Insurance	$92,323
Construction Contingencies	$123,097
Total Construction Costs	**$830,930**
Engineering and Construction Management	$166,190
Grant Preparation/Writing	$5,000
Funding Administration	$40,000
Legal and Bonding	$7,500
Audits, Publications and Miscellaneous	$2,500
Interim Construction Financing	$15,000
TOTAL PROJECT CAPITAL COSTS – PHASE 1	**$1,067,093**
PHASE 2	
Water Treatment Discharge Storage and Land Application	$448,661
Contractor Mob/Demob, Bonding, Admin and Insurance	$67,299
Construction Contingencies	$89,732
Total Construction Costs	**$605,692**
Engineering and Construction Management	$121,140
Grant Preparation/Writing	$5,000
Funding Administration	$40,000
Legal and Bonding	$7,500
Audits, Publications and Miscellaneous	$2,500
Interim Construction Financing	$15,000
TOTAL PROJECT CAPITAL COSTS – PHASE 2	**$796,832**
PHASE 3	
South Wastewater Treatment and Storage Lagoon Reconstruction Costs	$431,169
Contractor Mob/Demob, Bonding, Admin and Insurance	$64,675
Construction Contingencies	$86,234
Total Construction Costs	**$582,079**

Engineering and Construction Management	$116,420
Grant Preparation/Writing	$5,000
Funding Administration	$40,000
Legal and Bonding	$7,500
Audits, Publications and Miscellaneous	$2,500
Interim Construction Financing	$15,000
TOTAL PROJECT CAPITAL COSTS – PHASE 3	**$768,499**

6.4 PROJECT FINANCING

The District can submit applications for financing of the proposed sewer system development, including both loans and grants, to minimize the costs to the community. Potential sources of funding include the IDEQ Revolving Loan Fund, U.S. Department of Agriculture Rural Development Agency (RD) loans and grants, Department of Commerce Community Development Block Grant Program, Department of Commerce Economic Development Administration Grants and U.S. Army Corp of Engineers Section 595 Environmental Infrastructure Grants.

The Idaho Department Environmental Quality has funds available through their Revolving Loan Fund. This program provides below market rate interest loans to Idaho communities to build new, or repair, existing wastewater facilities. The loan term is 20 years; however, some applicants may qualify as disadvantaged and be eligible for reduced loan terms. The funding is derived from an appropriation from the Environmental Protection Agency (80%) and a 20% match from the Water Pollution Control Account.

Rural Development Agency makes loans and grants to public bodies and non-profit organizations in rural areas to construct or improve community facilities that are modest in size, cost and design. Water and Waste Disposal (WWD) Loans and Grants may be used to construct, repair, improve, expand or otherwise modify rural wastewater facilities; pay necessary fees and costs associated with the project; or finance facilities in conjunction with funds from other agencies or those provided by the applicant. The maximum loan term is 40 years and grant funds may be available for facilities serving the most financially needy communities.

The Idaho Community Development Block Grant program (ICDBG) assists Idaho Cities and Counties under 50,000 population with the development of needed public infrastructure and housing in an effort to support local economic diversification and growth. The program is administered by the Department of Commerce Division of Community Development, with funds received annually from the U.S. Department of Housing and Urban Development. ICDBG funds are used to construct projects that benefit low and moderate income persons, help prevent or eliminate slum and blight conditions, or solve catastrophic health and safety threats in local areas.

The U.S. Department of Commerce Economic Development Administration (EDA) provides funding for the construction of public infrastructure under the authority of the Public Works and Economic Development Act of 1965. Eligible projects include water and wastewater improvement and projects that support economic development within the community. Cities, counties and special districts are eligible to apply. Projects must meet economic development eligibility criteria as established by

Congress - specifically, per capita income, employment and other demographic characteristics, with an emphasis on resolving unemployment and barriers to economic growth and stability. EDA funds are provided as grants of from 50 to 80 percent of the project. Applicants must provide the local share from acceptable sources, including cash, local government bonds or a Community Development Block Grant.

The Idaho State Legislature ruled in March 1996 that Communities can attach a price to new development. The law allows government entities to charge a developer for a "proportionate share" of the cost of public facilities impacted by residential, commercial and industrial building. The calculation of the proportionate share must be based on a sturdy planning foundation that includes a comprehensive land use plan, a capital improvements plan and a cash flow analysis. The money must be spent on the specific project it was collected for, within five years of collection.

Many of the funding agencies consider a monthly user rate of approximately $40 to $45 per month as the minimum level at which they will consider a grant funding package. At rates lower than this level, the District may not be as likely to receive grant funding for the proposed project.

6.5 USER CHARGE RATES

User charge rates will be determined based upon the configuration of the financing for the project. It was estimated that there were 83 EDU's within the current Bruneau Water and Sewer District sewer service area. 76 EDU's are residential and 7 are commercial. Based on the revenue from this rate and equivalent users, the necessary configuration of the financing was calculated to reconstruct the wastewater treatment system.

Table 6-5 provides a funding summary for Alternative 4a and an estimated required user charge rate for various funding scenarios using USDA-RD and DEQ-SRF grants/loans and Block Grant funds. **Table 6-5a** provides a funding summary for Phase 1 only of Alternative 4a.

Table 6-5. Project Funding Summary

Cost/Funding Item	Funding Scenario A (USDA-RD Loan with No Grants)	Funding Scenario B (DEQ-SRF Loan with No Grants)	Funding Scenario C (USDA-RD Loan with Grants)	Funding Scenario D (USDA-RD Loan with some Grants)
COSTS				
Capital Costs				
Capital Cost from Section 5 (in 2015 dollars)	$2,197,503	$2,197,503	$2,197,503	$2,197,503
Davis-Bacon Prevailing Wage Compliance (@ 7.5%)	$0	$164,813	$0	$0
American Iron & Steel Compliance (@ 5.0%)	$0	$109,875	$0	$0
Inflation for 2017 Year of Construction (@ 2.7% annu	$120,267	$135,301	$120,267	$120,267
Total Capital Costs[1]	$2,317,770	$2,607,491	$2,317,770	$2,317,770
O&M Costs				
Current Total Monthly O&M[2]	$1,530	$1,530	$1,530	$1,530
Current Total Annual O&M	$18,360	$18,360	$18,360	$18,360
Change in Monthly O&M (increase)	$939	$939	$939	$939
Change in Annual O&M (increase)	$11,269	$11,269	$11,269	$11,269
Future Annual O&M	$29,629	$29,629	$29,629	$29,629
Future Monthly O&M	$2,469	$2,469	$2,469	$2,469
FUNDING				
Grant Funding				
Idaho Dept of Commerce Block Grant	$0	$0	$450,000	$450,000
USDA-RD Grant	$0	$0	$1,042,996	$1,042,996
DEQ Principal Forgiveness	$0	$0	$0	$0
Other Grant			$551,947	
Loan Funding				
New DEQ Loan Amount	$0	$2,607,491	$0	$0
New USDA-RD Loan Amount	$2,317,770	$0	$272,826	$824,773
New Other Loan Amount	$0	$0	$0	$0
City Capital Funds (cash)	$0	$0	$0	$0
Total Funding	$2,317,770	$2,607,491	$2,317,769	$2,317,769
Monthly Debt Service Costs				
Existing Debt Payment	$0	$0	$0	$0
New DEQ Loan Payment[3]	$0	$9,372	$0	$0
New USDA-RD Loan Payment[3]	$7,956	$0	$936	$2,831
New Other Loan Payment[3]	$0	$0	$0	$0
Total Future Debt Service	$7,956	$9,372	$936	$2,831
Change in Debt Service (increase)	$7,956	$9,372	$936	$2,831
Loan Reserve (@10% of loan)	$796	$937	$94	$283
Monthly Total Costs				
Total	$11,220	$12,778	$3,499	$5,583
Impact to Rates				
Total System EDU's	83	83	83	83
Current Average Monthly User Charge per EDU	$17.00	$17.00	$17.00	$17.00
Increase in O&M Monthly Charge per EDU	$11.31	$11.31	$11.31	$11.31
Increase in Debt Service Monthly Charge per EDU	$95.85	$112.91	$11.28	$34.11
Future Average Monthly User Charge per EDU[4]	$135.18	$153.95	$42.16	$67.27

Footnotes:

(1) Capital costs are in 2017 dollars and must be adjusted for inflation for actual year of construction.

(2) For a breakdown of O&M costs which include short-lived asset reserves, see Table 5-12.

(3) Assumes a loan interest rate of 2.70% with 40 year term for USDA-RD loan and 1.75% with 30 year term for DEQ-SRF loan.

(4) Based on the updated estimate of monthly total cost (a rate study should be considered to fully address system costs)

Table 6-6a. Project Funding Summary for Phase 1 Only

Cost/Funding Item	Funding Scenario A (USDA-RD Loan with No Grants)	Funding Scenario B (DEQ-SRF Loan with No Grants)	Funding Scenario C (USDA-RD Loan with Grants)	Funding Scenario D (USDA-RD Loan with some Grants)
COSTS				
Capital Costs				
Capital Cost from Section 6 (in 2015 dollars)	$1,067,093	$1,067,093	$1,067,093	$1,067,093
Davis-Bacon Prevailing Wage Compliance (@ 7.5%)	$0	$80,032	$0	$0
American Iron & Steel Compliance (@ 5.0%)	$0	$53,355	$0	$0
Inflation for 2017 Year of Construction (@ 2.7% annual)	$58,401	$65,701	$58,401	$58,401
Total Capital Costs(1)	$1,125,494	$1,266,181	$1,125,494	$1,125,494
O&M Costs				
Current Total Monthly O&M(2)	$1,530	$1,530	$1,530	$1,530
Current Total Annual O&M	$18,360	$18,360	$18,360	$18,360
Change in Monthly O&M (increase)	$939	$939	$939	$939
Change in Annual O&M (increase)	$11,269	$11,269	$11,269	$11,269
Future Annual O&M	$29,629	$29,629	$29,629	$29,629
Future Monthly O&M	$2,469	$2,469	$2,469	$2,469
FUNDING				
Grant Funding				
Idaho Dept of Commerce Block Grant	$0	$0	$450,000	$450,000
USDA-RD Grant	$0	$0	$506,472	$0
DEQ Principal Forgiveness	$0	$0	$0	$0
Other Grant				
Loan Funding				
New DEQ Loan Amount	$0	$1,266,181	$0	$0
New USDA-RD Loan Amount	$1,125,494	$0	$169,022	$675,494
New Other Loan Amount	$0	$0	$0	$0
City Capital Funds (cash)	$0	$0	$0	$0
Total Funding	$1,125,494	$1,266,181	$1,125,494	$1,125,494
Monthly Debt Service Costs				
Existing Debt Payment	$0	$0	$0	$0
New DEQ Loan Payment(3)	$0	$4,551	$0	$0
New USDA-RD Loan Payment(3)	$3,863	$0	$580	$2,319
New Other Loan Payment(3)	$0	$0	$0	$0
Total Future Debt Service	$3,863	$4,551	$580	$2,319
Change in Debt Service (increase)	$3,863	$4,551	$580	$2,319
Loan Reserve (@10% of loan)	$386	$455	$58	$232
Monthly Total Costs				
Total	$6,719	$7,475	$3,107	$5,020
Impact to Rates				
Total System EDU's	83	83	83	83
Current Average Monthly User Charge per EDU	$17.00	$17.00	$17.00	$17.00
Increase in O&M Monthly Charge per EDU	$11.31	$11.31	$11.31	$11.31
Increase in Debt Service Monthly Charge per EDU	$46.54	$54.83	$6.99	$27.94
Future Average Monthly User Charge per EDU(4)	$80.95	$90.06	$37.44	$60.48

Footnotes:

(1) Capital costs are in 2017 dollars and must be adjusted for inflation for actual year of construction.

(2) For a breakdown of O&M costs which include short-lived asset reserves, see Table 5-12.

(3) Assumes a loan interest rate of 2.70% with 40 year term for USDA-RD loan and 1.75% with 30 year term for DEQ-SRF loan.

(4) Based on the updated estimate of monthly total cost (a rate study should be considered to fully address system costs)

6.6 ENVIRONMENTAL CONSIDERATIONS

The proposed improvements, as outlined in this Facilities Plan, will take place at different geographic locations in and around the community. It is beyond the scope of this study to determine the full impacts to the environment, as the study looks only at general locations for the improvements.

The proposed improvements should have minimal environmental impacts from construction activities. Heavy equipment and machinery will be used during construction, resulting in increased noise levels. However, construction activity should be limited to normal working hours to reduce the noise impacts on residential areas. In addition, construction noise should be temporary and can be minimized by the use of well maintained equipment and mufflers.

Air quality may be impacted during construction due to dust and exhaust emissions from construction equipment, which may produce some minor air pollution. Debris created by construction should not be burned, but transported to a disposal area to avoid further air pollution. The impacts of construction dust can be mitigated by ceasing activity during exceptionally windy conditions and using watering equipment.

Open trenches, electrical utilities and heavy equipment may present health and safety hazards during construction. These hazards may be mitigated by educating project personnel about the applicable health and safety regulations, and establishing safe operating procedures. Traffic control may also result in a safety hazard, as traffic patterns are altered for construction purposes.

It is anticipated that impacts on agricultural lands, cultural resources, wetlands, plants or wildlife from the improvements will be minimal. If properly designed, operated and maintained, the proposed lagoons should have minimal impacts on the soil, groundwater and surface water. Additionally, the collection system improvements may improve groundwater quality by reducing potential seepage from the lagoon.

The preliminarily selected locations of some of the improvements are at sites where there are existing structures or streets. There is a possibility that some of the improvements will be constructed in areas where trees and vegetation have been planted and the area has been landscaped. In all areas where the construction or installation of proposed improvements takes place, an extensive effort will be required to reconstruct, replant and landscape the area to its former condition.

6.7 IMPLEMENTATION ISSUES

Implementability of the proposed projects is a function of regulatory approval, public acceptance, funding and constructability. It is anticipated that the District will be able to obtain the necessary regulatory approval and permits for construction and operation of the proposed wastewater treatment and collection system development.

The permits necessary to design and construct the wastewater system improvements may include:

- Idaho Transportation Department Permit – Highway Right-of-Way Construction

The recommended improvements should provide a reliable, long-term wastewater collection and treatment system capable of meeting the existing and future needs of the District. Several similar systems have been constructed in other communities in southern Idaho, and have operated

satisfactorily to date with no significant problems. However, it is essential that operating personnel perform the proper routine operation and maintenance of the improvements to maintain the reliability of the system.

Based on similar construction projects in southern Idaho, no insurmountable construction problems are expected for the recommended developments.

6.8 PUBLIC INPUT

A public hearing was held on July 23, 2015, at the Bruneau Public Library to discuss the alternatives and recommendations considered in this Wastewater System Master Plan. A notice for the public hearing was sent out with the July 1, 2015 water bills. A brief description of the Wastewater System Master Plan was presented with an outline of the alternatives under consideration, potential environmental impacts of each alternative, funding options, and estimated financial impacts to the public. Comments and questions were solicited. However, no questions or feedback on the plan was received according to the Bruneau Water and Sewer Secretary. A copy of the public advertisement notice and the meeting minutes are included in **Appendix D**.

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

APPENDIX A: PRELIMINARY SIZING SPREADSHEETS FOR ALTERNATIVES 3a, 3b, 4a, and 4b

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
ALTERNATIVE 3a - CURRENT AND FUTURE CONDITIONS - ALFALFA WITHOUT WATER TREATMENT
FLOOD IRRIGATION

1) Sludge Volume

	Sludge Depth (ft)	Lagoon Bottom Surface Area (acre)	Sludge Volume (mgal)	Lagoon Volume (mgal)	% of Volume Occupied by Sludge
Cell #1	1.47	5.54	2.65	6.85	38.7
			2.65	6.85	38.7

2) Hydraulic Retention Time

Average Day Flow =	20,422	gpd
Design Average Day Flow =	22,598	gpd

	Lagoon Volume (mgal)	Sludge Volume (mgal)	Operating Volume (mgal)	Operating HRT (d)	Design HRT (d)
Cell #1	6.85	2.65	4.20	205.5	303.1
	6.85	2.65	4.20	205.5	303.1

20 to 180 days (EPA Tech. Fact Sheet)
5 to 30 days warm climate, 180 days cold (Chpt. 6, p. 238)
180 days between high WSL & 2 foot - controlled discharge - entire system (10 State Standards, p. 90-15)
90 to 120 days - flow through - entire system (10 State Standards, p. 90-15)
40 to 60 days at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
15 to 30 days at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
5 to 30 days (M&E, p. 645)

3) Organic Surface Loading

Year	BOD lbs/d	Cell #1 Organic Loading lbs/ac-d	System Organic Loading lbs/ac-d
2011	46	8.3	8.3
2012	46	8.3	8.3
2013	46.84	8.5	8.5
2014	47.28	8.5	8.5
2015	47.50	8.6	8.6
2016	47.73	8.6	8.6
2017	47.96	8.7	8.7
2018	48.18	8.7	8.7
2019	48.41	8.7	8.7
2020	48.64	8.8	8.8
2021	48.87	8.8	8.8
2022	49.09	8.9	8.9
2023	49.32	8.9	8.9
2024	49.55	8.9	8.9
2025	49.77	9.0	9.0
2026	50.00	9.0	9.0
2027	50.23	9.1	9.1
2028	50.45	9.1	9.1
2029	50.68	9.1	9.1
2030	50.91	9.2	9.2
2031	51.14	9.2	9.2
2032	51.37	9.3	9.3

	Water Surface Area	
Cell #1	5.54	acres
Cell #2		acres
Total	5.54	acres

13 to 71 lbs/acre-d (EPA Tech. Fact Sheet)
15 to 50 lbs/acre-d (Chpt 6., p. 238 & 249)
15 to 35 lbs/acre-d - primary pond (10 State Standards, p. 90-15)
20 to 25 lbs/acre-d (Chpt. 10, p. 10-10)
20 to 40 lbs/acre-d at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
60 to 120 lbs/acre-d at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
25 to 35 lbs/acre-d - single pond or parallel (Reynolds, p. 560)
75 to 80 lbs/acre-d - primary pond in series operation (Reynolds, p. 560)
25 to 35 lbs/acre-d - secondary ponds in series operation (Reynolds, p. 560)
16.7 to 60 lbs/acre-d (M&E, p. 645)

4) Lagoon Depth

Cell #1 Max Depth	5.3	ft
Cell #2 Max Depth		ft

4 to 8 feet (EPA Tech. Fact Sheet)

4 to 8 feet (Chpt 6, p. 237)
6 feet primary cell (10 State Standards, p. 90-18)
6 feet primary cell (Chpt. 10, p. 10-10, 10-11)
4 to 6 feet at winter air temps of 33-59 F (Chpt. 10, p. 10-13)
3 to 6 feet (Reynolds, p. 560)
4 to 8 feet (M&E, p. 645)

5) Effluent Flows & Waste Loads - Current Conditions

Annual Effluent Volume = 1.42 mgal/yr

	mg/L	lbs/yr	
COD	77.00	912	
Total-N	9.25	110	Estimated as TKN + NO3-N
Total-P	3.87	46	

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load Spreadsheet with Water Treatment, Influent Conc. Of

	mg/L	Effluent Estimate	
BOD	275	15.4	COD assumes BOD/COD=0.2 (M&E BOD/COD in final effluent 0.1-0.3)
TSS	275	26.675	Total N Estimated as TKN + NO3-N
TKN	45	5.85	
NO3-N	2	3.398	
TP	9	3.87	For TP of 1, Acreage Required = 64.4 Acres, For TP of 4, 107 Acres Rqrd
COD		77.00	

6) Slow Rate Land Application & Storage - Current Conditions

Irrigation Water Requirement

Assume:				
	Crop =	Alfalfa		
	Type of Irrigation =	Gravity		
	Irrigation Efficiency =	45	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	6.05	5.49	4.07	2.20	32.72
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.24	0.22	0.16	0.09	1.29
Net IWR	inches	1.38	4.95	6.44	6.43	7.38	6.70	4.81	2.69	39.40
IWR	inches	3.07	11.00	14.31	14.29	16.40	14.89	10.69	5.98	87.56
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter		Units	
Crop Yield		tons/acre	5.7
Crop Yield		lbs/acre	11,400
Nitrogen			
	% Dry Mass Basis[1]	%	2.50
	Crop Uptake	lbs/acre-yr	285
	Allowable Application Rate[2]	lbs/acre-yr	427.5
Phosphorus			
	% Dry Mass Basis[3]	%	0.22
	Crop Uptake	lbs/acre-yr	25.1
	Allowable Application Rate[2]	lbs/acre-yr	37.6
Organic (COD)			
	Allowable Application Rate[4]	lbs/acre-d	50

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 125% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	1.42	Mgal
Allowable Hydraulic Loading	87.56	inches
Acreage Required	0.6	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	110	46	lbs/yr
Allowable Loading	427.5	37.6	lbs/acre-yr
Acreage Required	0.3	1.3	acres

Organic

Average Annual Effluent Load	912	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.1	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	1.3	acres
Contingency (10%)	0.2	acres
Total	**1.5**	acres

B) Calculate the lagoon storage volume and surface area requirements.

Water Balance Calculations - Alfalfa - Current

Influent Flow =	20,422	gpd	
Avg Lagoon Depth =	5.30	ft	
Irrigated Acreage =	1.5	acres	Actual Land Application Site = 5.66 acres
Cell #1 Seepage Rate =	0.0803	in/d	
Cell #2 Seepage Rate =		in/d	
Cell #1 Surface Area =	5.54	acres	
Cell #2 Surface Area =		acres	
Weighted Seepage Rate =	0.0803	in/d	

Existing Lagoon Surface Area =	5.54	acres	Existing Lagoon Volume =	4.20	Mgal
Iterative Additional Storage Lagoon Surface Area =	0.00	acres	Max Lagoon Volume Required =	1.30	Mgal
Additional Storage Lagoon Surface Area =	0.00	acres	Additional Storage Lagoon Volume =	0.00	Mgal
Total Lagoon Surface Area =	5.54	acres	Total Lagoon Volume =	4.20	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	0.63	0.54	0.08	2.52	0.38	2.49	0.37	0.00	5.98	0.24	0.00	0.24	0.01
Nov	30	0.61	0.87	0.13	0.51	0.08	2.41	0.36	0.30	0.00	0.00	0.30	0.00	0.00
Dec	31	0.63	0.74	0.11	0.18	0.03	2.49	0.37	0.34	0.00	0.00	0.64	0.00	0.00
Jan	31	0.63	0.87	0.13	0.23	0.03	2.49	0.37	0.36	0.00	0.00	1.00	0.00	0.00
Feb	28	0.57	0.57	0.09	0.42	0.06	2.25	0.34	0.26	0.00	0.00	1.26	0.00	0.00
Mar	31	0.63	0.74	0.11	1.41	0.21	2.49	0.37	0.16	3.07	0.12	1.30	0.00	0.00
Apr	30	0.61	0.84	0.13	5.24	0.79	2.41	0.36	0.00	11.00	0.45	0.85	0.00	0.00
May	31	0.63	0.85	0.13	6.34	0.95	2.49	0.37	0.00	14.31	0.58	0.27	0.00	0.00
Jun	30	0.61	0.84	0.13	6.48	0.97	2.41	0.36	0.00	14.29	0.58	0.00	0.31	0.01
Jul	31	0.63	0.18	0.03	6.82	1.03	2.49	0.37	0.00	16.40	0.67	0.00	0.67	0.02
Aug	31	0.63	0.23	0.03	5.96	0.90	2.49	0.37	0.00	14.89	0.61	0.00	0.61	0.02
Sep	30	0.61	0.42	0.06	4.56	0.69	2.41	0.36	0.00	10.69	0.44	0.00	0.44	0.01
Total		7.42	7.69	1.16	40.68	6.12	29.31	4.37	1.42	90.62	3.69		2.27	

7) Effluent Flows & Waste Loads - Future Conditions

Annual Effluent Volume = 0.00 mgal/yr

	mg/L	lbs/yr	
COD	77.00	912	
Total-N	9.25	110	Estimated as TKN + NO3-N
Total-P	3.87	46	

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load Spreadsheet with Water Treatment, Influent Conc. Of

	mg/L	Effluent Estimate	
BOD	275	15.4	COD assumes BOD/COD=0.2 (M&E BOD/COD in final effluent 0.1-0.3)
TSS	275	26.675	Total N Estimated as TKN + NO3-N
TKN	45	5.85	
NO3-N	2	3.398	
TP	9	3.87	For TP of 1, Acreage Required = 64.4 Acres, For TP of 4, 107 Acres Reqrd
COD		77.00	

8) Slow Rate Land Application & Storage - Future Conditions

Irrigation Water Requirement

Assume:				
	Crop =	Alfalfa		
	Type of Irrigation =	Gravity		
	Irrigation Efficiency =	45	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	6.05	5.49	4.07	2.20	32.72
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.24	0.22	0.16	0.09	1.29
Net IWR	inches	1.38	4.95	6.44	6.43	7.38	6.70	4.81	2.69	39.40
IWR	inches	3.07	11.00	14.31	14.29	16.40	14.89	10.69	5.98	87.56
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units	
Crop Yield	tons/acre	5.7
Crop Yield	lbs/acre	11,400
Nitrogen		
% Dry Mass Basis[1]	%	2.50
Crop Uptake	lbs/acre-yr	285
Allowable Application Rate[2]	lbs/acre-yr	427.5
Phosphorus		
% Dry Mass Basis[3]	%	0.22
Crop Uptake	lbs/acre-yr	25.1
Allowable Application Rate[2]	lbs/acre-yr	37.6
Organic (COD)		
Allowable Application Rate[4]	lbs/acre-d	50

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 150% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	1.79	Mgal
Allowable Hydraulic Loading	87.56	inches
Acreage Required	0.8	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	110	46	lbs/yr
Allowable Loading	427.5	37.6	lbs/acre-yr
Acreage Required	0.3	1.3	acres

8) Organic

Average Annual Effluent Load	912	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.1	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	1.3	acres
Contingency (10%)	0.2	acres
Total	**1.5**	acres

Water Balance Calculations - Alfalfa - Future

Influent Flow =	22,598	gpd	
Avg Lagoon Depth =	5.30	ft	
Irrigated Acreage =	1.5	acres	Actual Land Application Site = 5.66
Cell #1 Seepage Rate =	0.0803	in/d	
Cell #2 Seepage Rate =		in/d	
Cell #1 Surface Area =	5.54	acres	
Cell #2 Surface Area =		acres	
Weighted Seepage Rate =	0.0803	in/d	

Existing Lagoon Surface Area =	5.54	acres	Existing Lagoon Volume =	4.20	Mgal
Iterative Additional Storage Lagoon Surface Area =	0.00	acres	Max Lagoon Volume Required =	1.64	Mgal
Additional Storage Lagoon Surface Area =	0.00	acres	Additional Storage Lagoon Volume =	0.00	Mgal
Total Lagoon Surface Area =	5.54	acres	Total Lagoon Volume =	4.20	Mgal

		Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
Month	Days	Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	0.70	0.54	0.08	2.52	0.38	2.49	0.37	0.03	5.98	0.24	0.00	0.21	0.01
Nov	30	0.68	0.87	0.13	0.51	0.08	2.41	0.36	0.37	0.00	0.00	0.37	0.00	0.00
Dec	31	0.70	0.74	0.11	0.18	0.03	2.49	0.37	0.41	0.00	0.00	0.78	0.00	0.00
Jan	31	0.70	0.87	0.13	0.23	0.03	2.49	0.37	0.43	0.00	0.00	1.21	0.00	0.00
Feb	28	0.63	0.57	0.09	0.42	0.06	2.25	0.34	0.32	0.00	0.00	1.53	0.00	0.00
Mar	31	0.70	0.74	0.11	1.41	0.21	2.49	0.37	0.23	3.07	0.12	1.64	0.00	0.00
Apr	30	0.68	0.84	0.13	5.24	0.79	2.41	0.36	0.00	11.00	0.45	1.19	0.00	0.00
May	31	0.70	0.85	0.13	6.34	0.95	2.49	0.37	0.00	14.31	0.58	0.61	0.00	0.00
Jun	30	0.68	0.84	0.13	6.48	0.97	2.41	0.36	0.00	14.29	0.58	0.03	0.00	0.00
Jul	31	0.70	0.18	0.03	6.82	1.03	2.49	0.37	0.00	16.40	0.67	0.00	0.64	0.02
Aug	31	0.70	0.23	0.03	5.96	0.90	2.49	0.37	0.00	14.89	0.61	0.00	0.61	0.02
Sep	30	0.68	0.42	0.06	4.56	0.69	2.41	0.36	0.00	10.69	0.44	0.00	0.44	0.01
Total		8.25	7.69	1.16	40.68	6.12	29.31	4.37	1.79	90.62	3.69		1.90	

Lagoon Dimensions

Total Volume required	1.64	mgal
Number of Lagoons	2	lagoons
South Lagoon Volume	4.2	mgal
Additional Lagoon Volume	-2.56	mgal
Total Surface Area	5.54	acres
Existing Lagoon Surface Area	5.54	acres
Additional Surface Area	0.00	acres

Sludge Depth	1.5	ft
Water Depth	3.8	ft
Freeboard	3.3	ft
Total	8.57	ft

	Cell #1	Cell #2	WTP		
Interior Dike Slope	3	3	3	ft/ft	
Exterior Dike Slope	3	3	3	ft/ft	
Pond Bottom Slope	0	0	0	%	
Freeboard	3	3	3	ft	
Max Water Surface Elevation	2488.20	2494.30	2494.30		3.80
Top of Bank Elevation	2491.20	2497.30	2497.30		
Toe of Bank Elevation	2484.40	2491.80	2491.80		
Bottom Surface Area	5.06	1.8	2.59	acres	
Actual Water Surface Area	5.43	2.06	2.86	acres	
Top of Bank Area	5.93	2.39	3.13	acres	
Bank Mid-Slope Length	2180	1517	1498	ft	
Bank Slope Face Length	21.5	17.4	17.4	ft	
Bank Slope Area	46,870	26,396	26,065	sq.ft.	
Transition Additional Bank Height	6			ft	
Transition Additional Bank Slope Length	19.3				
Transition Additional Bank Length	710				
Transition Additional Bank Slope Area	13,703			sq. ft.	
Top of Interior Bank Length	2,320	1,579	1,549	ft	
Liner Trench Length	2330	1592	1561	ft	

New Bank Length	548	527		ft
New Bank Top Width	14	14		ft
New Bank Bottom Width	44.5	44.5		ft

Earthwork Quantities

A) Clearing & Grubbing

	Cell #1	Cell #2	WTP	
Remove Existing Liner and Soil Cover	290,307	111,172	145,129	sq. ft.
Remove Additional for New Bank		16,714	16,074	sq.ft.
Depth	6	6	6	inches
Volume	5,376	2,368	2,985	cy
Total Volume	7,744			

B) Lagoon Cut/Fill

	Cell #1	Cell #2	WTP	
Top Width - New Dike		14	14	ft
Dike Cross-Sectional Area Above Ground		168	168	ft^2
Total Dike Length		548	527	ft
Sub-Total Fill Volume		3,410	3,279	cy
Shrinkage		25	25	%
Shrinkage Volume		853	820	cy
Total Lagoon Fill Volume		4,263	4,099	cy
Total All Lagoons	4,263			cy

C) Borrow Area

Total Fill Volume				
Lagoon	4,263	cy	4,099	cy
Total	4,263	cy	4,099	cy
Borrow Area Excavation Depth	2.0	ft	2.0	ft
Borrow Area Acreage	1.3	acres	1.3	acres

D) Aggregate Surfacing

Top of Dike	Cell #1	Cell #2	Cell #2	
Road Width - Top of Dike	12	14	14	ft
Aggregate Depth	0.5	0.5	0.5	ft
Total Dike Length	2,153	1,042	1,000	ft
Top of Dike Aggregate Volume	478	270	259	cy
Total Top of Dike	748			cy
Exterior of Dike				
Side Length		17	17	ft
Aggregate Depth		0.5	0.5	ft
Exterior Dike Length		548	527	ft
Exterior of Dike Aggregate Volume		173	166	cy
Total Exterior of Dike	173			cy

Liner Quantities

Interior Slopes	Cell #1	Cell #2	Cell #2	
Interior Slope Liner Area	60,573	26,396	26,065	ft^2
Lagoon Bottom				
Lagoon Bottom Liner Area	220,414	78,408	112,820	ft^2
Anchor Trench Length	2,330	1,592	1,561	ft
Total Anchor Trench	3,922			
Anchor Trench Liner	11,650	7,960	7,805	ft^2
Sub-Total Liner Area	292,637	112,764	146,690	ft^2
Contingency (5%)	14,632	5,638	7,335	ft^2
Total Liner Area	307,269	118,402	154,025	ft^2
Total All Liner	425,671			ft^2

Spacing of Ladders	50	50	50	ft
Perimeter of Lagoon	2,330	1,592	1,561	ft
Number of Ladders	47	32	32	ladders
Total Ladders	79			ladders
Spacing of Air Vents	22	23	23	ft
Perimeter of Lagoon	2,330	1,592	1,561	ft
Number of Air Vents	106	70	68	vents
Total Air Vents	176			vents
Underdrain				
Drain Pipe Size	4	4	4	in
Drain Pipe Length	5726	2729	2950	ft
Total Drain Pipe	8455			ft
Drain Trench Width	2	2	2	ft
Drain Trench Height	2	2	2	ft
Drain Trench Cross Sectional Area	3.65	3.65	3.65	ft^2
Filter Fabric	45,808	21,832	23,600	ft^2
Total Filter Fabric	67,640			ft^2
Drain Rock	774	369	399	cy
Total Drain Rock	1143			cy

Lift Station Power Consumption

Exi: Pump Horsepower	5	Hp
Pump Capacity	170	gpm
Annual Operating Hours	809	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	5,056	Hp-Hr
Annual Kilowatt - Hours	3,770	KwH

Irrigation Pump Station Power Consumption

Exi: Pump Horsepower	7.5	Hp
Pump Capacity	100	gpm
Annual Operating Hours	615	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	5,766	Hp-Hr
Annual Kilowatt - Hours	4,300	KwH
WT Pump Horsepower	5	Hp
Pump Capacity	170	gpm
Annual Operating Hours	809	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	5,056	Hp-Hr
Annual Kilowatt - Hours	3,770	KwH
Total KwH	11,840	Kwh

Disinfection System

Liquid Sodium Hypochlorite System - Minimum Design

Max Chlorine Concentration	10	mg/L
Pumping Rate	100	gpm
Max Daily Chlorine Dose	12	lbs/d
Hypochlorite Concentration	12	%
Chlorine Mass/Volume	1.00	lbs/gal
Volumetric Hypochlorite Pumping Rate	12	gpd
Volumetric Hypochlorite Pumping Rate	0.5	gph
Average Chlorine Concentration	3	mg/L
Effluent Volume	1.79	mgal
Canal Water Volume	1.90	mgal
Total Annual Volume	3.69	mgal
Annual Mass of Chlorine	92	lbs
Annual Volume of Hypochlorite	92	gal

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
ALTERNATIVE 3a - CURRENT CONDITIONS - PASTURE WATERED WITH WATER TREATMENT DISCHARGE
GRAVITY IRRIGATION

1) Effluent Flows & Waste Loads - Current Conditions

Annual Effluent Volume = 11.0 mgal/yr

Irrigation Water Requirement

Assume:				
	Crop =	Pasture		
	Type of Irrigation =	Gravity		
	Irrigation Efficiency =	65	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Grass Pasture -low management
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	0.84	2.74	3.71	4.83	5.61	4.39	2.62	0.93	24.82
Net IWR Rate	in/day	0.03	0.11	0.15	0.19	0.22	0.17	0.10	0.04	0.98
Net IWR	inches	1.02	3.23	4.53	5.70	6.84	5.36	3.09	1.13	29.88
IWR	inches	1.57	4.97	6.97	8.77	10.52	8.25	4.75	1.74	45.97
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	11.01	Mgal
Allowable Hydraulic Loading	45.97	inches
Acreage Required	8.9	acres

B) Calculate the lagoon storage volume and surface area requirements.

Water Balance Calculations - Alfalfa - Current

Influent Flow =	30,165	gpd	
Avg Lagoon Depth =	5.30	ft	
Irrigated Acreage =	5.5	acres	Actual Land Application Site = 5.66 acres
Cell #1 Seepage Rate =	0.0803	in/d	
Cell #2 Seepage Rate =		in/d	
Cell #1 Surface Area =	5.54	acres	
Cell #2 Surface Area =		acres	
Weighted Seepage Rate =	0.0803	in/d	

Existing Lagoon Surface Area =	0.00	acres	Existing Lagoon Volume =	0.00	Mgal
Iterative Additional Storage Lagoon Surface Area =	2.34	acres	Max Lagoon Volume Required =	4.04	Mgal

Additional Storage Lagoon Surface Area =	2.34	acres	Additional Storage Lagoon Volume =	4.04	Mgal
Total Lagoon Surface Area =	2.34	acres	Total Lagoon Volume =	4.04	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	0.94	0.54	0.03	2.52	0.16	2.49	0.16	0.65	1.74	0.26	0.39	0.00	0.00
Nov	30	0.90	0.87	0.06	0.51	0.03	2.41	0.15	0.78	0.00	0.00	1.17	0.00	0.00
Dec	31	0.94	0.74	0.05	0.18	0.01	2.49	0.16	0.82	0.00	0.00	1.99	0.00	0.00
Jan	31	0.94	0.87	0.06	0.23	0.01	2.49	0.16	0.83	0.00	0.00	2.82	0.00	0.00
Feb	28	0.84	0.57	0.04	0.42	0.03	2.25	0.14	0.71	0.00	0.00	3.53	0.00	0.00
Mar	31	0.94	0.74	0.05	1.41	0.09	2.49	0.16	0.74	1.57	0.23	4.04	0.00	0.00
Apr	30	0.90	0.84	0.05	5.24	0.33	2.41	0.15	0.47	4.97	0.74	3.77	0.00	0.00
May	31	0.94	0.85	0.05	6.34	0.40	2.49	0.16	0.43	6.97	1.04	3.16	0.00	0.00
Jun	30	0.90	0.84	0.05	6.48	0.41	2.41	0.15	0.39	8.77	1.31	2.24	0.00	0.00
Jul	31	0.94	0.18	0.01	6.82	0.43	2.49	0.16	0.36	10.52	1.57	1.03	0.00	0.00
Aug	31	0.94	0.23	0.01	5.96	0.38	2.49	0.16	0.41	8.25	1.23	0.21	0.00	0.00
Sep	30	0.90	0.42	0.03	4.56	0.29	2.41	0.15	0.49	4.75	0.71	0.00	0.01	0.00
Total		11.02	7.69	0.49	40.68	2.57	29.31	1.86	7.08	47.54	7.09		0.01	

7) Effluent Flows & Waste Loads - Future Conditions

Irrigation Water Requirement

Assume:			
	Crop =	Pasture	
	Type of Irrigation =	Sprinkler	
	Irrigation Efficiency =	65	%
	WLAP Growing Season (GS) =	214	d
	WLAP Non-Growing Season (NGS) =	151	d

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Grass Pasture - low management
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	0.84	2.74	3.71	4.83	5.61	4.39	2.62	0.93	24.82
Net IWR Rate	in/day	0.03	0.11	0.15	0.19	0.22	0.17	0.10	0.04	0.98
Net IWR	inches	1.02	3.23	4.53	5.70	6.84	5.36	3.09	1.13	29.88
IWR	inches	1.57	4.97	6.97	8.77	10.52	8.25	4.75	1.74	45.97
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	12.23	Mgal
Allowable Hydraulic Loading	45.97	inches
Acreage Required	9.8	acres

Water Balance Calculations - Alfalfa - Future

Influent Flow =	33,497	gpd
Avg Lagoon Depth =	5.00	ft
Irrigated Acreage =	6.0	acres
Cell #1 Seepage Rate =	0.0803	in/d
Cell #2 Seepage Rate =		in/d
Cell #1 Surface Area =	2.82	acres
Cell #2 Surface Area =		acres
Weighted Seepage Rate =	0.0803	in/d

Existing Lagoon Surface Area =	0.00	acres	Existing Lagoon Volume =	0.00	Mgal
Iterative Additional Storage Lagoon Surface Area =	2.71	acres	Max Lagoon Volume Required =	4.41	Mgal
Additional Storage Lagoon Surface Area =	2.70	acres	Additional Storage Lagoon Volume =	4.41	Mgal
Total Lagoon Surface Area =	2.70	acres	Total Lagoon Volume =	4.41	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	1.04	0.54	0.03	2.52	0.18	2.49	0.18	0.71	1.74	0.28	0.43	0.00	0.00
Nov	30	1.00	0.87	0.06	0.51	0.04	2.41	0.18	0.84	0.00	0.00	1.27	0.00	0.00
Dec	31	1.04	0.74	0.05	0.18	0.01	2.49	0.18	0.90	0.00	0.00	2.17	0.00	0.00
Jan	31	1.04	0.87	0.06	0.23	0.02	2.49	0.18	0.90	0.00	0.00	3.07	0.00	0.00
Feb	28	0.94	0.57	0.04	0.42	0.03	2.25	0.16	0.79	0.00	0.00	3.86	0.00	0.00
Mar	31	1.04	0.74	0.05	1.41	0.10	2.49	0.18	0.81	1.57	0.26	4.41	0.00	0.00
Apr	30	1.00	0.84	0.05	5.24	0.38	2.41	0.18	0.49	4.97	0.81	4.09	0.00	0.00
May	31	1.04	0.85	0.05	6.34	0.46	2.49	0.18	0.45	6.97	1.14	3.40	0.00	0.00
Jun	30	1.00	0.84	0.05	6.48	0.48	2.41	0.18	0.39	8.77	1.43	2.36	0.00	0.00
Jul	31	1.04	0.18	0.01	6.82	0.50	2.49	0.18	0.37	10.52	1.71	1.02	0.00	0.00
Aug	31	1.04	0.23	0.01	5.96	0.44	2.49	0.18	0.43	8.25	1.34	0.11	0.00	0.00
Sep	30	1.00	0.42	0.03	4.56	0.33	2.41	0.18	0.52	4.75	0.77	0.00	0.14	0.00
Total		12.22	7.69	0.49	40.68	2.97	29.31	2.14	7.60	47.54	7.74		0.14	

Irrigation Pump Station Power Consumption

Exis Pump Horsepower	7.5	Hp
Pump Capacity	100	gpm
Annual Operating Hours	1,290	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	12,094	Hp-Hr
Annual Kilowatt - Hours	9,018	KwH

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
ALTERNATIVE 3b - CURRENT AND FUTURE CONDITIONS - ALFALFA WITH WATER TREATMENT
FLOOD IRRIGATION

1) Sludge Volume

	Sludge Depth (ft)	Lagoon Bottom Surface Area (acre)	Sludge Volume (mgal)	Lagoon Volume (mgal)	% of Volume Occupied by Sludge
Cell #1	1.47	5.54	2.65	6.85	38.7
			2.65	6.85	38.7

2) Hydraulic Retention Time

Average Day Flow =	50,588	gpd
Design Average Day Flow =	55,828	gpd

	Lagoon Volume (mgal)	Sludge Volume (mgal)	Operating Volume (mgal)	Operating HRT (d)	Design HRT (d)
Cell #1	6.85	2.65	4.20	83.0	122.7
	6.85	2.65	4.20	83.0	122.7

20 to 180 days (EPA Tech. Fact Sheet)
5 to 30 days warm climate, 180 days cold (Chpt. 6, p. 238)
180 days between high WSL & 2 foot - controlled discharge - entire system (10 State Standards, p. 90-15)
90 to 120 days - flow through - entire system (10 State Standards, p. 90-15)
40 to 60 days at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
15 to 30 days at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
5 to 30 days (M&E, p. 645)

3) Organic Surface Loading

Year	BOD lbs/d	Cell #1 Organic Loading lbs/ac-d	System Organic Loading lbs/ac-d
2011	46	8.3	8.3
2012	46	8.3	8.3
2013	46.84	8.5	8.5
2014	47.28	8.5	8.5
2015	47.50	8.6	8.6
2016	47.73	8.6	8.6
2017	47.96	8.7	8.7
2018	48.18	8.7	8.7
2019	48.41	8.7	8.7
2020	48.64	8.8	8.8
2021	48.87	8.8	8.8
2022	49.09	8.9	8.9
2023	49.32	8.9	8.9
2024	49.55	8.9	8.9
2025	49.77	9.0	9.0
2026	50.00	9.0	9.0
2027	50.23	9.1	9.1
2028	50.45	9.1	9.1
2029	50.68	9.1	9.1
2030	50.91	9.2	9.2
2031	51.14	9.2	9.2
2032	51.37	9.3	9.3

	Water Surface Area	
Cell #1	5.54	acres
Cell #2		acres
Total	5.54	acres

13 to 71 lbs/acre-d (EPA Tech. Fact Sheet)
15 to 50 lbs/acre-d (Chpt 6., p. 238 & 249)
15 to 35 lbs/acre-d - primary pond (10 State Standards, p. 90-15)
20 to 25 lbs/acre-d (Chpt. 10, p. 10-10)
20 to 40 lbs/acre-d at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
60 to 120 lbs/acre-d at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
25 to 35 lbs/acre-d - single pond or parallel (Reynolds, p. 560)
75 to 80 lbs/acre-d - primary pond in series operation (Reynolds, p. 560)
25 to 35 lbs/acre-d - secondary ponds in series operation (Reynolds, p. 560)
16.7 to 60 lbs/acre-d (M&E, p. 645)

4) Lagoon Depth

Cell #1 Max Depth	5.3	ft
Cell #2 Max Depth		ft

4 to 8 feet (EPA Tech. Fact Sheet)

4 to 8 feet (Chpt 6, p. 237)
6 feet primary cell (10 State Standards, p. 90-18)
6 feet primary cell (Chpt. 10, p. 10-10, 10-11)
4 to 6 feet at winter air temps of 33-59 F (Chpt. 10, p. 10-13)
3 to 6 feet (Reynolds, p. 560)
4 to 8 feet (M&E, p. 645)

5) Effluent Flows & Waste Loads - Current Conditions

Annual Effluent Volume = 7.73 mgal/yr

	mg/L	lbs/yr	
COD	31.08	2,004	
Total-N	3.73	241	Estimated as TKN + NO3-N
Total-P	1.562323	101	

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load Spreadsheet with Water Treatment, Influent Conc. Of

	mg/L	Effluent Estimate		
BOD	111	6.216996	COD	assumes BOD/COD=0.2 (M&E BOD/COD in final effluent 0.1-0.3)
TSS	111	10.76873	Total N	Estimated as TKN + NO3-N
TKN	18	2.361651		
NO3-N	1	1.371776		
TP	3.63	1.562323	For TP of 1, Acreage Required = 64.4 Acres, For TP of 4, 107 Acres Rqrd	
COD		31.08		

6) Slow Rate Land Application & Storage - Current Conditions

Irrigation Water Requirement

Assume:				
	Crop =	Alfalfa		
	Type of Irrigation =	Gravity		
	Irrigation Efficiency =	45	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	6.05	5.49	4.07	2.20	32.72
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.24	0.22	0.16	0.09	1.29
Net IWR	inches	1.38	4.95	6.44	6.43	7.38	6.70	4.81	2.69	39.40
IWR	inches	3.07	11.00	14.31	14.29	16.40	14.89	10.69	5.98	87.56
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units	
Crop Yield	tons/acre	5.7
Crop Yield	lbs/acre	11,400
Nitrogen		
% Dry Mass Basis[1]	%	2.50
Crop Uptake	lbs/acre-yr	285
Allowable Application Rate[2]	lbs/acre-yr	427.5
Phosphorus		
% Dry Mass Basis[3]	%	0.22
Crop Uptake	lbs/acre-yr	25.1
Allowable Application Rate[2]	lbs/acre-yr	37.6
Organic (COD)		
Allowable Application Rate[4]	lbs/acre-d	50

1 Value from IDEQ Technical Interpretive Supplement, Table 11, pJV-46
2 Assumed to be 150% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651 Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	7.73	Mgal
Allowable Hydraulic Loading	87.56	inches
Acreage Required	3.3	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	241	101	lbs/yr
Allowable Loading	427.5	37.6	lbs/acre-yr
Acreage Required	0.6	2.7	acres

Organic

Average Annual Effluent Load	2,004	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.2	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	3.3	acres
Contingency (10%)	0.4	acres
Total	**3.7**	acres

B) Calculate the lagoon storage volume and surface area requirements.

Water Balance Calculations - Alfalfa - Current

Influent Flow =	50,588	gpd	
Avg Lagoon Depth =	5.30	ft	
Irrigated Acreage =	3.7	acres	Actual Land Application Site = 5.66 acres
Cell #1 Seepage Rate =	0.0803	in/d	
Cell #2 Seepage Rate =		in/d	
Cell #1 Surface Area =	5.54	acres	
Cell #2 Surface Area =		acres	
Weighted Seepage Rate =	0.0803	in/d	

Existing Lagoon Surface Area =	5.54	acres	Existing Lagoon Volume =	4.20	Mgal
Iterative Additional Storage Lagoon Surface Area =	0.82	acres	Max Lagoon Volume Required =	5.62	Mgal
Additional Storage Lagoon Surface Area =	0.82	acres	Additional Storage Lagoon Volume =	1.42	Mgal
Total Lagoon Surface Area =	6.36	acres	Total Lagoon Volume =	5.62	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	1.57	0.54	0.09	2.52	0.44	2.49	0.43	0.79	5.98	0.60	0.19	0.00	0.00
Nov	30	1.52	0.87	0.15	0.51	0.09	2.41	0.42	1.16	0.00	0.00	1.35	0.00	0.00
Dec	31	1.57	0.74	0.13	0.18	0.03	2.49	0.43	1.24	0.00	0.00	2.59	0.00	0.00
Jan	31	1.57	0.87	0.15	0.23	0.04	2.49	0.43	1.25	0.00	0.00	3.84	0.00	0.00
Feb	28	1.42	0.57	0.10	0.42	0.07	2.25	0.39	1.06	0.00	0.00	4.90	0.00	0.00
Mar	31	1.57	0.74	0.13	1.41	0.24	2.49	0.43	1.03	3.07	0.31	5.62	0.00	0.00
Apr	30	1.52	0.84	0.15	5.24	0.90	2.41	0.42	0.35	11.00	1.11	4.86	0.00	0.00
May	31	1.57	0.85	0.15	6.34	1.10	2.49	0.43	0.19	14.31	1.44	3.61	0.00	0.00
Jun	30	1.52	0.84	0.15	6.48	1.12	2.41	0.42	0.13	14.29	1.44	2.30	0.00	0.00
Jul	31	1.57	0.18	0.03	6.82	1.18	2.49	0.43	0.00	16.40	1.65	0.65	0.00	0.00
Aug	31	1.57	0.23	0.04	5.96	1.03	2.49	0.43	0.15	14.89	1.50	0.00	0.70	0.02
Sep	30	1.52	0.42	0.07	4.56	0.79	2.41	0.42	0.38	10.69	1.07	0.00	0.69	0.02
Total		18.49	7.69	1.34	40.68	7.03	29.31	5.08	7.73	90.62	9.12		1.39	

7) Effluent Flows & Waste Loads - Future Conditions

Annual Effluent Volume = 9.13 mgal/yr

	mg/L	lbs/yr
COD	31.03	2,000
Total-N	3.73	240
Total-P	1.56	119

Estimated as TKN + NO3-N

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load Spreadsheet with Water Treatment, Influent Conc. Of

	mg/L	Effluent Estimate		
BOD	111	6.206011	COD	assumes BOD/COD=0.2 (M&E BOD/COD in final effluent 0.1-0.3)
TSS	111	10.7497	Total N	Estimated as TKN + NO3-N
TKN	18	2.357478		
NO3-N	0.81	1.369352		
TP	3.63	1.559563	For TP of 1, Acreage Required = 64.4 Acres, For TP of 4, 107 Acres Required	
COD		31.03		

8) Slow Rate Land Application & Storage - Future Conditions

Irrigation Water Requirement

Assume:	Crop =	Alfalfa		
	Type of Irrigation =	Gravity		
	Irrigation Efficiency =	45	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	6.05	5.49	4.07	2.20	32.72
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.24	0.22	0.16	0.09	1.29
Net IWR	inches	1.38	4.95	6.44	6.43	7.38	6.70	4.81	2.69	39.40
IWR	inches	3.07	11.00	14.31	14.29	16.40	14.89	10.69	5.98	87.56
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units	
Crop Yield	tons/acre	5.7
Crop Yield	lbs/acre	11,400
Nitrogen		
% Dry Mass Basis[1]	%	2.50
Crop Uptake	lbs/acre-yr	285
Allowable Application Rate[2]	lbs/acre-yr	427.5
Phosphorus		
% Dry Mass Basis[3]	%	0.22
Crop Uptake	lbs/acre-yr	25.1
Allowable Application Rate[2]	lbs/acre-yr	37.6
Organic (COD)		
Allowable Application Rate[4]	lbs/acre-d	50

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 150% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	9.13	Mgal
Allowable Hydraulic Loading	87.56	inches
Acreage Required	3.9	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	240	119	lbs/yr
Allowable Loading	427.5	37.6	lbs/acre-yr
Acreage Required	0.6	3.2	acres

8) Organic

Average Annual Effluent Load	2,000	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.2	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	3.9	acres
Contingency (10%)	0.4	acres
Total	**4.3**	acres

Water Balance Calculations - Alfalfa - Future

Influent Flow =	55,828	gpd
Avg Lagoon Depth =	5.30	ft
Irrigated Acreage =	4.3	acres
Cell #1 Seepage Rate =	0.0E03	in/d
Cell #2 Seepage Rate =		in/d
Cell #1 Surface Area =	5.54	acres
Cell #2 Surface Area =		acres
Weighted Seepage Rate =	0.0E03	in/d

Existing Lagoon Surface Area =	5.54	acres	Existing Lagoon Volume =	4.20	Mgal
Iterative Additional Storage Lagoon Surface Area =	1.24	acres	Max Lagoon Volume Required =	6.35	Mgal
Additional Storage Lagoon Surface Area =	1.24	acres	Additional Storage Lagoon Volume =	2.15	Mgal
Total Lagoon Surface Area =	6.78	acres	Total Lagoon Volume =	6.35	Mgal

		Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
Month	Days	Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	1.73	0.54	0.09	2.52	0.46	2.49	0.43	0.93	5.98	0.70	0.23	0.00	0.00
Nov	30	1.67	0.87	0.15	0.51	0.09	2.41	0.42	1.31	0.00	0.00	1.54	0.00	0.00
Dec	31	1.73	0.74	0.13	0.18	0.03	2.49	0.43	1.40	0.00	0.00	2.94	0.00	0.00
Jan	31	1.73	0.87	0.15	0.23	0.04	2.49	0.43	1.41	0.00	0.00	4.35	0.00	0.00
Feb	28	1.56	0.57	0.10	0.42	0.08	2.25	0.39	1.19	0.00	0.00	5.54	0.00	0.00
Mar	31	1.73	0.74	0.13	1.41	0.26	2.49	0.43	1.17	3.07	0.36	6.35	0.00	0.00
Apr	30	1.67	0.84	0.15	5.24	0.96	2.41	0.42	0.44	11.00	1.28	5.51	0.00	0.00
May	31	1.73	0.85	0.15	6.34	1.17	2.49	0.43	0.28	14.31	1.67	4.12	0.00	0.00
Jun	30	1.67	0.84	0.15	6.48	1.19	2.41	0.42	0.21	14.29	1.67	2.66	0.00	0.00
Jul	31	1.73	0.18	0.03	6.82	1.26	2.49	0.43	0.07	16.40	1.91	0.82	0.00	0.00
Aug	31	1.73	0.23	0.04	5.96	1.10	2.49	0.43	0.24	14.89	1.74	0.00	0.68	0.02
Sep	30	1.67	0.42	0.07	4.56	0.84	2.41	0.42	0.48	10.69	1.25	0.00	0.77	0.03
Total		20.35	7.69	1.34	40.68	7.48	29.31	5.08	9.13	90.62	10.58		1.45	

9) Land Area Requirements

WLAP Site		
Existing Land Application Site	20.1	acres
Existing Irrigated Acreage	5.61	acres
Total Irrig Acreage Required	6.78	acres
Additional Irrig Acreage Required	1.17	acres
Irrigated Areage LxW	226	ft
Buffer Zone Distance	50	ft
Buffer Zone Area	1.3	acres
Total Additional WLAP Site Area	2.47	acres
Access Roads	0	acres
Total Land Area Requirement	22.57	acres

Lagoon Dimensions

Total Volume	6.35	mgal
Number of Lagoons	2	lagoons
South Lagoon Volume	4.2	mgal
Additional Lagoon Volume	2.15	mgal
Total Surface Area	6.78	acres

Sludge Depth	1.5	ft
Water Depth	3.8	ft
Freeboard	3.3	ft
Total	8.57	ft

Existing Lagoon Surface Area	5.54	acres
Additional Surface Area	1.24	acres

	Cell #1	Cell #2	Cell #3	
Interior Dike Slope	3	3	3	ft/ft
Exterior Dike Slope	3	3	3	ft/ft
Pond Bottom Slope	0	0	0	%
Freeboard	3	3	2.7	ft
Max Water Surface Elevation	2488.20	2494.30	2494.3	
Top of Bank Elevation	249[illegible].20	2497.30	2497	
Toe of Bank Elevation	2484.40	2491.80	2491.8	
Bottom Surface Area	5.06	6.3	2.49	acres
Actual Water Surface Area	5.43	6.68	2.8	acres
Top of Bank Area	5.93	7.10	2.73	acres
Bank Mid-Slope Length	2180	2241	1445	ft
Bank Slope Face Length	21.5	17.4	16.4	ft
Bank Slope Area	46,870	38,993	23698	sq.ft.
Transition Additional Bank Height	6			ft
Transition Additional Bank Slope Length	19.3			
Transition Additional Bank Length	710			
Transition Additional Bank Slope Area	13,703			sq. ft.
Top of Interior Bank Length	2,320	2,290	1494	ft
Liner Trench Length	2330	2302	1506	ft
New Bank Length		642		ft
New Bank Top Width		14		ft
New Bank Bottom Width		41.5		ft

Earthwork Quantities

A) Clearing & Grubbing

	Cell #1	Cell #2	Cell #3	
Remove Existing Liner and Soil Cover	290,307	322,629	138,186	sq. ft.
Remove Additional for New Bank		19,581	0	sq.ft.
Depth	6	6	6	inches
Volume	5,376	6,337	2,559	cy
Total Volume	14,272			

B) Lagoon Cut/Fill

	Cell #1	Cell #2	WTP	
Top Width - New Dike		14	6	ft
Dike Cross-Sectional Area Above Ground		168	40	ft^3
Total Dike Length		642	557	ft
Sub-Total Fill Volume		3,995	825	cy
Shrinkage		25	25	%
Shrinkage Volume		999	206	cy
Total Lagoon Fill Volume		4,994	1,031	cy
Total All Lagoons	6,025			cy

C) Borrow Area

Total Fill Volume			
Lagoon	6,025	cy	1,031
Total	6,025	cy	1,031
Borrow Area Excavation Depth	2.0	ft	2.0
Borrow Area Acreage	1.9	acres	0.3

D) Aggregate Surfacing

Top of Dike	Cell #1	Cell #2	WTP	
Road Width - Top of Dike	12	14	15	ft
Aggregate Depth	0.5	0.5	0.5	ft
Total Dike Length	2,153	2,003	560	ft
Top of Dike Aggregate Volume	478	519	156	cy
Total Top of Dike	1153			cy

Exterior of Dike				
Side Length		17		ft
Aggregate Depth		0.5		ft
Exterior Dike Length		642		ft
Exterior of Dike Aggregate Volume		202		cy
Total Exterior of Dike	202			cy

Liner Quantities

	Cell #1	Cell #2	WTP	
Interior Slopes				
Interior Slope Liner Area	60,573	38,993	23,698	ft^2
Lagoon Bottom				
Lagoon Bottom Liner Area	220,414	274,428	108,464	ft^2
Anchor Trench Length	2,330	2,302	1,506	ft
Total Anchor Trench	4,632			
Anchor Trench Liner	11,650	11,510	7,530	ft^2
Sub-Total Liner Area	292,637	324,931	139,692	ft^2
Contingency (5%)	14,632	16,247	6,985	ft^2
Total Liner Area	307,269	341,178	146,677	ft^2
Total All Liner	795,124			ft^2
Spacing of Ladders	50	50	50	ft
Perimeter of Lagoon	2,330	2,302	1,506	ft
Number of Ladders	47	47	31	ladders
Total Ladders	125			ladders
Spacing of Air Vents	22	23	23	ft
Perimeter of Lagoon	2,330	2,302	1,506	ft
Number of Air Vents	106	101	66	vents
Total Air Vents	273			vents

Underdrain

Drain Pipe Size	4	4	4	in
Drain Pipe Length	3180	4040	2934	ft
Total Drain Pipe	10154			ft
Drain Trench Width	2	2	2	ft
Drain Trench Height	2	2	2	ft
Drain Trench Cross Sectional Area	3.65	3.65	3.65	ft^2
Filter Fabric	25,440	32,320	23,472	ft^2
Total Filter Fabric	81,232			ft^2
Drain Rock	430	546	397	cy
Total Drain Rock	1373			cy

Lift Station Power Consumption

Exist Pump Horsepower	5	Hp
Pump Capacity	170	gpm
Annual Operating Hours	1,998	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	12,488	Hp-Hr
Annual Kilowatt - Hours	9,312	KwH

Irrigation Pump Station Power Consumption

Exist Pump Horsepower	7.5	Hp
Pump Capacity	100	gpm
Annual Operating Hours	1,763	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	16,528	Hp-Hr
Annual Kilowatt - Hours	12,325	KwH

Total KwH 21,637 Kwh

Disinfection System

Liquid Sodium Hypochlorite System - Minimum Design

Max Chlorine Concentration	10	mg/L
Pumping Rate	100	gpm
Max Daily Chlorine Dose	12	lbs/d
Hypochlorite Concentration	12	%
Chlorine Mass/Volume	1.00	lbs/gal
Volumetric Hypochlorite Pumping Rate	12	gpd
Volumetric Hypochlorite Pumping Rate	0.5	gph
Average Chlorine Concentration	3	mg/L
Effluent Volume	9.13	mgal
Canal Water Volume	1.45	mgal
Total Annual Volume	10.58	mgal
Annual Mass of Chlorine	265	lbs
Annual Volume of Hypochlorite	265	gal

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER FACILITIES PLAN
ALTERNATIVE 4a - TOTAL CONTAINMENT LAGOON W/O WATER TREATMENT
CURRENT SITE

Surface Area and Volume Requirements - Current

Influent Flow =	20,422	gpd	existing domestic wastewater flow
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	8.30	acres	
Max Lagoon Volume Required =	3.49	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	0.63	0.54	0.12	2.52	0.57	0.00	0.00	0.18	0.18
Nov	30	0.61	0.87	0.20	0.51	0.12	0.00	0.00	0.69	0.87
Dec	31	0.63	0.74	0.17	0.18	0.04	0.00	0.00	0.76	1.63
Jan	31	0.63	0.87	0.20	0.23	0.05	0.00	0.00	0.78	2.41
Feb	28	0.57	0.57	0.13	0.42	0.10	0.00	0.00	0.60	3.01
Mar	31	0.63	0.74	0.17	1.41	0.32	0.00	0.00	0.48	3.49
Apr	30	0.61	0.84	0.19	5.24	1.18	0.00	0.00	-0.38	3.11
May	31	0.63	0.85	0.19	6.34	1.43	0.00	0.00	-0.61	2.50
Jun	30	0.61	0.84	0.19	6.48	1.46	0.00	0.00	-0.66	1.84
Jul	31	0.63	0.18	0.04	6.82	1.54	0.00	0.00	-0.87	0.97
Aug	31	0.63	0.23	0.05	5.96	1.34	0.00	0.00	-0.66	0.31
Sep	30	0.61	0.42	0.09	4.56	1.03	0.00	0.00	-0.33	-0.02
Total		7.42	7.69	1.74	40.68	9.18	0.00	0.00	-0.02	

Lagoon Dimensions

Total Volume	3.49	mgal
Number of Lagoons	2	lagoons
Volume per Lagoon	1.75	mgal/lagoon
Total Surface Area	8.30	acres
Number of Lagoons	2	lagoons
Surface Area per Lagoon	4.15	acres/lagoons

Sludge Depth	1.5	ft
Water Depth	3.8	ft
Freeboard	3.3	ft
Total	8.57	ft

Surface Area and Volume Requirements - Future

Influent Flow =	22,598	gpd	
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	9.20	acres	
Max Lagoon Volume Required =	3.85	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	0.70	0.54	0.13	2.52	0.63	0.00	0.00	0.20	0.20
Nov	30	0.68	0.87	0.22	0.51	0.13	0.00	0.00	0.77	0.97
Dec	31	0.70	0.74	0.18	0.18	0.05	0.00	0.00	0.83	1.80
Jan	31	0.70	0.87	0.22	0.23	0.06	0.00	0.00	0.86	2.66
Feb	28	0.63	0.57	0.14	0.42	0.11	0.00	0.00	0.66	3.32
Mar	31	0.70	0.74	0.18	1.41	0.35	0.00	0.00	0.53	3.85
Apr	30	0.68	0.84	0.21	5.24	1.31	0.00	0.00	-0.42	3.43
May	31	0.70	0.85	0.21	6.34	1.58	0.00	0.00	-0.67	2.76
Jun	30	0.68	0.84	0.21	6.48	1.62	0.00	0.00	-0.73	2.03
Jul	31	0.70	0.18	0.04	6.82	1.70	0.00	0.00	-0.96	1.07
Aug	31	0.70	0.23	0.06	5.96	1.49	0.00	0.00	-0.73	0.34
Sep	30	0.68	0.42	0.10	4.56	1.14	0.00	0.00	-0.36	-0.02
Total		8.25	7.69	1.90	40.68	10.17	0.00	0.00	-0.02	

Lagoon Dimensions

Total Volume	3.85	mgal
Number of Lagoons	2	lagoons
South Lagoon Volume	4.2	mgal
Additional Lagoon Volume	-0.35	mgal
Total Surface Area	9.20	acres
Existing Lagoon Surface Area		acres
Additional Surface Area	#VALUE!	acres

Sludge Depth	1.5	ft
Water Depth	3.8	ft
Freeboard	3.3	ft
Total	8.57	ft

	Cell #1	Cell #2	WTP	
Interior Dike Slope	3	3	3	ft/ft
Exterior Dike Slope	3	3	3	ft/ft

Pond Bottom Slope	0	0	0	%
Freeboard	3.3	2.7	2.7	ft
Max Water Surface Elevation	2488.20	2494.30	2494.30	
Top of Bank Elevation	2491.50	2497.00	2497.00	
Toe of Bank Elevation	2484.40	2491.80	2491.80	
Bottom Surface Area	5.06	3.76	2.49	acres
Actual Water Surface Area	5.43	4.07	2.80	acres
Top of Bank Area	5.93	4.42	2.73	acres
Bank Mid-Slope Length	2180	1845	1445	ft
Bank Slope Face Length	22.5	16.4	16.4	ft
Bank Slope Area	49,050	30,258	23,698	sq.ft.
Transition Additional Bank Height	6			ft
Transition Additional Bank Slope Length	17.4			
Transition Additional Bank Length	710			
Transition Additional Bank Slope Area	12,354			sq. ft.
Top of Interior Bank Length	2,320	1,894	1494	ft
Liner Trench Length	2330	1907	1506	ft
New Bank Length		542		ft
New Bank Top Width		12		ft
New Bank Bottom Width		42.5		ft

Earthwork Quantities

A) Clearing & Grubbing

	Cell #1	Cell #2	WTP	
Remove Existing Liner and Soil Cover	291,138	201,672	138,186	sq. ft.
Remove Additional for New Bank		14,959	0	sq.ft.
Depth	6	6	6	inches
Volume	5,391	4,012	2,559	cy
Total Volume	11,962			

B) Lagoon Cut/Fill

	Cell #1	Cell #2	WTP	
Top Width - New Dike		12	6	ft
Dike Cross-Sectional Area Above Ground		144	40	ft^2
Total Dike Length		542	557	ft
Sub-Total Fill Volume		2,891	825	cy
Shrinkage		25	25	%

Shrinkage Volume		723	206	cy
Total Lagoon Fill Volume		3,614	1,031	cy
Total All Lagoons	4,645			cy

C) Borrow Area

Total Fill Volume				
Lagoon	4,645	cy	1,031	cy
Total	4,645	cy	1,031	cy
Borrow Area Excavation Depth	2.0	ft	2.0	ft
Borrow Area Acreage	1.4	acres	0.3	acres

D) Aggregate Surfacing

Top of Dike	Cell #1	Cell #2	WTP	
Road Width - Top of Dike	12	15	15	ft
Aggregate Depth	0.5	0.5	0.5	ft
Total Dike Length	2,153	1,370	560	ft
Top of Dike Aggregate Volume	478	381	156	cy
Total Top of Dike	1015			cy

Exterior of Dike - if WTP not completed				
Side Length		16		ft
Aggregate Depth		0.5		ft
Exterior Dike Length		542		ft
Exterior of Dike Aggregate Volume		161		cy
Total Exterior of Dike	161			cy

Liner Quantities

Interior Slopes	Cell #1	Cell #2	WTP	
Interior Slope Liner Area	61,404	30,258	23,698	ft^2

Lagoon Bottom				
Lagoon Bottom Liner Area	220,414	163,786	108,464	ft^2
Anchor Trench Length	2,330	1,907	1,506	ft
Total Anchor Trench	5,743			
Anchor Trench Liner	11,650	9,535	7,530	ft^2

Sub-Total Liner Area	293,468	203,579	139,692	ft^2
Contingency (5%)	14,673	10,179	6,985	ft^2
Total Liner Area	308,141	213,758	146,677	ft^2
Total All Liner	668,576			ft^2
Spacing of Ladders	50	50	50	ft
Perimeter of Lagoon	2,330	1,907	1,506	ft
Number of Ladders	47	39	31	ladders
Total Ladders	117			ladders
Spacing of Air Vents	22	23	23	ft
Perimeter of Lagoon	2,330	1,907	1,506	ft
Number of Air Vents	106	83	66	vents
Total Air Vents	255			vents
Underdrain				
Drain Pipe Size	4	4	4	in
Drain Pipe Length	5726	4500	2934	ft
Drain Trench Width	2	2	2	ft
Drain Trench Height	2	2	2	ft
Drain Trench Cross Sectional Area	3.65	3.65	3.65	ft^2
Filter Fabric	45,808	36,000	23,472	ft^2
Drain Rock	774	608	397	cy

Lift Station Power Consumption

Pump Horsepower	5	Hp
Pump Capacity	170	gpm
Annual Operating Hours	809	hrs
Motor Efficiency	80%	
Annual Horsepower - hours	5,056	Hp-Hr
Annual Kilowatt - Hours	3,770	KwH

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER FACILITIES PLAN
ALTERNATIVE 4b - TOTAL CONTAINMENT LAGOON WITH WATER TREATMENT DISCHARGE
CURRENT SITE

Surface Area and Volume Requirements - Current Conditions

Influent Flow =	50,588	gpd	existing flows with WTP discharge
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	20.65	acres	
Max Lagoon Volume Required =	8.68	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	1.57	0.54	0.30	2.52	1.41	0.00	0.00	0.46	0.46
Nov	30	1.52	0.87	0.49	0.51	0.29	0.00	0.00	1.72	2.18
Dec	31	1.57	0.74	0.41	0.18	0.10	0.00	0.00	1.88	4.06
Jan	31	1.57	0.87	0.49	0.23	0.13	0.00	0.00	1.93	5.99
Feb	28	1.42	0.57	0.32	0.42	0.24	0.00	0.00	1.50	7.49
Mar	31	1.57	0.74	0.41	1.41	0.79	0.00	0.00	1.19	8.68
Apr	30	1.52	0.84	0.47	5.24	2.94	0.00	0.00	-0.95	7.73
May	31	1.57	0.85	0.48	6.34	3.56	0.00	0.00	-1.51	6.22
Jun	30	1.52	0.84	0.47	6.48	3.63	0.00	0.00	-1.64	4.58
Jul	31	1.57	0.18	0.10	6.82	3.83	0.00	0.00	-2.16	2.42
Aug	31	1.57	0.23	0.13	5.96	3.34	0.00	0.00	-1.64	0.78
Sep	30	1.52	0.42	0.24	4.56	2.56	0.00	0.00	-0.80	-0.02
Total		18.49	7.69	4.31	40.68	22.82	0.00	0.00	-0.02	

Lagoon Dimensions

Total Volume	8.68	mgal
Number of Lagoons	2	lagoons
Volume per Lagoon	4.34	mgal/lagoon
Total Surface Area	20.65	acres
Number of Lagoons	2	lagoons
Surface Area per Lagoon	10.33	acres/lagoons

Sludge Depth	1.0	ft
Water Depth	3.8	ft
Freeboard	2.0	ft
Total	6.8	ft

Surface Area and Volume Requirements - Future Conditions

Influent Flow =	55,828	gpd	
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	22.80	acres	
Max Lagoon Volume Required =	9.57	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	1.73	0.54	0.33	2.52	1.56	0.00	0.00	0.50	0.50
Nov	30	1.67	0.87	0.54	0.51	0.32	0.00	0.00	1.89	2.39
Dec	31	1.73	0.74	0.46	0.18	0.11	0.00	0.00	2.08	4.47
Jan	31	1.73	0.87	0.54	0.23	0.14	0.00	0.00	2.13	6.60
Feb	28	1.56	0.57	0.35	0.42	0.26	0.00	0.00	1.65	8.25
Mar	31	1.73	0.74	0.46	1.41	0.87	0.00	0.00	1.32	9.57
Apr	30	1.67	0.84	0.52	5.24	3.24	0.00	0.00	-1.05	8.52
May	31	1.73	0.85	0.53	6.34	3.93	0.00	0.00	-1.67	6.85
Jun	30	1.67	0.84	0.52	6.48	4.01	0.00	0.00	-1.82	5.03
Jul	31	1.73	0.18	0.11	6.82	4.22	0.00	0.00	-2.38	2.65
Aug	31	1.73	0.23	0.14	5.96	3.69	0.00	0.00	-1.82	0.83
Sep	30	1.67	0.42	0.26	4.56	2.82	0.00	0.00	-0.89	-0.06
Total		20.35	7.69	4.76	40.68	25.17	0.00	0.00	-0.06	

Lagoon Dimensions

Total Volume	9.57	mgal
Number of Lagoons	4	lagoons
South Lagoon Volume	4.2	mgal
North Lagoon Volume	5.65	mgal
Additional Lagoon Volume	-0.28	mgal
Total Surface Area	22.80	acres
Existing Lagoon Surface Area	5.54	acres
North Lagoon Surface Area	7.14	acres
Additional Surface Area	10.12	acres

Sludge Depth	1.5	ft
Water Depth	3.8	ft
Freeboard	3.3	ft
Total	8.57	ft

	Cell #1	Cell #2	Cell #3	Cell #4	Cell #5	Total
Interior Dike Slope	3	3	3	3	3	ft/ft
Exterior Dike Slope	3	3	3	3	3	ft/ft
Pond Bottom Slope	0	0	2	2	2	%
Freeboard	3.3	2.7	2	2	2	ft
Max Water Surface Elevation	2488.20	2494.30	2492.00	2495.50	2501.00	
Top of Bank Elevation	2491.50	2497.00	2494.00	2497.50	2503.00	
Toe of Bank Elevation	2484.40	2491.80	2490.00	2493.50	2499.00	
Existing Ground Elevation			2490.00	2493.50	2500.00	
Bottom Surface Area	5.06	6.74	3.76	3.63	2.22	acres
Actual Water Surface Area	5.43	7.14	3.98	3.85	2.40	acres
Top of Bank Area	5.93	7.57	4.21	4.07	2.58	acres
Bank Mid-Slope Length	2180	2300	1643	1615	1289	ft
Bank Slope Face Length	22.5	16.4	12.6	12.6	12.6	ft
Bank Slope Area	49,050	37,720	20,702	20,349	16,241	sq.ft.
Transition Additional Bank Height	6					ft
Transition Additional Bank Slope Length	17.4					ft
Transition Additional Bank Length	710					ft
Transition Additional Bank Slope Area	12,354					sq. ft.
Top of Interior Bank Length	2,320	2,350	1,680	1,652	1,327	ft
Liner Trench Length	2330	2362	1693	1665	1339	ft
New Bank Length		561	1725	1696	1371	ft
New Bank Top Width		12	14	14	14	ft
New Bank Bottom Width		42.5	38	38	38	ft

Earthwork Quantities

A) Clearing & Grubbing

	Cell #1	Cell #2	Cell #3	Cell #4	Cell #5	
Remove Existing Liner and Soil Cover	291,138	340,762				sq. ft.
Remove Additional for Reconstructed Dike		15,484				sq.ft.
Clearing and Grubbing			227,670	220,791	157,163	
Depth	6	6	6	6	6	inches
Volume	5,391	6,597	4,216	4,089	2,910	cy
Total Volume	11,988		11,215			

B) Lagoon Cut/Fill

Cell #1	Cell #2	Cell #3	Cell #4	Cell #5

Average Cut Depth Below Natural Ground Surface			2	2	1.5	ft
Surface Area at Toe			163,786	158,123	96,703	ft^2
Surface Area at Natural Ground Level			227,670	220,791	157,163	ft^2
Cut Volume Below Toe			3,033	2,928	1,791	cy
Cut Volume Above Toe			14,498	14,034	7,052	cy
Total Cut Volume			17,531	16,962	8,843	cy
Total All Lagoons	43,336					
Road Width on Top		14	14	14	14	ft
Dike Cross-Sectional Area Above Ground		144	104	104	104	ft^2
Total Dike Length		561	1,725	1,696	1,371	ft
Sub-Total Fill Volume		2,992	6,644	6,533	5,281	cy
Shrinkage		25	25	25	25	%
Shrinkage Volume		748	1,661	1,633	1,320	cy
Total Lagoon Fill Volume		3,740	8,305	8,166	6,601	cy
Total All Lagoons	26,812					

C) Approach

Avg. Width			26	26	23	ft
Sub-Total Approach Fill Volume			129	129	64	cy
Shrinkage			25	25	25	%
Shrinkage Volume			32	32	16	cy
Total Road Fill Volume			161	161	80	cy
Total All Approaches	402					cy

D) Retention Berm Fill

Height	1	ft
Side Slope	1.5	ft/ft
Top Width	2	ft
Bottom Width	5.0	ft
Cross-Sectional Area	3.5	ft^2
Retention Berm Length	1,100	ft
Sub-Total Berm Fill Volume	143	cy
Shrinkage	25	%
Shrinkage Volume	36	cy
Total Berm Fill Volume	179	cy

E) Borrow Area

Total Fill Volume		
Lagoon Cut	32,121	cy
Lagoon Fill	26,812	cy
Approach	402	cy
Retention Berm	179	cy
Total	-4,728	cy
Borrow Area Excavation Depth	2.0	ft
Borrow Area Acreage	-1.5	acres

D) Aggregate Surfacing

Top of Dike	Cell #1	Cell #2	Cell #3	Cell #4	Cell #5	
Road Width - Top of Dike	12	15	14	14	14	ft
Aggregate Depth	0.5	0.5	0.5	0.5	0.5	ft
Total Dike Length	2,153	1,370	25	25	1,371	ft
Top of Dike Aggregate Volume	478	381	6	6	355	cy
Total Top of Dike	1226					cy
Exterior of Dike						
Side Length		16	13	13	13	ft
Aggregate Depth		0.5	0.5	0.5	0.5	ft
Exterior Dike Length		561	1,725	1,696	1,371	ft
Exterior of Dike Aggregate Volume		166	415	408	330	cy
Total Exterior of Dike	1319					cy
Approach						
Approach Width			14	14	14	ft
Aggregate Depth			0.5	0.5	0.5	ft
Approach Length			67	67	50	ft
Approach Side Area			268	268	151	ft^2
Approach Aggregate Volume			27	27	19	cy
Total Exterior of Approach	73					cy

Liner Quantities

Interior Slopes	Cell #1	Cell #2	Cell #3	Cell #4	Cell #5	
Interior Slope Liner Area	61,404	37,720	20,702	20,349	16,241	ft^2

Lagoon Bottom						
Lagoon Bottom Liner Area	220,414	293,594	163,786	158,123	96,703	ft^2
Anchor Trench Length	2,330	2,362	1,693	1,665	1,339	ft
Total Anchor Trench	8,050					
Anchor Trench Liner	11,650	11,810	8,465	8,325	6,695	ft^2
Sub-Total Liner Area	293,468	343,124	192,953	186,797	119,639	ft^2
Contingency (5%)	14,673	17,156	9,648	9,340	5,982	ft^2
Total Liner Area	308,141	360,280	202,601	196,137	125,621	ft^2
Total All Liner	1,192,780					ft^2
Spacing of Ladders	50	50	50	50	50	ft
Perimeter of Lagoon	2,330	2,362	1,693	1,665	1,339	ft
Number of Ladders	47	48	34	34	27	ladders
Total Ladders	190					ladders
Spacing of Air Vents	22	23	23	23	23	ft
Perimeter of Lagoon	2,330	2,362	1,693	1,665	1,339	ft
Number of Air Vents	106	103	74	73	59	vents
Total Air Vents	415					vents
Underdrain						
Drain Pipe Size	4	4	4	4	4	in
Drain Pipe Length	3180	4069	2222	2246	2080	ft
Total Drain Pipe	13,797					ft
Drain Trench Width	2	2	2	2	2	ft
Drain Trench Height	2	2	2	2	2	ft
Drain Trench Cross Sectional Area	3.65	3.65	3.65	3.65	3.65	ft^2
Filter Fabric	25,440	32,552	17,776	17,968	16,640	ft^2
Total Filter Fabric	110,376					ft^2
Drain Rock	430	550	300	304	281	cy
Total Draiin Rock	1,865					cy

Sewer Lift Station

2013	2033

	Average Daily Volume =	0.06	mgal
	Average Hourly RT	50	min.
	Daily Pump Run Time	1117	min.
	Pump Discharge	47	gpm
	Elevation Head	13	ft
	Discharge Pressure	10	psi
	FM Length	1,275	ft
	FM Friction Losses	0.16	ft/100 ft (4"pressure main)
	FM Headloss	2	ft
	Misc. Head Loss	10	ft
	TDH	48	ft
	Pump Efficiency =	60	%
	Pump Horsepower =	1	hp

Lift Station Power Consumption

Exist	Pump Horsepower	5	Hp
	Pump Capacity	170	gpm
	Annual Operating Hours	1998	hrs
	Motor Efficiency	80%	
	Annual Horsepower - hours	12,488	Hp-Hr
	Annual Kilowatt - Hours	9,312	KwH
New	Annual Operating Hours	7300	hrs
	Pump Horsepower	1	
	Motor Efficiency	80%	
	Annual Horsepower - hours	9,125	Hp-Hr
	Annual Kilowatt - Hours	6,805	KwH
Total		16,117	Kwh

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

APPENDIX B: PRELIMINARY SIZING SPREADSHEETS FOR ALTERNATIVES 5a, 5b, 6a, and 6b

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
ALTERNATIVE 5a - NEW TREATMENT - ALFALFA WITHOUT WATER TREATMENT
SPRINKLER IRRIGATION ENDING AT THE END OF JUNE

1) Sludge Volume

	Sludge Depth (ft)	Lagoon Bottom Surface Area (acre)	Sludge Volume (mgal)	Lagoon Volume (mgal)	% of Volume Occupied by Sludge
Cell #1	1.00	0.88	0.29	1.595	18.0
	1.00	0.88	0.29	1.595	18.0
			0.57	3.19	35.90

2) Hydraulic Retention Time

Average Day Flow = 20,422 gpd
Design Average Day Flow = 22,598 gpd

	Lagoon Volume (mgal)	Sludge Volume (mgal)	Operating Volume (mgal)	Operating HRT (d)	Design HRT (d)
Cell #1	1.60	0.29	1.31	64.1	70.6
Cell #2	1.60	0.29	1.31	64.1	70.6
	3.19	0.57	2.62	128.20	141.20

20 to 180 days (EPA Tech. Fact Sheet)
5 to 30 days warm climate, 180 days cold (Chpt. 6, p. 238)
180 days between high WSL & 2 foot - controlled discharge - entire system (10 State Standards, p. 90-15)
90 to 120 days - flow through - entire system (10 State Standards, p. 90-15)
40 to 60 days at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
15 to 30 days at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
5 to 30 days (M&E, p. 645)

3) Organic Surface Loading

Year	BOD lbs/d	Cell #1 Organic Loading lbs/ac-d	System Organic Loading lbs/ac-d
2011	46	49.7	24.9
2012	46	49.7	24.9
2013	46.84	50.6	25.3
2014	47.28	51.1	25.6
2015	47.50	51.4	25.7
2016	47.73	51.6	25.8
2017	47.96	51.8	25.9
2018	48.18	52.1	26.0

	Water Surface Area	
Cell #1	0.925	acres
Cell #2	0.925	acres
Total	1.85	acres

13 to 71 lbs/acre-d (EPA Tech. Fact Sheet)

2019	48.41	52.3	26.2	15 to 50 lbs/acre-d (Chpt 6., p. 238 & 249)
2020	48.64	52.6	26.3	15 to 35 lbs/acre-d - primary pond (10 State Standards, p. 90-15)
2021	48.87	52.8	26.4	20 to 25 lbs/acre-d (Chpt. 10, p. 10-10)
2022	49.09	53.1	26.5	20 to 40 lbs/acre-d at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
2023	49.32	53.3	26.7	60 to 120 lbs/acre-d at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
2024	49.55	53.6	26.8	25 to 35 lbs/acre-d - single pond or parallel (Reynolds, p. 560)
2025	49.77	53.8	26.9	75 to 80 lbs/acre-d - primary pond in series operation (Reynolds, p. 560)
2026	50.00	54.1	27.0	25 to 35 lbs/acre-d - secondary ponds in series operation (Reynolds, p. 560)
2027	50.23	54.3	27.2	16.7 to 60 lbs/acre-d (M&E, p. 645)
2028	50.45	54.5	27.3	
2029	50.68	54.8	27.4	
2030	50.91	55.0	27.5	
2031	51.14	55.3	27.6	
2032	51.37	55.5	27.8	

4) Lagoon Depth

Cell #1 Max Depth	4.0	ft
Cell #2 Max Depth	4.0	ft

4 to 8 feet (EPA Tech. Fact Sheet)
4 to 8 feet (Chpt 6, p. 237)
6 feet primary cell (10 State Standards, p. 90-18)
6 feet primary cell (Chpt. 10, p. 10-10, 10-11)
4 to 6 feet at winter air temps of 33-59 F (Chpt. 10, p. 10-13)
3 to 6 feet (Reynolds, p. 560)
4 to 8 feet (M&E, p. 645)

5) Effluent Flows & Waste Loads - Current Conditions

Annual Effluent Volume = 5.26 mgal/yr

	mg/L	lbs/yr	
COD	77.00	3,378	
Total-N	9.25	406	Estimated as TKN + NO3-N
Total-P	3.87	170	

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load Spreadshee

	mg/L	Effluent Es
BOD	275	15.4
TSS	275	26.675
TKN	45	5.85
NO3-N	2	3.398
TP	9	3.87
COD		77.00

6) Slow Rate Land Application & Storage - Current Conditions

Irrigation Water Requirement

Assume:				
	Crop =	Alfalfa		
	Type of Irrigation =	Sprinkler		
	Irrigation Efficiency =	65	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	0.00	0.00	0.00	0.00	14.91
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.00	0.00	0.00	0.00	0.59
Net IWR	inches	1.38	4.95	6.44	6.43	0.00	0.00	0.00	0.00	17.82
IWR	inches	2.12	7.62	9.91	9.89	0.00	0.00	0.00	0.00	27.42
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units	
Crop Yield	tons/acre	4
Crop Yield	lbs/acre	8,000
Nitrogen		
% Dry Mass Basis[1]	%	2.50
Crop Uptake	lbs/acre-yr	200
Allowable Application Rate[2]	lbs/acre-yr	300
Phosphorus		
% Dry Mass Basis[3]	%	0.22
Crop Uptake	lbs/acre-yr	17.6
Allowable Application Rate[2]	lbs/acre-yr	26.4
Organic (COD)		
Allowable Application Rate[4]	lbs/acre-d	50

Note: Yield is reduced for irrigation through June only.

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 125% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	5.26	Mgal
Allowable Hydraulic Loading	27.42	inches
Acreage Required	7.1	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	406	170	lbs/yr
Allowable Loading	300	26.4	lbs/acre-yr
Acreage Required	1.4	6.5	acres

Organic

Average Annual Effluent Load	3,378	lbs/yr

Allowable Loading	50	lbs/acre-d
Acreage Required	0.4	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	7.1	acres
Contingency (10%)	0.8	acres
Total	**7.9**	acres

B) Calculate the lagoon storage volume and surface area requirements.

Water Balance Calculations - Alfalfa - Current

Influent Flow =	20,422	gpd
Avg Lagoon Depth =	5.30	ft
Irrigated Acreage =	7.9	acres
Cell #1 Seepage Rate =	0.0803	in/d
Cell #2 Seepage Rate =		in/d
Cell #1 Surface Area =	0.84	acres
Cell #2 Surface Area =	0.84	acres
Weighted Seepage Rate =	0.0402	in/d

Existing Lagoon Surface Area =	0.00	acres	Existing Lagoon Volume =	0.00	Mgal
Iterative Additional Storage Lagoon Surface Area =	1.66	acres	Max Lagoon Volume Required =	2.86	Mgal
Additional Storage Lagoon Surface Area =	1.67	acres	Additional Storage Lagoon Volume =	2.86	Mgal
Total Lagoon Surface Area =	1.67	acres	Total Lagoon Volume =	2.86	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	0.63	0.54	0.02	2.52	0.11	1.25	0.06	0.48	0.00	0.00	0.48	0.00	0.00
Nov	30	0.61	0.87	0.04	0.51	0.02	1.21	0.05	0.58	0.00	0.00	1.06	0.00	0.00
Dec	31	0.63	0.74	0.03	0.18	0.01	1.25	0.06	0.59	0.00	0.00	1.65	0.00	0.00
Jan	31	0.63	0.87	0.04	0.23	0.01	1.25	0.06	0.60	0.00	0.00	2.25	0.00	0.00
Feb	28	0.57	0.57	0.03	0.42	0.02	1.13	0.05	0.53	0.00	0.00	2.78	0.00	0.00
Mar	31	0.63	0.74	0.03	1.41	0.06	1.25	0.06	0.54	2.12	0.46	2.86	0.00	0.00
Apr	30	0.61	0.84	0.04	5.24	0.24	1.21	0.05	0.36	7.62	1.63	1.59	0.00	0.00
May	31	0.63	0.85	0.04	6.34	0.29	1.25	0.06	0.32	9.91	2.13	0.00	0.22	0.01
Jun	30	0.61	0.84	0.04	6.48	0.29	1.21	0.05	0.31	9.89	2.12	0.00	1.81	0.06
Jul	31	0.63	0.18	0.01	6.82	0.31	1.25	0.06	0.27	0.00	0.00	0.27	0.00	0.00
Aug	31	0.63	0.23	0.01	5.96	0.27	1.25	0.06	0.31	0.00	0.00	0.58	0.00	0.00
Sep	30	0.61	0.42	0.02	4.56	0.21	1.21	0.05	0.37	0.00	0.00	0.95	0.00	0.00
Total		7.42	7.69	0.35	40.68	1.84	14.67	0.67	5.26	29.54	6.34		2.03	

7) Effluent Flows & Waste Loads - Future Conditions

Annual Effluent Volume = 5.88 mgal/yr

	mg/L	lbs/yr
COD	31.03	1,522
Total-N	3.73	183
Total-P	1.56	76

Estimated as TKN + NO3-N

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load Spreadshee

	mg/L	Effluent Es
BOD	111	6.206011
TSS	111	10.7497
TKN	18	2.357478
NO3-N	0.81	1.369352
TP	3.63	1.559563
COD		31.03

8) Slow Rate Land Application & Storage - Future Conditions

Irrigation Water Requirement

Assume:	Crop =	Alfalfa		
	Type of Irrigation =	Sprinkler		
	Irrigation Efficiency =	65	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	0.00	0.00	0.00	0.00	14.91
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.00	0.00	0.00	0.00	0.59
Net IWR	inches	1.38	4.95	6.44	6.43	0.00	0.00	0.00	0.00	17.82
IWR	inches	2.12	7.62	9.91	9.89	0.00	0.00	0.00	0.00	27.42
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units	
Crop Yield	tons/acre	4
Crop Yield	lbs/acre	8,000
Nitrogen		
% Dry Mass Basis[1]	%	2.50
Crop Uptake	lbs/acre-yr	200
Allowable Application Rate[2]	lbs/acre-yr	300
Phosphorus		
% Dry Mass Basis[3]	%	0.22
Crop Uptake	lbs/acre-yr	17.6
Allowable Application Rate[2]	lbs/acre-yr	26.4
Organic (COD)		
Allowable Application Rate[4]	lbs/acre-d	50

Note: Yield is reduced for irrigation through June only.

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 150% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	5.88	Mgal
Allowable Hydraulic Loading	27.42	inches
Acreage Required	7.9	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	183	76	lbs/yr
Allowable Loading	300	26.4	lbs/acre-yr
Acreage Required	0.7	2.9	acres

Organic

Average Annual Effluent Load	1,522	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.2	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	7.9	acres
Contingency (10%)	0.8	acres
Total	**8.7**	acres

Water Balance Calculations - Alfalfa - Future

Influent Flow =	22,598	gpd
Avg Lagoon Depth =	5.30	ft
Irrigated Acreage =	8.7	acres
Cell #1 Seepage Rate =	0.0803	in/d
Cell #2 Seepage Rate =		in/d
Cell #1 Surface Area =	0.93	acres
Cell #2 Surface Area =	0.93	acres
Weighted Seepage Rate =	0.0402	in/d

Existing Lagoon Surface Area =	0.00	acres	Existing Lagoon Volume =	0.00	Mgal
Iterative Additional Storage Lagoon Surface Area =	1.85	acres	Max Lagoon Volume Required =	3.19	Mgal
Additional Storage Lagoon Surface Area =	1.85	acres	Additional Storage Lagoon Volume =	3.19	Mgal
Total Lagoon Surface Area =	1.85	acres	Total Lagoon Volume =	3.19	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	0.70	0.54	0.02	2.52	0.13	1.25	0.06	0.53	0.00	0.00	0.53	0.00	0.00

Nov	30	0.68	0.87	0.04	0.51	0.03	1.21	0.05	0.64	0.00	0.00	1.17	0.00	0.00
Dec	31	0.70	0.74	0.03	0.18	0.01	1.25	0.06	0.66	0.00	0.00	1.83	0.00	0.00
Jan	31	0.70	0.87	0.04	0.23	0.01	1.25	0.06	0.67	0.00	0.00	2.50	0.00	0.00
Feb	28	0.63	0.57	0.03	0.42	0.02	1.13	0.05	0.59	0.00	0.00	3.09	0.00	0.00
Mar	31	0.70	0.74	0.03	1.41	0.07	1.25	0.06	0.60	2.12	0.50	3.19	0.00	0.00
Apr	30	0.68	0.84	0.04	5.24	0.26	1.21	0.05	0.41	7.62	1.80	1.80	0.00	0.00
May	31	0.70	0.85	0.04	6.34	0.32	1.25	0.06	0.36	9.91	2.34	0.00	0.18	0.01
Jun	30	0.68	0.84	0.04	6.48	0.33	1.21	0.05	0.34	9.89	2.34	0.00	2.00	0.07
Jul	31	0.70	0.18	0.01	6.82	0.34	1.25	0.06	0.31	0.00	0.00	0.31	0.00	0.00
Aug	31	0.70	0.23	0.01	5.96	0.30	1.25	0.06	0.35	0.00	0.00	0.66	0.00	0.00
Sep	30	0.68	0.42	0.02	4.56	0.23	1.21	0.05	0.42	0.00	0.00	1.08	0.00	0.00
Total		8.25	7.69	0.35	40.68	2.05	14.67	0.67	5.88	29.54	6.98		2.18	

9) Storage Lagoon Dimensions

	Storage Lagoon	
Number of Lagoons	2	
Interior Dike Slope	3	ft/ft
Exterior Dike Slope	3	ft/ft
Pond Bottom Slope	2	%
Freeboard	3	ft
Bottom Elevation	0	ft
Toe Elevation	1.49	ft
Water Depth Above Toe	3.5	ft
Max Water Surface Elevation	4.99	ft
Top of Bank Elevation	7.99	ft
L:W Ratio	2	ft:ft
Max Water Surface Length	340	ft
Max Water Surface Width	170	ft
Top of Interior Bank Length	358	ft
Top of Interior Bank Width	188 ft	
Toe Length	319	ft
Toe Width	149	ft
Surface Area at Toe	47,531	ft2
Surface Area at Max SWL	57,800	ft2
	1.33	acres
Required Surface Area	0.93	acres
Volume Below Toe	35,411	ft3
	0.26	mgal
Volume Above Toe	184,329	ft3
	1.38	mgal

Total Operating Volume	219,740	ft3	HRT	
	1.64	mgal	27.90	days
Required Volume	1.60	mgal		
Surface Area at Max SWL	57,800	ft2		
Required calculated surface area	40,293	ft2		
Surface Area to Top of Dike	67,304	ft2		
Freeboard Volume	165,397	ft3		
	1.24	mgal		
Total Lagoon Volume	2.88	mgal		
Total Lagoon Volume	5.76	mgal		

10) Land Area Requirements

Storage Lagoon		
Road Width - Top of Dike	15	ft
Total Length	436	ft
Total Width	266	ft
Total Lagoon Area	2.66	acres
WLAP Site		
Existing Irrigated Acreage	0	acres
Total Irrig Acreage Required	8.7	acres
Additional Irrig Acreage Required	8.7	acres
Irrigated Areage LxW	616	ft
Buffer Zone Distance	300	ft
Buffer Zone Area	25	acres
Total Additional WLAP Site Area	33.7	acres
Access Roads	0.25	acres
Total Land Area Requirement	39.3	acres

11) Earthwork Quantities

A) Clearing & Grubbing

Total Lagoon Area	5.32	acres
Access Roads	0	acres
Sub-Total Area	5.57	acres
Depth	6	inches
Volume	4493	cy

B) Lagoon Cut/Fill

Cut Depth Below Natural Ground Surface	4	ft
Toe Height	1.49	ft

Height of Natural Ground Level Above Toe	2.81	ft
Toe Length	319	ft
Toe Width	149	ft
Natural Ground Level Length	344.8	ft
Natural Ground Level Width	174.8	ft
Surface Area at Toe	47,531	ft2
Surface Area at Natural Ground Level	60,271	ft2
Cut Volume Below Toe	1,312	cy
Cut Volume Above Toe	5,610	cy
Total Cut Volume per Lagoon	6922	cy
Total Lagoon Cut Volume	13844	cy
Dike Cross-Sectional Area Above Ground	96	ft2
Total Dike Length	1,092	ft
Sub-Total Fill Volume	3,883	cy
Shrinkage	25	%
Shrinkage Volume	971	cy
Total Fill Volume per Lagoon	4,854	cy
Total Lagoon Fill Volume	9,708	cy

C) Approach Fill

Height	4	ft
Slope	5	%
Length	74	ft
Avg. Width	19	ft
Fill Volume per Road	96	cy/road
Number of Approaches	1	roads
Sub-Total Approach Fill Volume	96	cy
Shrinkage	25	%
Shrinkage Volume	24	cy
Total Road Fill Volume per Lagoon	120	cy
Total Road Fill Volume	240	cy

D) Retention Berm Fill

Height	1	ft
Side Slope	1.50	ft/ft
Top Width	2.00	ft
Bottom Width	5.00	ft
Cross-Sectional Area	3.5	ft2
Retention Berm Length	476	ft
Retention Berm Width	306	ft
Total Berm Length	1,564	ft

Sub-Total Berm Fill Volume	203	cy
Shrinkage	25	%
Shrinkage Volume	51	cy
Total Berm Fill Volume	254	cy

E) Borrow Area

Total Fill Volume		
Lagoon	9,708	cy
Approach	240	cy
Berm	254	cy
Total	10,202	cy
Total Cut Volume	13,844	cy
Borrow Volume Required	-3,642	cy
Borrow Area Excavation Depth	3	ft
Borrow Area Acreage	-0.8	acres

F) Aggregate Surfacing

Top of Dike		
Road Width - Top of Dike	15	ft
Aggregate Depth	0.5	ft
Total Dike Length	949	ft
Top of Dike Aggregate Volume	264	cy
Exterior of Dike		
Side Length	11.07	ft
Aggregate Depth	0.5	ft
Total Dike Length	979	ft
Exterior of Dike Aggregate Volume	201	cy
Approach		
Side Length	11.07	ft
Aggregate Depth	0.5	ft
Approach Length	74	ft
Exterior or Approach Aggr. Volume per Lagoc	15	cy
Total Approach Aggregate Volume	30	cy

12) Liner Quantities

Interior Slopes		
Width of Interior Slope to Toe	19.5	ft
Liner in Anchor Trench	5	ft
Liner Slack	1	ft
Total Liner Width	25.5	ft
Top of Dike Length	358	ft
Top of Dike Width	188	ft
Interior Slope Liner Area	27,846	ft2

Lagoon Bottom

Length of Slope from Toe to Center	75	ft
Liner Slack	2	ft
Total Liner Width	152	ft
Toe Length	319	ft
Lagoon Bottom Liner Area	48,488	ft2
Sub-Total Liner Area	76,334	ft2
Contingency (5%)	3,817	ft2
Total Liner Area per Lagoon	80,151	ft2
Total Liner Area	160,301	ft2
Anchor Trench Length per Lagoon	1,092	ft
Total Anchor Trench Length	2,184	ft
Spacing of Ladders	50	ft
Perimeter of Lagoon	1,092	ft
Number of Ladders Per Lagoon	22	ladders
Total Number of Ladders	44	ladders
Spacing of Air Vents	25	ft
Perimeter of Lagoon	1,092	ft
Number of Air Vents per Lagoon	44	vents
Total Number of Air Vents	88	vents

13) Irrigation Pump Station

	Site 1		
Max Monthly Volume =	2.34	mgal	
Irrigating Days =	25	day	
Pump Capacity =	65	gpm	
Elevation Head	-5	ft	
Discharge Pressure	60	psi	
FM Length	694	ft	
FM Friction Losses	1.01	ft/100 ft	(6"pressure main)
FM Headloss	7	ft	
Misc. Head Loss	3	ft	
TDH	144	ft	
Pump Efficiency =	70	%	
Pump Horsepower =	3.4	hp	

Disinfection System

Liquid Sodium Hypochlorite System - Minimum Design

Max Chlorine Concentration	10	mg/L
Pumping Rate	65	gpm
Max Daily Chlorine Dose	7.8	lbs/d
Hypochlorite Concentration	12	%
Chlorine Mass/Volume	1.00	lbs/gal
Volumetric Hypochlorite Pumping Rate	7.8	gpd
Volumetric Hypochlorite Pumping Rate	0.33	gph
Average Chlorine Concentration	3	mg/L
Effluent Volume	5.88	mgal
Canal Water Volume	2.18	mgal
Total Annual Volume	8.06	mgal
Annual Mass of Chlorine	202	lbs
Annual Volume of Hypochlorite	202	gal

Chlorine Contact Chamber

NEW		
Pumping Rate	65	gpm
Contact Time	30	min
Minimum Basin Volume	1,950	gal
Pipe size	12	in.
Pipe Cross Section Area	0.78	sq. ft.
Length	334	ft

* Ten State Standards requires "a minimum contact period of 15 minutes at maximum rate of pumpage...." (102.44, p. 100-3).

Irrigation Pump Station Power Consumption

Annual Operating Hours	1790	hrs
Pump Horsepower	3.4	
Motor Efficiency	80%	
Annual Horsepower - hours	7,608	Hp-Hr
Annual Kilowatt - Hours	5,673	KwH

14) Sewer Lift Station

	2013	2033		
Peak Hour Volume =	0.08	0.09	mgal	
Pump Capacity =	80	80	gpm	
Daily Pump Run Time	1021	1125	min.	
Average Hourly RT	43	47	min.	
Elevation Head	175	175	ft	
Discharge Pressure	10	10	psi	
FM Length	6800	6,800	ft	
FM Friction Losses	0.38	0.38	ft/100 ft	(4"pressure main)
FM Headloss	26	26	ft	
Misc. Head Loss	10	10	ft	
TDH	234	234	ft	

Pump Efficiency =	60	60	%
Pump Horsepower =	7.9	7.9	hp

Lift Station Power Consumption

Annual Operating Hours	1718	hrs
Pump Horsepower	7.9	
Motor Efficiency	80%	
Annual Horsepower - hours	16,965	Hp-Hr
Annual Kilowatt - Hours	12,651	KwH

15) Site Fencing

Total Land Area Requirement	39.3	acres
Site Length	1179	ft
Site Width	1451	ft
Fence Length	5260	ft

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
ALTERNATIVE 5b - NEW TREATMENT SITE - ALFALFA WITH WATER TREATMENT
SPRINKLER IRRIGATION

1) Sludge Volume

	Sludge Depth (ft)	Lagoon Bottom Surface Area (acre)	Sludge Volume (mgal)	Lagoon Volume (mgal)	% of Volume Occupied by Sludge
Cell #1	1.00	5.54	1.81	6.85	26.4
			1.81	6.85	26.4

2) Hydraulic Retention Time

Average Day Flow =	50,588	gpd
Design Average Day Flow =	55,828	gpd

	Lagoon Volume (mgal)	Sludge Volume (mgal)	Operating Volume (mgal)	Operating HRT (d)	Design HRT (d)
Cell #1	6.85	1.81	5.04	99.7	122.7
	6.85	1.81	5.04	99.7	122.7

20 to 180 days (EPA Tech. Fact Sheet)
5 to 30 days warm climate, 180 days cold (Chpt. 6, p. 238)
180 days between high WSL & 2 foot - controlled discharge - entire system (10 State Standards, p. 90-15)
90 to 120 days - flow through - entire system (10 State Standards, p. 90-15)
40 to 60 days at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)
15 to 30 days at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
5 to 30 days (M&E, p. 645)

3) Organic Surface Loading

Year	BOD lbs/d	Cell #1 Organic Loading lbs/ac-d	System Organic Loading lbs/ac-d
2011	46	8.3	8.3
2012	46	8.3	8.3
2013	46.84	8.5	8.5
2014	47.28	8.5	8.5
2015	47.50	8.6	8.6
2016	47.73	8.6	8.6
2017	47.96	8.7	8.7
2018	48.18	8.7	8.7
2019	48.41	8.7	8.7
2020	48.64	8.8	8.8
2021	48.87	8.8	8.8
2022	49.09	8.9	8.9

	Water Surface Area	
Cell #1	5.54	acres
Cell #2		acres
Total	5.54	acres

13 to 71 lbs/acre-d (EPA Tech. Fact Sheet)
15 to 50 lbs/acre-d (Chpt 6., p. 238 & 249)
15 to 35 lbs/acre-d - primary pond (10 State Standards, p. 90-15)
20 to 25 lbs/acre-d (Chpt. 10, p. 10-10)
20 to 40 lbs/acre-d at winter air temps of 33-59 F - total system (Chpt. 10, p. 10-13)

2023	49.32	8.9	8.9	60 to 120 lbs/acre-d at winter air temps of 33-59 F - first cell (Chpt. 10, p. 10-13)
2024	49.55	8.9	8.9	25 to 35 lbs/acre-d - single pond or parallel (Reynolds, p. 560)
2025	49.77	9.0	9.0	75 to 80 lbs/acre-d - primary pond in series operation (Reynolds, p. 560)
2026	50.00	9.0	9.0	25 to 35 lbs/acre-d - secondary ponds in series operation (Reynolds, p. 560)
2027	50.23	9.1	9.1	16.7 to 60 lbs/acre-d (M&E, p. 645)
2028	50.45	9.1	9.1	
2029	50.68	9.1	9.1	
2030	50.91	9.2	9.2	
2031	51.14	9.2	9.2	
2032	51.37	9.3	9.3	

4) Lagoon Depth

Cell #1 Max Depth	5.3	ft
Cell #2 Max Depth	5.3	ft

4 to 8 feet (EPA Tech. Fact Sheet)
4 to 8 feet (Chpt 6, p. 237)
6 feet primary cell (10 State Standards, p. 90-18)
6 feet primary cell (Chpt. 10, p. 10-10, 10-11)
4 to 6 feet at winter air temps of 33-59 F (Chpt. 10, p. 10-13)
3 to 6 feet (Reynolds, p. 560)
4 to 8 feet (M&E, p. 645)

5) Effluent Flows & Waste Loads - Current Conditions

Annual Effluent Volume = 12.07 mgal/yr

	mg/L	lbs/yr	
COD	31.08	3,129	
Total-N	3.73	376	Estimated as TKN + NO3-N
Total-P	1.562323	157	

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load S

	mg/L
BOD	111
TSS	111
TKN	18
NO3-N	0.81
TP	3.63
COD	

6) Slow Rate Land Application & Storage - Current Conditions

Irrigation Water Requirement

Assume:				
	Crop =	Alfalfa		
	Type of Irrigation =	Sprinkler		
	Irrigation Efficiency =	65	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
	WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
	WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	0.00	0.00	0.00	0.00	14.91
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.00	0.00	0.00	0.00	0.59
Net IWR	inches	1.38	4.95	6.44	6.43	0.00	0.00	0.00	0.00	17.82
IWR	inches	2.12	7.62	9.91	9.89	0.00	0.00	0.00	0.00	27.42

IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units		
Crop Yield	tons/acre	4	Note: Yield is reduced for irrigation through June only.
Crop Yield	lbs/acre	8,000	
Nitrogen			
% Dry Mass Basis[1]	%	2.50	
Crop Uptake	lbs/acre-yr	200	
Allowable Application Rate[2]	lbs/acre-yr	300	
Phosphorus			
% Dry Mass Basis[3]	%	0.22	
Crop Uptake	lbs/acre-yr	17.6	
Allowable Application Rate[2]	lbs/acre-yr	26.4	
Organic (COD)			
Allowable Application Rate[4]	lbs/acre-d	50	

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 150% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	12.07	Mgal
Allowable Hydraulic Loading	27.42	inches
Acreage Required	16.3	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	376	157	lbs/yr
Allowable Loading	300	26.4	lbs/acre-yr
Acreage Required	1.3	6	acres

Organic

Average Annual Effluent Load	3,129	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.3	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	16.3	acres
Contingency (10%)	1.7	acres
Total	**18.0**	acres

B) Calculate the lagoon storage volume and surface area requirements.

Water Balance Calculations - Alfalfa - Current

Influent Flow =	50,588	gpd	
Avg Lagoon Depth =	5.30	ft	
Irrigated Acreage =	18.0	acres	Actual Land Application Site = 5.66 acres
Cell #1 Seepage Rate =	0.0803	in/d	
Cell #2 Seepage Rate =		in/d	
Cell #1 Surface Area =	5.54	acres	
Cell #2 Surface Area =		acres	
Weighted Seepage Rate =	0.0803	in/d	

Existing Lagoon Surface Area =	0.00	acres	Existing Lagoon Volume =	0.00	Mgal
Iterative Additional Storage Lagoon Surface Area =	3.81	acres	Max Lagoon Volume Required =	6.58	Mgal
Additional Storage Lagoon Surface Area =	3.80	acres	Additional Storage Lagoon Volume =	6.58	Mgal
Total Lagoon Surface Area =	3.80	acres	Total Lagoon Volume =	6.58	Mgal

Month	Days	Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
		Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	1.57	0.54	0.06	2.52	0.26	2.49	0.26	1.11	0.00	0.00	1.11	0.00	0.00
Nov	30	1.52	0.87	0.09	0.51	0.05	2.41	0.25	1.31	0.00	0.00	2.42	0.00	0.00
Dec	31	1.57	0.74	0.08	0.18	0.02	2.49	0.26	1.37	0.00	0.00	3.79	0.00	0.00
Jan	31	1.57	0.87	0.09	0.23	0.02	2.49	0.26	1.38	0.00	0.00	5.17	0.00	0.00
Feb	28	1.42	0.57	0.06	0.42	0.04	2.25	0.23	1.21	0.00	0.00	6.38	0.00	0.00
Mar	31	1.57	0.74	0.08	1.41	0.15	2.49	0.26	1.24	2.12	1.04	6.58	0.00	0.00
Apr	30	1.52	0.84	0.09	5.24	0.54	2.41	0.25	0.82	7.62	3.72	3.68	0.00	0.00
May	31	1.57	0.85	0.09	6.34	0.65	2.49	0.26	0.75	9.91	4.84	0.00	0.41	0.01
Jun	30	1.52	0.84	0.09	6.48	0.67	2.41	0.25	0.69	9.89	4.84	0.00	4.15	0.14
Jul	31	1.57	0.18	0.02	6.82	0.70	2.49	0.26	0.63	0.00	0.00	0.63	0.00	0.00
Aug	31	1.57	0.23	0.02	5.96	0.61	2.49	0.26	0.72	0.00	0.00	1.35	0.00	0.00
Sep	30	1.52	0.42	0.04	4.56	0.47	2.41	0.25	0.84	0.00	0.00	2.19	0.00	0.00
Total		18.49	7.69	0.81	40.68	4.18	29.31	3.05	12.07	29.54	14.44		4.56	

7) Effluent Flows & Waste Loads - Future Conditions

Annual Effluent Volume = 13.42 mgal/yr

	mg/L	lbs/yr
COD	31.03	3,124
Total-N	3.73	375
Total-P	1.56	175

Estimated as TKN + NO3-N

*According to Master Plan page 4-2

Parameter	Removal Efficiency
BOD	94.4
TSS	90.3
TKN	87
Nitrate N	-69.9
Total P	57

*From Flow and Load S

	mg/L
BOD	111
TSS	111
TKN	18
NO3-N	0.81
TP	3.63
COD	

8) Slow Rate Land Application & Storage - Future Conditions

Irrigation Water Requirement

Assume: Crop = Alfalfa

Type of Irrigation =	Sprinkler		
Irrigation Efficiency =	65	%	(2007 IDEQ Supplemental WLAP Guidelines, p. 4-79)
WLAP Growing Season (GS) =	214	d	(April 1 - October 31)
WLAP Non-Growing Season (NGS) =	151	d	(November 1 - March 31)

Net Irrigation Water Requirement (Precipitation Deficit) from "2012 Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho"
Bruneau Site - Alfalfa, Less Frequent Cutting
http://www.kimberly.uidaho.edu/ETidaho/stcvrstats.php?station+104670&cover=2&stats=Deficit

Parameter	Units	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Net IWR Rate	mm/day	1.13	4.19	5.28	5.44	0.00	0.00	0.00	0.00	14.91
Net IWR Rate	in/day	0.04	0.16	0.21	0.21	0.00	0.00	0.00	0.00	0.59
Net IWR	inches	1.38	4.95	6.44	6.43	0.00	0.00	0.00	0.00	17.82
IWR	inches	2.12	7.62	9.91	9.89	0.00	0.00	0.00	0.00	27.42
IWR	MG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Allowable Loadings

Parameter	Units		
Crop Yield	tons/acre	4	Note: Yield is reduced for irrigation through June only.
Crop Yield	lbs/acre	8,000	
Nitrogen			
% Dry Mass Basis[1]	%	2.50	
Crop Uptake	lbs/acre-yr	200	
Allowable Application Rate[2]	lbs/acre-yr	300	
Phosphorus			
% Dry Mass Basis[3]	%	0.22	
Crop Uptake	lbs/acre-yr	17.6	
Allowable Application Rate[2]	lbs/acre-yr	26.4	
Organic (COD)			
Allowable Application Rate[4]	lbs/acre-d	50	

1 Value from IDEQ Technical Interpretive Supplement, Table 11, p.IV-46
2 Assumed to be 150% of crop uptake per IDEQ Land Application Permit
3 Value from Agricultural Waste Management Handbook, Part 651, Table 6-6, p. 6-20
4 Value from IDEQ Technical Interpretive Supplement, P. IV-10

Storage and Land Area Requirements

A) Make an initial estimate at the irrigated land area requirements based on one of the following limiting factors:

Hydraulic

Annual Effluent Volume	13.42	Mgal
Allowable Hydraulic Loading	27.42	inches
Acreage Required	18.1	acres

Nutrients

	Total-N	Total-P	
Average Annual Effluent Load	375	175	lbs/yr

Allowable Loading	300	26.4	lbs/acre-yr
Acreage Required	1.3	6.7	acres

Organic

Average Annual Effluent Load	3,124	lbs/yr
Allowable Loading	50	lbs/acre-d
Acreage Required	0.3	acres

Initial Estimate of Irrigated Acreage Requirement

Sub-Total	18.1	acres
Contingency (10%)	1.9	acres
Total	**20.0**	acres

Water Balance Calculations - Alfalfa - Future

Influent Flow =	55,828	gpd
Avg Lagoon Depth =	5.30	ft
Irrigated Acreage =	20.0	acres
Cell #1 Seepage Rate =	0.0803	in/d
Cell #2 Seepage Rate =		in/d
Cell #1 Surface Area =	2.12	acres
Cell #2 Surface Area =	2.12	acres
Weighted Seepage Rate =	0.0402	in/d

Existing Lagoon Surface Area =	0.00	acres	Existing Lagoon Volume =	0.00	Mgal
Iterative Additional Storage Lagoon Surface Area =	4.24	acres	Max Lagoon Volume Required =	7.33	Mgal
Additional Storage Lagoon Surface Area =	4.24	acres	Additional Storage Lagoon Volume =	7.33	Mgal
Total Lagoon Surface Area =	4.24	acres	Total Lagoon Volume =	7.33	Mgal

		Inflow	Precipitation		Evaporation		Seepage		Net Inflow	Crop Requirement/ WW Applied		Net Accum. Storage	Supplemental Irrigation Water	
Month	Days	Mgal	Inches	Mgal	Inches	Mgal	Inches	Mgal	Mgal	Inches	Mgal	Mgal	Mgal	MGD
Oct	31	1.73	0.54	0.06	2.52	0.29	2.49	0.26	1.24	0.00	0.00	1.24	0.00	0.00
Nov	30	1.67	0.87	0.09	0.51	0.06	2.41	0.25	1.45	0.00	0.00	2.69	0.00	0.00
Dec	31	1.73	0.74	0.08	0.18	0.02	2.49	0.26	1.53	0.00	0.00	4.22	0.00	0.00
Jan	31	1.73	0.87	0.09	0.23	0.03	2.49	0.26	1.53	0.00	0.00	5.75	0.00	0.00
Feb	28	1.56	0.57	0.06	0.42	0.05	2.25	0.23	1.34	0.00	0.00	7.09	0.00	0.00
Mar	31	1.73	0.74	0.08	1.41	0.16	2.49	0.26	1.39	2.12	1.15	7.33	0.00	0.00
Apr	30	1.67	0.84	0.09	5.24	0.60	2.41	0.25	0.91	7.62	4.14	4.10	0.00	0.00
May	31	1.73	0.85	0.09	6.34	0.73	2.49	0.26	0.83	9.91	5.38	0.00	0.45	0.01
Jun	30	1.67	0.84	0.09	6.48	0.75	2.41	0.25	0.76	9.89	5.37	0.00	4.61	0.15
Jul	31	1.73	0.18	0.02	6.82	0.79	2.49	0.26	0.70	0.00	0.00	0.70	0.00	0.00
Aug	31	1.73	0.23	0.02	5.96	0.69	2.49	0.26	0.80	0.00	0.00	1.50	0.00	0.00
Sep	30	1.67	0.42	0.04	4.56	0.52	2.41	0.25	0.94	0.00	0.00	2.44	0.00	0.00
Total		20.35	7.69	0.81	40.68	4.69	29.31	3.05	13.42	29.54	16.04		5.06	

9) **Storage Lagoon Dimensions**

	Storage Lagoon			
Number of Lagoons	3			
Interior Dike Slope	3	ft/ft		
Exterior Dike Slope	3	ft/ft		
Pond Bottom Slope	2	%		
Freeboard	3	ft		
Bottom Elevation	0	ft		
Toe Elevation	1.32	ft		
Water Depth Above Toe	7.1	ft		
Max Water Surface Elevation	8.42	ft		
Top of Bank Elevation	11.42	ft		
L:W Ratio	2	ft:ft		
Max Water Surface Length	350	ft		
Max Water Surface Width	175	ft		
Top of Interior Bank Length	368	ft		
Top of Interior Bank Width	193 ft			
Toe Length	307	ft		
Toe Width	132	ft		
Surface Area at Toe	40,524	ft2		
Surface Area at Max SWL	61,250	ft2		
	1.41	acres		
Required Surface Area	1.41	acres		
Volume Below Toe	26,746	ft3		
	0.2	mgal		
Volume Above Toe	361,298	ft3		
	2.7	mgal		
Total Operating Volume	388,044	ft3	HRT	
	2.9	mgal	27.90	days
Required Volume	2.44	mgal		
Surface Area at Max SWL	61,250	ft2		
Required Surface Area	61,565	ft2		
Surface Area to Top of Dike	71,024	ft2		
Freeboard Volume	193,839	ft3		
	1.45	mgal		
Total Volume per Lagoon	4.35	mgal		
Total Lagoon Volume	13.05	mgal		

10) Land Area Requirements

Storage Lagoon		
Road Width - Top of Dike	15	ft
Total Length	467	ft
Total Width	292	ft
Total Lagoon Area	3.13	acres
WLAP Site		
Existing Irrigated Acreage	0	acres
Total Irrig Acreage Required	20.0	acres
Additional Irrig Acreage Required	20.0	acres
Irrigated Areage LxW	933	ft
Buffer Zone Distance	300	ft
Buffer Zone Area	34	acres
Total Additional WLAP Site Area	54.0	acres
Access Roads	0.25	acres
Total Land Area Requirement	63.6	acres

11) **Earthwork Quantities**

A) Clearing & Grubbing

Total Lagoon Area	9.39	acres
Access Roads	0.25	acres
Sub-Total Area	9.64	acres
Depth	6	inches
Volume	7776	cy

B) Lagoon Cut/Fill

Cut Depth Below Natural Ground Surface	4	ft
Toe Height	1.32	ft
Height of Natural Ground Level Above Toe	2.98	ft
Toe Length	307	ft
Toe Width	132	ft
Natural Ground Level Length	324.9	ft
Natural Ground Level Width	149.9	ft
Surface Area at Toe	40,524	ft2
Surface Area at Natural Ground Level	48,703	ft2
Cut Volume Below Toe	991	cy
Cut Volume Above Toe	4,924	cy
Total Cut Volume per Lagoon	5915	cy
Total Lagoon Cut Volume	17745	cy
Dike Cross-Sectional Area Above Ground	259	ft2

Total Dike Length	1,122	ft
Sub-Total Fill Volume	10,763	cy
Shrinkage	25	%
Shrinkage Volume	2,691	cy
Total Fill Volume per Lagoon	13,454	cy
Total Lagoon Fill Volume	40,362	cy

C) Approach Fill

Height	7	ft
Slope	5	%
Length	142	ft
Avg. Width	29	ft
Fill Volume per Road	543	cy/road
Number of Approaches	1	roads
Sub-Total Approach Fill Volume	543	cy
Shrinkage	25	%
Shrinkage Volume	136	cy
Total Road Fill Volume per Lagoon	679	cy
Total Road Fill Volume	2,037	cy

D) Retention Berm Fill

Height	1	ft
Side Slope	1.50	ft/ft
Top Width	2.00	ft
Bottom Width	5.00	ft
Cross-Sectional Area	3.5	ft2
Retention Berm Length	507	ft
Retention Berm Width	332	ft
Total Berm Length	2,185	ft
Sub-Total Berm Fill Volume	283	cy
Shrinkage	25	%
Shrinkage Volume	71	cy
Total Berm Fill Volume	354	cy

E) Borrow Area

Total Fill Volume		
Lagoon	40,362	cy
Approach	2,037	cy
Berm	354	cy
Total	42,753	cy
Total Cut Volume	17,745	cy
Borrow Volume Required	25,008	cy
Borrow Area Excavation Depth	3	ft
Borrow Area Acreage	5.2	acres

F) Aggregate Surfacing

Top of Dike

Road Width - Top of Dike	15	ft
Aggregate Depth	0.5	ft
Total Dike Length	1,357	ft
Top of Dike Aggregate Volume	377	cy
Exterior of Dike		
Side Length	21.36	ft
Aggregate Depth	0.5	ft
Total Dike Length	1,387	ft
Exterior of Dike Aggregate Volume	549	cy
Approach		
Side Length	21.36	ft
Aggregate Depth	0.5	ft
Approach Length	142	ft
Exterior or Approach Aggr. Volume per Lagoon	56	cy
Total Approach Aggregate Volume	168	cy

12) Liner Quantities

Interior Slopes		
Width of Interior Slope to Toe	30.3	ft
Liner in Anchor Trench	5	ft
Liner Slack	1	ft
Total Liner Width	36.3	ft
Top of Dike Length	368	ft
Top of Dike Width	193	ft
Interior Slope Liner Area	40,729	ft2
Lagoon Bottom		
Length of Slope from Toe to Center	66	ft
Liner Slack	2	ft
Total Liner Width	134	ft
Toe Length	307	ft
Lagoon Bottom Liner Area	41,138	ft2
Sub-Total Liner Area	81,867	ft2
Contingency (5%)	4,093	ft2
Total Liner Area per Lagoon	85,960	ft2
Total Liner Area	257,881	ft2
Anchor Trench Length per Lagoon	1,122	ft
Total Anchor Trench Length	3,366	ft
Spacing of Ladders	50	ft
Perimeter of Lagoon	1,122	ft
Number of Ladders Per Lagoon	22	ladders
Total Number of Ladders	66	ladders
Spacing of Air Vents	25	ft
Perimeter of Lagoon	1,122	ft

Number of Air Vents per Lagoon	45	vents
Total Number of Air Vents	135	vents

13) Irrigation Pump Station

	Site 1		
Max Monthly Volume =	5.38	mgal	
Irrigating Days =	25	day	
Pump Capacity =	149	gpm	
Elevation Head	-5	ft	
Discharge Pressure	60	psi	
FM Length	918	ft	
FM Friction Losses	1.01	ft/100 ft	(6"pressure main)
FM Headloss	9	ft	
Misc. Head Loss	3	ft	
TDH	146	ft	
Pump Efficiency =	70	%	
Pump Horsepower =	7.8	hp	

Disinfection System

Liquid Sodium Hypochlorite System - Minimum Design

Max Chlorine Concentration	10	mg/L
Pumping Rate	149	gpm
Max Daily Chlorine Dose	17.9	lbs/d
Hypochlorite Concentration	12	%
Chlorine Mass/Volume	1.00	lbs/gal
Volumetric Hypochlorite Pumping Rate	17.9	gpd
Volumetric Hypochlorite Pumping Rate	0.75	gph
Average Chlorine Concentration	3	mg/L
Effluent Volume	13.42	mgal
Canal Water Volume	5.06	mgal
Total Annual Volume	18.48	mgal
Annual Mass of Chlorine	462	lbs
Annual Volume of Hypochlorite	462	gal

Chlorine Contact Chamber

NEW		
Pumping Rate	149	gpm
Contact Time	30	min
Minimum Basin Volume	4,470	gal
Pipe size	24	in.
Pipe Cross Section Area	3.12	sq. ft.
Length	192	ft

* Ten State Standards requires "a minimum contact period of 15 minutes at maximum rate of pumpage...." (102.44, p. 100-3).

Irrigation Pump Station Power Consumption

Annual Operating Hours	1794	hrs
Pump Horsepower	7.8	
Motor Efficiency	80%	
Annual Horsepower - hours	17,492	Hp-Hr
Annual Kilowatt - Hours	13,044	KwH

14) Sewer Lift Station

	2013	2033		
Peak Hour Volume =	0.24	0.25	mgal	
Pump Capacity =	190	190	gpm	
Daily Pump Run Time	1251	1295	min.	
Average Hourly RT	52	54	min.	
Elevation Head	175	175	ft	
Discharge Pressure	10	10	psi	
FM Length	6800	6,800	ft	
FM Friction Losses	0.27	0.27	ft/100 ft	(6"pressure main)
FM Headloss	18	18	ft	
Misc. Head Loss	10	10	ft	
TDH	226	226	ft	
Pump Efficiency =	60	60	%	
Pump Horsepower =	18.1	18.1	hp	

Lift Station Power Consumption

Annual Operating Hours	1787	hrs
Pump Horsepower	18.1	
Motor Efficiency	80%	
Annual Horsepower - hours	40,431	Hp-Hr
Annual Kilowatt - Hours	30,149	KwH

15) Site Fencing

Total Land Area Requirement	63.6	acres
Site Length	1587	ft
Site Width	1747	ft
Fence Length	6668	ft

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER FACILITIES PLAN
ALTERNATIVE 6a - TOTAL CONTAINMENT LAGOON W/O WATER TREATMENT - NEW SITE

Surface Area and Volume Requirements - Current

Influent Flow =	20,422	gpd	
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	8.30	acres	
Max Lagoon Volume Required =	3.49	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	0.63	0.54	0.12	2.52	0.57	0.00	0.00	0.18	0.18
Nov	30	0.61	0.87	0.20	0.51	0.12	0.00	0.00	0.69	0.87
Dec	31	0.63	0.74	0.17	0.18	0.04	0.00	0.00	0.76	1.63
Jan	31	0.63	0.87	0.20	0.23	0.05	0.00	0.00	0.78	2.41
Feb	28	0.57	0.57	0.13	0.42	0.10	0.00	0.00	0.60	3.01
Mar	31	0.63	0.74	0.17	1.41	0.32	0.00	0.00	0.48	3.49
Apr	30	0.61	0.84	0.19	5.24	1.18	0.00	0.00	-0.38	3.11
May	31	0.63	0.85	0.19	6.34	1.43	0.00	0.00	-0.61	2.50
Jun	30	0.61	0.84	0.19	6.48	1.46	0.00	0.00	-0.66	1.84
Jul	31	0.63	0.18	0.04	6.82	1.54	0.00	0.00	-0.87	0.97
Aug	31	0.63	0.23	0.05	5.96	1.34	0.00	0.00	-0.66	0.31
Sep	30	0.61	0.42	0.09	4.56	1.03	0.00	0.00	-0.33	-0.02
Total		7.42	7.69	1.74	40.68	9.18	0.00	0.00	-0.02	

Lagoon Dimensions

Total Volume	3.49	mgal
Number of Lagoons	2	lagoons
Volume per Lagoon	1.75	mgal/lagoon
Total Surface Area	8.30	acres
Number of Lagoons	2	lagoons
Surface Area per Lagoon	4.15	acres/lagoons

Sludge Depth	1.0	ft
Water Depth	3.0	ft
Freeboard	2.0	ft
Total	6	ft

Surface Area and Volume Requirements - Future

Influent Flow =	22,598	gpd	
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	9.50	acres	
Max Lagoon Volume Required =	3.86	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	0.70	0.54	0.14	2.52	0.65	0.00	0.00	0.19	0.19
Nov	30	0.68	0.87	0.22	0.51	0.13	0.00	0.00	0.77	0.96
Dec	31	0.70	0.74	0.19	0.18	0.05	0.00	0.00	0.84	1.80
Jan	31	0.70	0.87	0.22	0.23	0.06	0.00	0.00	0.86	2.66
Feb	28	0.63	0.57	0.15	0.42	0.11	0.00	0.00	0.67	3.33
Mar	31	0.70	0.74	0.19	1.41	0.36	0.00	0.00	0.53	3.86
Apr	30	0.68	0.84	0.22	5.24	1.35	0.00	0.00	-0.45	3.41
May	31	0.70	0.85	0.22	6.34	1.64	0.00	0.00	-0.72	2.69
Jun	30	0.68	0.84	0.22	6.48	1.67	0.00	0.00	-0.77	1.92
Jul	31	0.70	0.18	0.05	6.82	1.76	0.00	0.00	-1.01	0.91
Aug	31	0.70	0.23	0.06	5.96	1.54	0.00	0.00	-0.78	0.13
Sep	30	0.68	0.42	0.11	4.56	1.18	0.00	0.00	-0.39	-0.26
Total		8.25	7.69	1.99	40.68	10.50	0.00	0.00	-0.26	

Lagoon Dimensions

Total Volume	3.86	mgal
Number of Lagoons	2	lagoons
Volume per Lagoon	1.93	mgal/lagoon
Lagoon Setback	200	feet
Total Surface Area	9.50	acres
Number of Lagoons	2	lagoons
Surface Area per Lagoon	4.75	acres/lagoons

Sludge Depth	1.0	ft
Water Depth	1.6	ft
Freeboard	2.0	ft
Total	4.6	ft

	Cell #1	Cell #2	Total	
Interior Dike Slope	3	3		ft/ft
Exterior Dike Slope	3	3		ft/ft
Pond Bottom Slope	2	2		%

Freeboard	3.0	3.0		ft
Bottom Elevation	0.00	0.00		ft
Toe Elevation	2.20	2.20		ft
Water Depth Above Toe	1.60	1.60		ft
Max Water Surface Elevation	3.80	3.80		ft
Top of Bank Elevation	6.80	6.80		ft
L:W Ratio	2	2		ft:ft
Max Water Surface Length	460	460		ft
Max Water Surface Width	230	230		ft
Top of Interior Bank Length	478	478		ft
Top of Interior Bank Width	248	248		ft
Toe Length	450	450		ft
Toe Width	220	220		ft
Surface Area at Toe	99,000	99,000		ft^2
	2.27	**2.27**	**4.54**	acres
Surface Area at Max SWL	105,800	105,800		ft^2
	2.43	**2.43**	**4.86**	acres
Required Surface Area	4.15	4.15	8.30	
Volume Below Toe	108,900	108,900		ft^3
	0.81	0.81		mgal
Volume Above Toe	163,840	163,840		ft^3
	1.23	1.23		mgal
Total Operating Volume	272,740	272,740		ft^3
	2.04	**2.04**	**4.08**	mgal
Required Volume	1.75	1.75	3.86	mgal
			0.22	
Surface Area at Max SWL	105,800	105,800		ft^2
Surface Area to Top of Dike	118,544	118,544		ft^2
Freeboard Volume	336,516	336,516		ft^3
	2.52	2.52	5.04	mgal

Total Lagoon Volume	**4.56**	**4.56**	**9.12**	mgal

Land Area Requirements

Lagoon Area		
Road Width - Top of Dike	15	ft
Total Length	549	ft
Total Width	319	ft
Total Area Per Lagoon	4.02	acres
Total Lagoon Area	8.04	acres
Lagoon Setback	15	acres
Access Roads	0.50	acres
Total Land Area Requirement	**23.5**	acres

Earthwork Quantities

A) Clearing & Grubbing

Total Lagoon Area	8.04	acres
Access Roads	0.50	acres
Sub-Total Area	8.54	acres
Depth	6	inches
Volume	6,889	cy

B) Lagoon Cut/Fill

	Cell #1	Cell #2	
Cut Depth Below Natural Ground Surface	2.6	2.6	ft
Toe Height	2.20	2.20	ft
Height of Natural Ground Level Above Toe	0.40	0.40	ft
Toe Length	450	450	ft
Toe Width	220	220	ft
Natural Ground Level Length	465.6	465.6	ft
Natural Ground Level Width	235.6	235.6	ft

Surface Area at Toe	99,000	99,000	ft^2
Surface Area at Natural Ground Level	109,695	109,695	ft^2
Cut Volume Below Toe	4,033	4,033	cy
Cut Volume Above Toe	1,546	1,546	cy
Total Cut Volume	5,579	5,579	cy
Total All Lagoons	11,158		cy
Road Width on Top	15	15	ft
Dike Cross-Sectional Area Above Ground	116	116	ft^2
Total Dike Length	1,452	1,452	ft
Sub-Total Fill Volume	6,238	6,238	cy
Shrinkage	25	25	%
Shrinkage Volume	1,560	1,560	cy
Total Lagoon Fill Volume	7,798	7,798	cy
Total All Lagoons	15,596		cy

C) Approach Fill

	Road #1	Road #2	
Height	4.2	4.2	ft
Slope	5.0	5.0	%
Length	84	84	ft
Avg. Width	20	20	ft
Sub-Total Approach Fill Volume	131	131	cy
Shrinkage	25	25	%
Shrinkage Volume	33	33	cy
Total Road Fill Volume	164	164	cy
Total All Approaches	328		cy

D) Retention Berm Fill

Height	1	ft
Side Slope	1.5	ft/ft
Top Width	2	ft
Bottom Width	5.0	ft
Cross-Sectional Area	3.5	ft^2
Retention Berm Length	980	ft
Retention Berm Width	520	ft
Total Berm Length	3,000	ft

Sub-Total Berm Fill Volume	389	cy
Shrinkage	25	%
Shrinkage Volume	97	cy
Total Berm Fill Volume	486	cy

E) Borrow Area

Total Fill Volume		
Lagoon	15,596	cy
Approach	328	cy
Berm	486	cy
Total	16,410	cy
Total Cut Volume	11,158	cy
Borrow Volume Required	5,252	cy
Borrow Area Excavation Depth	2.0	ft
Borrow Area Acreage	1.6	acres

F) Aggregate Surfacing

Top of Dike	Cell #1	Cell #2	
Road Width - Top of Dike	15	15	ft
Aggregate Depth	0.5	0.5	ft
Total Dike Length	1,452	1,452	ft
Top of Dike Aggregate Volume	403	403	cy
Total Top of Dike	806		cy
Exterior of Dike			
Side Length	12.6	12.6	ft
Aggregate Depth	0.5	0.5	ft
Exterior Dike Length	1,452	1,452	ft
Exterior of Dike Aggregate Volume	339	339	cy
Total Exterior of Dike	678		cy
Approach			
Side Length	12.6	12.6	ft
Aggregate Depth	0.5	0.5	ft
Approach Length	84	84	ft
Exterior or Approach Aggregate Volume	39	39	cy
Total Exterior of Approach	78		cy

Liner Quantities

	Cell #1	Cell #2	
Interior Slopes			
Width of Interior Slope to Toe	13.80	13.80	ft
Liner in Anchor Trench	3.50	3.50	ft
Liner Slack	1.00	1.00	ft
Total Liner Width	18.30	18.30	ft
Top of Dike Length	478	478	ft
Top of Dike Width	248	248	ft
Interior Slope Liner Area	26,572	26,572	ft^2
Lagoon Bottom			
Length of Slope from Toe to Center	110	110	ft
Liner Slack	2	2	ft
Total Liner Width	222	222	ft
Toe Length	450	450	ft
Lagoon Bottom Liner Area	99,900	99,900	ft^2
Sub-Total Liner Area	126,472	126,472	ft^2
Contingency (5%)	6,324	6,324	ft^2
Total Liner Area	132,796	132,796	ft^2
Total All Liner	265,592		ft^2
Anchor Trench Length	1,452	1,452	ft
Total Anchor Trench	2,904		
Spacing of Ladders	50	50	ft
Perimeter of Lagoon	1,452	1,452	ft
Number of Ladders	30	30	ladders
Total Ladders	60		ladders
Spacing of Air Vents	22	23	ft
Perimeter of Lagoon	1,452	1,452	ft
Number of Air Vents	66	64	vents
Total Air Vents	130		vents

Site Fencing

Property Area		23.5	acres
Property Perimeter		4,434	feet

Sewer Lift Station

	2013	2033		
Peak Hour Volume =	0.08	0.09	mgal	
Pump Capacity =	80	80	gpm	
Daily Pump Run Time	1021	1125	min.	
Average Hourly RT	43	47	min.	
Elevation Head	175	175	ft	
Discharge Pressure	10	10	psi	
FM Length	6800	6,800	ft	
FM Friction Losses	0.38	0.38	ft/100 ft	(4"pressure main)
FM Headloss	26	26	ft	
Misc. Head Loss	10	10	ft	
TDH	234	234	ft	
Pump Efficiency =	60	60	%	
Pump Horsepower =	7.9	7.9	hp	

Lift Station Power Consumption

Annual Operating Hours	1718	hrs
Pump Horsepower	7.9	
Motor Efficiency	80%	
Annual Horsepower - hours	16,965	Hp-Hr
Annual Kilowatt - Hours	12,651	KwH

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER FACILITIES PLAN
ALTERNATIVE 6b - TOTAL CONTAINMENT LAGOON WITH WATER TREATMENT DISCHARGE - NEW SITE

Surface Area and Volume Requirements - Current Conditions

Influent Flow =	50,588	gpd	
Seepage Rate =	0	in/d	(to be conservative)
Total Lagoon Surface Area =	20.65	acres	
Max Lagoon Volume Required =	8.68	Mgal	

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	1.57	0.54	0.30	2.52	1.41	0.00	0.00	0.46	0.46
Nov	30	1.52	0.87	0.49	0.51	0.29	0.00	0.00	1.72	2.18
Dec	31	1.57	0.74	0.41	0.18	0.10	0.00	0.00	1.88	4.06
Jan	31	1.57	0.87	0.49	0.23	0.13	0.00	0.00	1.93	5.99
Feb	28	1.42	0.57	0.32	0.42	0.24	0.00	0.00	1.50	7.49
Mar	31	1.57	0.74	0.41	1.41	0.79	0.00	0.00	1.19	8.68
Apr	30	1.52	0.84	0.47	5.24	2.94	0.00	0.00	-0.95	7.73
May	31	1.57	0.85	0.48	6.34	3.56	0.00	0.00	-1.51	6.22
Jun	30	1.52	0.84	0.47	6.48	3.63	0.00	0.00	-1.64	4.58
Jul	31	1.57	0.18	0.10	6.82	3.83	0.00	0.00	-2.16	2.42
Aug	31	1.57	0.23	0.13	5.96	3.34	0.00	0.00	-1.64	0.78
Sep	30	1.52	0.42	0.24	4.56	2.56	0.00	0.00	-0.80	-0.02
Total		18.49	7.69	4.31	40.68	22.82	0.00	0.00	-0.02	

Lagoon Dimensions

Total Volume	8.68	mgal
Number of Lagoons	2	lagoons
Volume per Lagoon	4.34	mgal/lagoon
Total Surface Area	20.65	acres
Number of Lagoons	2	lagoons
Surface Area per Lagoon	10.33	acres/lagoons

Sludge Depth	1.0	ft
Water Depth	3.8	ft
Freeboard	2.0	ft
Total	6.8	ft

Surface Area and Volume Requirements - Future Conditions

Influent Flow =	55,828	gpd	
Seepage Rate =	0	in/d	(to be conservative)

Total Lagoon Surface Area =	22.80	acres
Max Lagoon Volume Required =	9.57	Mgal

Month	Days	Inflow Mgal	Precipitation Inches	Precipitation Mgal	Evaporation Inches	Evaporation Mgal	Seepage Inches	Seepage Mgal	Net Inflow Mgal	Net Accum. Storage Mgal
Oct	31	1.73	0.54	0.33	2.52	1.56	0.00	0.00	0.50	0.50
Nov	30	1.67	0.87	0.54	0.51	0.32	0.00	0.00	1.89	2.39
Dec	31	1.73	0.74	0.46	0.18	0.11	0.00	0.00	2.08	4.47
Jan	31	1.73	0.87	0.54	0.23	0.14	0.00	0.00	2.13	6.60
Feb	28	1.56	0.57	0.35	0.42	0.26	0.00	0.00	1.65	8.25
Mar	31	1.73	0.74	0.46	1.41	0.87	0.00	0.00	1.32	9.57
Apr	30	1.67	0.84	0.52	5.24	3.24	0.00	0.00	-1.05	8.52
May	31	1.73	0.85	0.53	6.34	3.93	0.00	0.00	-1.67	6.85
Jun	30	1.67	0.84	0.52	6.48	4.01	0.00	0.00	-1.82	5.03
Jul	31	1.73	0.18	0.11	6.82	4.22	0.00	0.00	-2.38	2.65
Aug	31	1.73	0.23	0.14	5.96	3.69	0.00	0.00	-1.82	0.83
Sep	30	1.67	0.42	0.26	4.56	2.82	0.00	0.00	-0.89	-0.06
Total		20.35	7.69	4.76	40.68	25.17	0.00	0.00	-0.06	

Lagoon Dimensions

Total Volume	9.57	mgal
Number of Lagoons	3	lagoons
Volume per Lagoon	3.19	mgal/lagoon
Lagoon Setback	200	feet
Total Surface Area	22.80	acres
Number of Lagoons	3	lagoons
Surface Area per Lagoon	7.6	acres/lagoons

Sludge Depth	1.0	ft
Water Depth	1.6	ft
Freeboard	2.0	ft
Total	4.6	ft

	Cell #1	Cell #2	Cell #3	Total	
Interior Dike Slope	3	3	3		ft/ft
Exterior Dike Slope	3	3	3		ft/ft

Pond Bottom Slope	2	2	2		%
Freeboard	3.0	3.0	3.0		ft
Bottom Elevation	0.00	0.00	0.00		ft
Toe Elevation	3.98	3.98	3.98		ft
Water Depth Above Toe	1.60	1.60	1.60		ft
Max Water Surface Elevation	5.58	5.58	5.58		ft
Top of Bank Elevation	8.58	8.58	8.58		ft
L:W Ratio	2	2	2		ft:ft
Max Water Surface Length	815	815	815		ft
Max Water Surface Width	408	408	408		ft
Top of Interior Bank Length	833	833	833		ft
Top of Interior Bank Width	426	426	426		ft
Toe Length	805	805	805		ft
Toe Width	398	398	398		ft
Surface Area at Toe	320,390	320,390	320,390		ft^2
	7.36	**7.36**	**7.36**	**22.08**	acres
Surface Area at Max SWL	332,520	332,520	332,520		ft^2
	7.63	**7.63**	**7.63**	**22.89**	acres
Required Surface Area				22.80	acres
Volume Below Toe	637,576	637,576	637,576		ft^3
	4.77	4.77	4.77		mgal
Volume Above Toe	522,328	522,328	522,328		ft^3
	3.91	3.91	3.91		mgal
Total Operating Volume	1,159,904	1,159,904	1,159,904		ft^3
	8.68	**8.68**	**8.68**	**26.04**	mgal
Required Volume				9.57	mgal
				16.47	
Surface Area at Max SWL	332,520	332,520	332,520		ft^2
Surface Area to Top of Dike	354,858	354,858	354,858		ft^2
Freeboard Volume	1,031,067	1,031,067	1,031,067		ft^3

	7.71	7.71	7.71	**23.13**	mgal
Total Lagoon Volume	**16.39**	**16.39**	**16.39**	**49.17**	mgal

Land Area Requirements

Lagoon Area		
Road Width - Top of Dike	15	ft
Total Length	914	ft
Total Width	507	ft
Total Area Per Lagoon	10.64	acres
Total Lagoon Area	31.92	acres
Setback Area	31	ACRES
Access Roads	0.50	acres
Total Land Area Requirement	**63.4**	acres

Earthwork Quantities

A) Clearing & Grubbing

Total Lagoon Area	31.92	acres
Access Roads	0.50	acres
Sub-Total Area	32.42	acres
Depth	6	inches
Volume	26,152	cy

B) Lagoon Cut/Fill

	Cell #1	Cell #2	Cell #3	
Cut Depth Below Natural Ground Surface	2.6	2.6	2.6	ft
Toe Height	3.98	3.98	3.98	ft
Height of Natural Ground Level Above Toe	0.00	0.00	0.00	ft
Toe Length	805	805	805	ft
Toe Width	398	398	398	ft
Natural Ground Level Length	820.6	820.6	820.6	ft
Natural Ground Level Width	413.6	413.6	413.6	ft

Surface Area at Toe	320,390	320,390	320,390	ft^2
Surface Area at Natural Ground Level	339,400	339,400	339,400	ft^2
Cut Volume Below Toe	16,341	16,341	16,341	cy
Cut Volume Above Toe	0	0	0	cy
Total Cut Volume	16,341	16,341	16,341	cy
Total All Lagoons	49,023			
Road Width on Top	15	15	15	ft
Dike Cross-Sectional Area Above Ground	197	197	197	ft^2
Total Dike Length	2,518	2,518	2,518	ft
Sub-Total Fill Volume	18,372	18,372	18,372	cy
Shrinkage	25	25	25	%
Shrinkage Volume	4,593	4,593	4,593	cy
Total Lagoon Fill Volume	22,965	22,965	22,965	cy
Total All Lagoons	68,895			cy

C) Approach Fill

	Road #1	Road #2	Road #3	
Height	6.0	6.0	6.0	ft
Slope	5.0	5.0	5.0	%
Length	120	120	120	ft
Avg. Width	25	25	25	ft
Sub-Total Approach Fill Volume	332	332	332	cy
Shrinkage	25	25	25	%
Shrinkage Volume	83	83	83	cy
Total Road Fill Volume	415	415	415	cy
Total All Approaches	1,245			cy

D) Retention Berm Fill

Height	1	ft
Side Slope	1.5	ft/ft
Top Width	2	ft
Bottom Width	5.0	ft
Cross-Sectional Area	3.5	ft^2
Retention Berm Length	1,730	ft
Retention Berm Width	916	ft

Total Berm Length	5,292	ft
Sub-Total Berm Fill Volume	686	cy
Shrinkage	25	%
Shrinkage Volume	172	cy
Total Berm Fill Volume	858	cy

E) Borrow Area

Total Fill Volume		
Lagoon	68,895	cy
Approach	1,245	cy
Berm	858	cy
Total	70,998	cy
Total Cut Volume	32,682	cy
Borrow Volume Required	38,316	cy
Borrow Area Excavation Depth	2.0	ft
Borrow Area Acreage	11.9	acres

F) Aggregate Surfacing

	Cell #1	Cell #2	Cell #3	
Top of Dike				
Road Width - Top of Dike	15	15	15	ft
Aggregate Depth	0.5	0.5	0.5	ft
Total Dike Length	2,518	2,518	2,518	ft
Top of Dike Aggregate Volume	699	699	699	cy
Total Top of Dike	2097			cy
Exterior of Dike				
Side Length	17.94	17.94	17.94	ft
Aggregate Depth	0.5	0.5	0.5	ft
Exterior Dike Length	2,518	2,518	2,518	ft
Exterior of Dike Aggregate Volume	837	837	837	cy
Total Exterior of Dike	2511			cy
Approach				
Side Length	17.94	17.94	17.94	ft
Aggregate Depth	0.5	0.5	0.5	ft
Approach Length	120	120	120	ft
Exterior or Approach Aggregate Volume	80	80	80	cy
Total Exterior of Approach	240			cy

Liner Quantities

Interior Slopes	Cell #1	Cell #2	Cell #3	
Width of Interior Slope to Toe	13.80	13.80	13.80	ft
Liner in Anchor Trench	3.50	3.50	3.50	ft
Liner Slack	1.00	1.00	1.00	ft
Total Liner Width	18.30	18.30	18.30	ft
Top of Dike Length	833	833	833	ft
Top of Dike Width	426	426	426	ft
Interior Slope Liner Area	46,079	46,079	46,079	ft^2
Lagoon Bottom				
Length of Slope from Toe to Center	199	199	199	ft
Liner Slack	2	2	2	ft
Total Liner Width	400	400	400	ft
Toe Length	805	805	805	ft
Lagoon Bottom Liner Area	322,000	322,000	322,000	ft^2
Sub-Total Liner Area	368,079	368,079	368,079	ft^2
Contingency (5%)	18,404	18,404	18,404	ft^2
Total Liner Area	386,483	386,483	386,483	ft^2
Total All Liner	1,159,449			ft^2
Anchor Trench Length	2,518	2,518	2,518	ft
Total Anchor Trench	7,554			
Spacing of Ladders	50	50	50	ft
Perimeter of Lagoon	2,518	2,518	2,518	ft
Number of Ladders	51	51	51	ladders
Total Ladders	153			ladders
Spacing of Air Vents	22	23	23	ft
Perimeter of Lagoon	2,518	2,518	2,518	ft
Number of Air Vents	115	110	110	vents
Total Air Vents	335			vents

Site Fencing

Property Size	63.4	
Property Perimeter	8,098	feet

Sewer Lift Station

	2013	2033		
Peak Hour Volume =	0.24	0.25	mgal	
Pump Capacity =	190	190	gpm	
Daily Pump Run Time	1251	1295	min.	
Average Hourly RT	52	54	min.	
Elevation Head	175	175	ft	
Discharge Pressure	10	10	psi	
FM Length	6800	6,800	ft	
FM Friction Losses	2.10	2.1	ft/100 ft	(4"pressure main)
FM Headloss	143	143	ft	
Misc. Head Loss	10	10	ft	
TDH	351	351	ft	
Pump Efficiency =	60	60	%	
Pump Horsepower =	28.1	28.1	hp	

Lift Station Power Consumption

Annual Operating Hours	1787	hrs
Pump Horsepower	28.1	
Motor Efficiency	80%	
Annual Horsepower - hours	62,768	Hp-Hr
Annual Kilowatt - Hours	46,806	KwH

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

APPENDIX C: COST BREAKDOWNS AND SUMMARIES AND PRESENT WORTH ANALYSIS

FOR ALTERNATIVES

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
COST SUMMARY AND PRESENT WORTH ANALYSIS FOR ALTERNATIVES 3a, 3b, 5a, AND 5b

Capital Costs

Interest Rate =	3.0	%
Loan Payback Period =	30	Years

	Alternative 3a	Alternative 3b	Alternative 5a	Alternative 5b
Lagoon Headworks	$0	$0	$30,600	$30,600
Lagoons	$679,234	$1,020,054	$306,132	$565,187
Water Treatment Discharge Storage and Land Appl.	$488,259			
Irrigation Pump Station	$0	$0	$106,144	$116,144
Irrigation Pressure Main	$0	$44,210	$40,326	$51,858
Disinfection System	$0	$0	$37,805	$31,490
Yard Piping	$0	$0	$89,500	$89,500
Site Fencing	$68,000	$81,350	$105,200	$133,360
Site Power	$0	$0	$195,000	$195,000
Groundwater Monitor Wells	$0	$0	$42,000	$42,000
Irrigation System	$0	$39,315	$28,750	$28,750
Gravel Access Road	$0	$0	$25,200	$25,200
Supplemental Irrigation Water	$20,000	$170,000	$0	$0
Water Treatment Discharge Pipeline	$0	$0	$143,690	$0
Sub-Total Construction Costs	**$1,255,493**	**$1,354,929**	**$1,006,657**	**$1,309,089**
Contractor Admin, Ins, Bond (10%)	$125,549	$135,493	$100,666	$130,909
Contractor Mob/Demob (5%)	$62,775	$67,746	$50,333	$65,454
Contingencies (20%)	$251,099	$270,986	$201,331	$261,818
Land Acquistion	$0	$132,150	$196,350	$318,200
Total Construction Costs	**$1,694,916**	**$1,961,304**	**$1,555,337**	**$2,085,470**
Engineering & Const. Mngt. (20%)	$338,983	$392,261	$311,067	$417,094
Admin, Legal, and Publications	$95,000	$95,000	$95,000	$95,000
Total Project Capital Costs	**$2,128,899**	**$2,448,565**	**$1,961,404**	**$2,597,564**
Annualized Capital Costs	**$108,615**	**$124,924**	**$100,069**	**$132,526**

O&M Costs

	Alternative 3a	Alternative 3b	Alternative 5a	Alternative 5b
Labor	$14,560	$14,560	$14,560	$14,560
Power	$1,910	$1,759	$2,299	$3,792
Chemicals	$506	$633	$601	$731
Seepage Test	$600	$900	$600	$900
Sampling	$4,000	$4,000	$4,000	$4,000
Equipment/Repairs	$15,000	$15,000	$15,000	$15,000
Professional Services	$500	$500	$500	$500
Sub-Total Annual O&M Costs	**$37,076**	**$37,351**	**$37,560**	**$39,483**
Contingencies (20%)	$7,415	$7,470	$7,512	$7,897
Short Lived Asset Reserve	$1,000	$1,000	$1,880	$2,630
Total Annual O&M Costs	**$45,491**	**$45,821**	**$46,952**	**$50,010**

20-Year Life Cycle Costs

Inflation Rate = 3.0 %

	Alternative 3a			Alternative 3b			Alternative 5a			Alternative 5b		
Year	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	Annual Capital Cost	Annual O&M Cost	Total Annual Cost
0	$108,615	$45,491	$154,106	$124,924	$45,821	$170,745	$100,069	$46,952	$147,022	$132,526	$50,010	$182,535
1	$108,615	$46,856	$155,471	$124,924	$47,196	$172,120	$100,069	$48,361	$148,430	$132,526	$51,510	$184,036
2	$108,615	$48,262	$156,877	$124,924	$48,612	$173,536	$100,069	$49,812	$149,881	$132,526	$53,055	$185,581
3	$108,615	$49,710	$158,325	$124,924	$50,070	$174,994	$100,069	$51,306	$151,375	$132,526	$54,647	$187,173
4	$108,615	$51,201	$159,816	$124,924	$51,572	$176,496	$100,069	$52,845	$152,914	$132,526	$56,286	$188,812
5	$108,615	$52,737	$161,352	$124,924	$53,119	$178,043	$100,069	$54,430	$154,499	$132,526	$57,975	$190,501
6	$108,615	$54,319	$162,934	$124,924	$54,713	$179,637	$100,069	$56,063	$156,132	$132,526	$59,714	$192,240
7	$108,615	$55,949	$164,564	$124,924	$56,354	$181,278	$100,069	$57,745	$157,814	$132,526	$61,505	$194,031
8	$108,615	$57,627	$166,242	$124,924	$58,045	$182,969	$100,069	$59,477	$159,546	$132,526	$63,350	$195,876
9	$108,615	$59,356	$167,971	$124,924	$59,786	$184,710	$100,069	$61,261	$161,330	$132,526	$65,251	$197,777
10	$108,615	$61,137	$169,752	$124,924	$61,580	$186,504	$100,069	$63,099	$163,168	$132,526	$67,209	$199,735
11	$108,615	$62,971	$171,586	$124,924	$63,427	$188,351	$100,069	$64,992	$165,061	$132,526	$69,225	$201,751
12	$108,615	$64,860	$173,475	$124,924	$65,330	$190,254	$100,069	$66,942	$167,011	$132,526	$71,302	$203,828
13	$108,615	$66,806	$175,421	$124,924	$67,290	$192,214	$100,069	$68,950	$169,019	$132,526	$73,441	$205,967
14	$108,615	$68,810	$177,425	$124,924	$69,309	$194,233	$100,069	$71,019	$171,088	$132,526	$75,644	$208,170
15	$108,615	$70,874	$179,489	$124,924	$71,388	$196,312	$100,069	$73,150	$173,219	$132,526	$77,913	$210,439
16	$108,615	$73,000	$181,615	$124,924	$73,530	$198,454	$100,069	$75,345	$175,414	$132,526	$80,250	$212,776
17	$108,615	$75,190	$183,805	$124,924	$75,736	$200,660	$100,069	$77,605	$177,674	$132,526	$82,658	$215,184
18	$108,615	$77,446	$186,061	$124,924	$78,008	$202,932	$100,069	$79,933	$180,002	$132,526	$85,138	$217,664
19	$108,615	$79,769	$188,384	$124,924	$80,348	$205,272	$100,069	$82,331	$182,400	$132,526	$87,692	$220,218
20	$108,615	$82,162	$190,777	$124,924	$82,758	$207,682	$100,069	$84,801	$184,870	$132,526	$90,323	$222,849

Equivalent Present Worth Analysis

Interest Rate = 3.0 %

Year	Alternative 3a			Alternative 3b			Alternative 5a			Alternative 5b		
	PW Capital Cost	PW O&M Cost	PW Total Cost	PW Capital Cost	PW O&M Cost	PW Total Cost	PW Capital Cost	PW O&M Cost	PW Total Cost	PW Capital Cost	PW O&M Cost	PW Total Cost
1	$105,451	$45,491	$150,943	$121,285	$45,821	$167,107	$97,155	$46,952	$144,107	$128,666	$50,010	$178,676
2	$102,380	$45,492	$147,872	$117,753	$45,821	$163,574	$94,325	$46,953	$141,278	$124,918	$50,009	$174,928
3	$99,398	$45,492	$144,890	$114,323	$45,821	$160,144	$91,578	$46,952	$138,530	$121,280	$50,010	$171,290
4	$96,503	$45,491	$141,994	$110,993	$45,821	$156,814	$88,910	$46,952	$135,862	$117,747	$50,009	$167,757
5	$93,692	$45,491	$139,184	$107,761	$45,821	$153,581	$86,321	$46,952	$133,273	$114,318	$50,010	$164,328
6	$90,963	$45,491	$136,455	$104,622	$45,821	$150,443	$83,807	$46,952	$130,758	$110,988	$50,010	$160,998
7	$88,314	$45,492	$133,806	$101,575	$45,821	$147,396	$81,366	$46,952	$128,318	$107,756	$50,009	$157,765
8	$85,742	$45,491	$131,233	$98,616	$45,821	$144,437	$78,996	$46,952	$125,947	$104,617	$50,009	$154,626
9	$83,244	$45,491	$128,736	$95,744	$45,821	$141,565	$76,695	$46,951	$123,646	$101,570	$50,009	$151,579
10	$80,820	$45,492	$126,311	$92,955	$45,821	$138,776	$74,461	$46,952	$121,413	$98,612	$50,010	$148,621
11	$78,466	$45,492	$123,957	$90,248	$45,821	$136,069	$72,292	$46,952	$119,244	$95,739	$50,010	$145,749
12	$76,180	$45,491	$121,672	$87,619	$45,821	$133,440	$70,187	$46,952	$117,138	$92,951	$50,010	$142,961
13	$73,962	$45,492	$119,453	$85,067	$45,821	$130,888	$68,142	$46,952	$115,094	$90,244	$50,010	$140,253
14	$71,807	$45,492	$117,299	$82,589	$45,821	$128,411	$66,158	$46,952	$113,110	$87,615	$50,010	$137,625
15	$69,716	$45,491	$115,207	$80,184	$45,821	$126,005	$64,231	$46,952	$111,183	$85,063	$50,009	$135,073
16	$67,685	$45,491	$113,176	$77,848	$45,821	$123,670	$62,360	$46,953	$109,312	$82,586	$50,009	$132,595
17	$65,714	$45,491	$111,205	$75,581	$45,822	$121,403	$60,544	$46,952	$107,496	$80,180	$50,009	$130,190
18	$63,800	$45,491	$109,291	$73,380	$45,821	$119,201	$58,780	$46,952	$105,732	$77,845	$50,010	$127,855
19	$61,942	$45,491	$107,433	$71,242	$45,821	$117,064	$57,068	$46,952	$104,020	$75,578	$50,010	$125,587
20	$60,137	$45,491	$105,629	$69,167	$45,821	$114,988	$55,406	$46,952	$102,358	$73,376	$50,010	$123,386
Total	$1,615,916	$909,827	$2,525,746	$1,858,552	$916,421	$2,774,976	$1,488,782	$939,041	$2,427,819	$1,971,649	$1,000,192	$2,971,842
Total ($M)	$1.62	$0.91	$2.53	$1.86	$0.92	$2.77	$1.49	$0.94	$2.43	$1.97	$1.00	$2.97
Annual	**$108,615**	**$61,155**	**$169,770**	**$124,924**	**$61,598**	**$186,522**	**$100,070**	**$63,118**	**$163,188**	**$132,526**	**$67,229**	**$199,754**
Check	$108,615		$169,770	$124,924		$186,522	$100,069		$163,188	$132,526		$199,755

BRUNEAU WATER AND SEWER DISTRICT
WASTEWATER MASTER PLAN
COST SUMMARY AND PRESENT WORTH ANALYSIS FOR ALTERNATIVES 4a, 4b, 6a, AND 6b

Capital Costs

	Alternative 4a	Alternative 4b	Alternative 6a	Alternative 6b
Lagoon Headworks	$0	$0	$38,900	$38,900
Total Containment Lagoons	$781,181	$1,764,267	$453,069	$1,689,368
Yard Piping	$0	$8,960	$27,216	$47,376
Site Fencing	$68,000	$123,450	$88,680	$161,960
Gravel Access Road	$0	$25,200	$34,500	$34,500
Lift Station	$0	$134,358	$444,888	$515,688
Water Treatment Discharge Storage and Piping	$448,661	$0	$63,180	$0
Sub-Total Construction Costs	$1,297,841	$2,056,235	$1,150,433	$2,487,792
Contractor Mob/Demob (5%)	$64,892	$102,812	$57,522	$124,390
Contractor Bonding, Administration and Insurance (10%)	$129,784	$205,624	$115,043	$248,779
Contingencies (20%)	$259,568	$411,247	$230,087	$497,558
Total Construction Costs	**$1,752,085**	**$2,775,918**	**$1,553,085**	**$3,358,519**
Land Acquisition	$0	$250,000	$117,700	$317,100
Engineering & Const. Mngt. (20%)	$350,417	$555,184	$310,617	$671,704
Admin, Legal, and Publications	$95,000	$95,000	$95,000	$95,000
Total Project Capital Costs	**$2,197,503**	**$3,676,102**	**$2,076,402**	**$4,442,323**
Annualized Capital Costs	**$112,115**	**$187,552**	**$105,936**	**$226,644**

Interest Rate = 3.0%
Loan Payback Period = 30 Years

O&M Costs

	Alternative 4a	Alternative 4b	Alternative 6a	Alternative 6b
Labor/Administration	$16,380	$16,380	$16,380	$16,380
Lift Station Power	$303	$0	$759	$2,808
Irrigation Pump Station Power WTP	$1,741			
Chemicals	$500	$500	$1,000	$1,000
Lagoon Seepage Testing	$600	$1,500	$600	$900
Sampling	$0	$0	$0	$0
Professional Services	$1,000	$1,000	$1,000	$1,000
Miscellaneous Equipment/Repairs	$3,000	$3,000	$3,000	$3,000
Sub-Total Annual O&M Costs	$23,524	$22,380	$22,739	$25,088
Contingencies (20%)	$4,705	$4,476	$4,548	$5,018
Short Lived Asset Reserve	$1,400	$1,400	$2,280	$3,030
Total Annual O&M Costs	**$29,629**	**$28,256**	**$29,567**	**$33,136**
Total Annualized Costs	**$141,744**	**$215,808**	**$135,503**	**$259,780**

20-Year Life Cycle Costs

Inflation Rate = 3.0 %

	Alternative 4a			Alternative 4b			Alternative 6a			Alternative 6b		
Year	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	Annual Capital Cost	Annual O&M Cost	Total Annual Cost	Annual Capital Cost	Annual O&M Cost	Total Annual Cost
0	$112,115	$29,629	$141,744	$187,552	$28,256	$215,808	$105,936	$29,567	$135,503	$226,644	$33,136	$259,780
1	$112,115	$30,518	$142,633	$187,552	$29,104	$216,656	$105,936	$30,454	$136,390	$226,644	$34,130	$260,774
2	$112,115	$31,434	$143,549	$187,552	$29,977	$217,529	$105,936	$31,368	$137,304	$226,644	$35,154	$261,798
3	$112,115	$32,377	$144,492	$187,552	$30,876	$218,428	$105,936	$32,309	$138,245	$226,644	$36,209	$262,853
4	$112,115	$33,348	$145,463	$187,552	$31,802	$219,354	$105,936	$33,278	$139,214	$226,644	$37,295	$263,939
5	$112,115	$34,348	$146,463	$187,552	$32,756	$220,308	$105,936	$34,276	$140,212	$226,644	$38,414	$265,058
6	$112,115	$35,378	$147,493	$187,552	$33,739	$221,291	$105,936	$35,304	$141,240	$226,644	$39,566	$266,210
7	$112,115	$36,439	$148,554	$187,552	$34,751	$222,303	$105,936	$36,363	$142,299	$226,644	$40,753	$267,397
8	$112,115	$37,532	$149,647	$187,552	$35,794	$223,346	$105,936	$37,454	$143,390	$226,644	$41,976	$268,620
9	$112,115	$38,658	$150,773	$187,552	$36,868	$224,420	$105,936	$38,578	$144,514	$226,644	$43,235	$269,879
10	$112,115	$39,818	$151,933	$187,552	$37,974	$225,526	$105,936	$39,735	$145,671	$226,644	$44,532	$271,176
11	$112,115	$41,013	$153,128	$187,552	$39,113	$226,665	$105,936	$40,927	$146,863	$226,644	$45,868	$272,512
12	$112,115	$42,243	$154,358	$187,552	$40,286	$227,838	$105,936	$42,155	$148,091	$226,644	$47,244	$273,888
13	$112,115	$43,510	$155,625	$187,552	$41,495	$229,047	$105,936	$43,420	$149,356	$226,644	$48,661	$275,305
14	$112,115	$44,815	$156,930	$187,552	$42,740	$230,292	$105,936	$44,723	$150,659	$226,644	$50,121	$276,765
15	$112,115	$46,159	$158,274	$187,552	$44,022	$231,574	$105,936	$46,065	$152,001	$226,644	$51,625	$278,269
16	$112,115	$47,544	$159,659	$187,552	$45,343	$232,895	$105,936	$47,447	$153,383	$226,644	$53,174	$279,818
17	$112,115	$48,970	$161,085	$187,552	$46,703	$234,255	$105,936	$48,870	$154,806	$226,644	$54,769	$281,413
18	$112,115	$50,439	$162,554	$187,552	$48,104	$235,656	$105,936	$50,336	$156,272	$226,644	$56,412	$283,056
19	$112,115	$51,952	$164,067	$187,552	$49,547	$237,099	$105,936	$51,846	$157,782	$226,644	$58,104	$284,748
20	$112,115	$53,511	$165,626	$187,552	$51,033	$238,585	$105,936	$53,401	$159,337	$226,644	$59,847	$286,491

Equivalent Present Worth Analysis

Interest Rate = 3.0 %

	Alternative 4a			Alternative 4b			Alternative 6a			Alternative 6b		
Year	PW Capital Cost	PW O&M Cost	PW Total Cost	PW Capital Cost	PW O&M Cost	PW Total Cost	PW Capital Cost	PW O&M Cost	PW Total Cost	PW Capital Cost	PW O&M Cost	PW Total Cost
1	$108,850	$29,629	$138,479	$182,089	$28,256	$210,346	$102,850	$29,567	$132,417	$220,043	$33,136	$253,179
2	$105,679	$29,630	$135,309	$176,786	$28,256	$205,042	$99,855	$29,567	$129,422	$213,634	$33,136	$246,770
3	$102,601	$29,630	$132,231	$171,637	$28,256	$199,893	$96,946	$29,567	$126,514	$207,411	$33,136	$240,548
4	$99,613	$29,629	$129,242	$166,638	$28,256	$194,893	$94,123	$29,567	$123,690	$201,370	$33,136	$234,506
5	$96,711	$29,629	$126,340	$161,784	$28,256	$190,040	$91,381	$29,567	$120,948	$195,505	$33,136	$228,641
6	$93,895	$29,629	$123,523	$157,072	$28,256	$185,328	$88,720	$29,567	$118,286	$189,811	$33,136	$222,947
7	$91,160	$29,628	$120,788	$152,497	$28,256	$180,753	$86,136	$29,566	$115,702	$184,282	$33,136	$217,418
8	$88,505	$29,628	$118,133	$148,055	$28,256	$176,311	$83,627	$29,567	$113,193	$178,915	$33,136	$212,051
9	$85,927	$29,628	$115,555	$143,743	$28,256	$171,999	$81,191	$29,567	$110,758	$173,704	$33,136	$206,840
10	$83,424	$29,628	$113,052	$139,556	$28,256	$167,813	$78,826	$29,567	$108,393	$168,644	$33,136	$201,780
11	$80,994	$29,629	$110,623	$135,492	$28,256	$163,748	$76,530	$29,567	$106,097	$163,732	$33,136	$196,868
12	$78,635	$29,628	$108,264	$131,545	$28,256	$159,801	$74,301	$29,567	$103,868	$158,964	$33,136	$192,100
13	$76,345	$29,628	$105,973	$127,714	$28,256	$155,970	$72,137	$29,567	$101,704	$154,334	$33,136	$187,469
14	$74,121	$29,628	$103,749	$123,994	$28,256	$152,250	$70,036	$29,567	$99,603	$149,838	$33,136	$182,974
15	$71,962	$29,628	$101,590	$120,382	$28,256	$148,639	$67,996	$29,567	$97,564	$145,474	$33,136	$178,610
16	$69,866	$29,628	$99,494	$116,876	$28,256	$145,132	$66,016	$29,567	$95,583	$141,237	$33,136	$174,373
17	$67,831	$29,628	$97,459	$113,472	$28,256	$141,728	$64,093	$29,567	$93,660	$137,123	$33,136	$170,259
18	$65,856	$29,628	$95,483	$110,167	$28,256	$138,423	$62,226	$29,567	$91,793	$133,129	$33,136	$166,266
19	$63,938	$29,627	$93,565	$106,958	$28,256	$135,214	$60,414	$29,567	$89,981	$129,252	$33,136	$162,388
20	$62,075	$29,628	$91,703	$103,843	$28,256	$132,099	$58,654	$29,567	$88,221	$125,487	$33,136	$158,623
Total	$1,667,988	$592,568	$2,260,555	$2,790,300	$565,120	$3,355,422	$1,576,058	$591,339	$2,167,397	$3,371,889	$662,720	$4,034,610
Total ($M)	$1.67	$0.59	$2.26	$2.79	$0.57	$3.36	$1.58	$0.59	$2.17	$3.37	$0.66	$4.03
Annual	**$112,115**	**$39,830**	**$151,945**	**$187,552**	**$37,985**	**$225,537**	**$105,936**	**$39,747**	**$145,683**	**$226,644**	**$44,545**	**$271,189**
Check	$112,115		$151,945	$187,552		$225,537	$105,936		$145,683	$226,644		$271,189

BRUNEAU WATER AND SEWER DISTRICT

WASTEWATER MASTER PLAN

APPENDIX D: NOTICE OF PUBLIC HEARING

July 1st, 2015

Contact:
Stacey Buckingham
Bruneau Water and Sewer District
(208) 845-2188

Public comment sought on 2013 Wastewater System Master Plan

BRUNEAU, ID – The public is invited to attend a public meeting on **Thursday, July 23rd, 2015,** to discuss the 2013 Wastewater System Master Plan .

The public meeting will be held at Bruneau Public LIbrary, 32073 Ruth Street, in Bruneau, at 7:00 p.m. The meeting will be an open-house format that allows individuals to review information and visit with district staff.

The purpose of this public meeting will be to review the improvement alternatives for the wastewater treatment system and determine the preferred alternative for design and construction.

If you are unable to attend, but would like to provide feedback on the Master Plan, public comment is being accepted until, July 22nd, 2015. For more information, or to provide comment, please contact Kelli Buckingham by phone at (208) 845-2188.

Bruneau Water and Sewer
Special Board Meeting July 23rd, 2015

Present:	Stacey Buckingham	President
	Denise Stewart	Vice-President
	Pat Welsh	Member
	Wylee Aquiso	Member
	Justin Howard	Member
	Kelli Buckingham	Sec/Treasure

Stacey Buckingham opened the meeting at 7:10pm.

The Master Plan was in the Bruneau Public Library for public review. No written public feedback was given nor was verbal. No guests were present at the meeting.

Stacey explained the alternatives in the approved Master Plan with the board members again, including the potential environmental impacts of each alternative. The funding options were discussed and the potential financial impact on the public.

The board discussed the options and decided that the original vote on February 11th, 2014 for alternative 4A in the technically approved Master Plan is the best option for the board.

Denise made a motion, that the original vote on February 11th, 2014 for alternative 4A in the technically approved Master Plan would be the best option for the board, Pat 2nd all in favor, motion carried.

Wylee made a motion to adjourn the meeting at 8:15pm. Denise 2nd, all in favor, motion carried.