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

Date: **March 6, 2019**

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Standards and Technical Services

Facility: **Ensign-Bickford 002, UPDES Permit No. UT0025283**
Receiving water: **Spanish Fork River (2B, 3B, 3D, 4)**

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

Discharge

002 Discharge from the Spanish Fork granular activated carbon groundwater treatment system. Design flow 2.16 mgd (3.35 cfs).

Receiving Water

Per UAC R317-2-13.5(c), the designated beneficial uses of Spanish Fork River and tributaries, from Utah Lake to diversion at Moark Junction are: 2B, 3B, 3D, 4.

- *Class 2B - Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.*

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

- *Class 3D - Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.*

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

Flow

Typically, the critical flow for the receiving water in the wasteload analysis is considered the lowest stream flow for seven consecutive days with a ten year return frequency (7Q10). Due to the lack of available and representative flow data on the Spanish Fork River at the discharge location, the 7Q10 flow was estimated using the 20th percentile of flow data from DWQ monitoring station # 4995580, *SPANISH FORK R AB UTAH L (LAKESHORE)* for the period 2007-2013. This station is located below the discharge location, but was the only representative data available. The upstream station used to characterize the receiving water quality (DWQ station #4995600, *SPANISH FORK RIVER AT MOARK DIVERSION)* has a good long term flow record, but is located immediately above a major water diversion.

TMDL

According to the Utah's 2016 303(d) Water Quality Assessment Report, the receiving water for the discharge; Spanish Fork River from Utah Lake to Moark Diversion (AU# UT16020202-001_00) is not listed as impaired for any of its beneficial uses.

The downstream waterbody, Utah Lake other than Provo Bay (AU UT-L-16020201-004_01), is listed as impaired for harmful algal blooms (Class 2B); PCB in fish tissue and total phosphorus (Class 3B) and total dissolved solids (Class 4). Although the WLA may show higher allowed effluent limits for these impaired constituents should be evaluated in the effluent against the end of pipe Water Quality Standards in Table 1 to determine whether or not they have reasonable potential to cause or contribute to the existing impairments.

Table 1. End of pipe Criteria

Constituent	Criteria
TDS	1200 mg/l
Harmful algal blooms	N/A
PCB in fish tissue	N/A
Total phosphorous	N/A

Mixing Zone

The maximum allowable mixing zone is 15 minutes of travel time for acute conditions, not to exceed 50% of stream width, and for chronic conditions, per UAC R317-2-5. Water quality standards must be met at the end of the mixing zone. The mixing zone model showed complete mixing within 2,500 feet for chronic conditions. Acute effluent limits were calculated using 50% of the critical low flow value in the receiving water.

Parameters of Concern

The potential parameters of concern identified for the discharge were TDS, RDX and nitrate as determined by the impairment status of the receiving water and review of the previous permit.

WET Limits

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

test, needs to be below the WET limits, as determined by the WLA. The WET limit for LC_{50} is typically 100% effluent and does not need to be determined by the WLA.

IC25 WET limits for Outfall 002 should be based on 10.0 % effluent.

Wasteload Allocation Methods

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

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

Models and supporting documentation are available for review upon request.

Antidegradation Level I Review

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

A Level II Antidegradation Review (ADR) is not required for this facility. The proposed permit is a simple renewal of an existing UPDES permit. No increase in flow or concentration of pollutants over those authorized in the the existing permit is being requested.

Documents:

WLA Document: Ensign_Bickford_002-WLADoc_3-7-19.docx
Wasteload Analysis and Addendums: Ensign_Bickford_002-WLA_3-7-19.*xlsm*

References:

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

Utah Division of Water Quality
Salt Lake City, Utah

WASTELOAD ANALYSIS [WLA] **7-Mar-19**
Addendum: Statement of Basis

Facilities: **Ensign Bickford 002** **UPDES No: UT-0025283**
Discharging to: **Spanish Fork River**
Design Flow: **2.16** **MGD**

I. Introduction

Wasteload analyses are performed to determine point source effluent limitations necessary to maintain designated beneficial uses by evaluating projected effects of discharge concentrations on in-stream water quality. The wasteload analysis also takes into account downstream designated uses [R317-2-8, UAC]. Projected concentrations are compared to numeric water quality standards to determine acceptability. The anti-degradation policy and procedures are also considered. The primary in-stream parameters of concern may include metals (as a function of hardness), total dissolved solids (TDS), total residual chlorine (TRC), un-ionized ammonia (as a function of pH and temperature, measured and evaluated interms of total ammonia), and dissolved oxygen.

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

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

II. Receiving Water and Stream Classification

Spanish Fork River:	2B, 3B, 3D, 4
Antidegradation Review:	Level I review completed. Level II review not required.

III. Numeric Stream Standards for Protection of Aquatic Wildlife

Total Ammonia (TNH3)	Varies as a function of Temperature and pH Rebound. See Water Quality Standards
Chronic Total Residual Chlorine (TRC)	0.011 mg/l (4 Day Average) 0.019 mg/l (1 Hour Average)
Chronic Dissolved Oxygen (DO)	5.50 mg/l (30 Day Average) 4.00 mg/l (7Day Average) 3.00 mg/l (1 Day Average
Maximum Total Dissolved Solids	1200.0 mg/l

Acute and Chronic Heavy Metals (Dissolved)

Parameter	4 Day Average (Chronic) Standard Concentration		Load*	1 Hour Average (Acute) Standard Concentration		Load*
Aluminum	87.00	ug/l**	1.570 lbs/day	750.00	ug/l	13.534 lbs/day
Arsenic	190.00	ug/l	3.429 lbs/day	340.00	ug/l	6.136 lbs/day
Cadmium	0.32	ug/l	0.006 lbs/day	0.57	ug/l	0.010 lbs/day
Chromium III	32.21	ug/l	0.581 lbs/day	673.83	ug/l	12.160 lbs/day
ChromiumVI	11.00	ug/l	0.199 lbs/day	16.00	ug/l	0.289 lbs/day
Copper	3.34	ug/l	0.060 lbs/day	4.51	ug/l	0.081 lbs/day
Iron				1000.00	ug/l	18.046 lbs/day
Lead	0.69	ug/l	0.012 lbs/day	17.68	ug/l	0.319 lbs/day
Mercury	0.0120	ug/l	0.000 lbs/day	2.40	ug/l	0.043 lbs/day
Nickel	18.87	ug/l	0.341 lbs/day	169.74	ug/l	3.063 lbs/day
Selenium	4.60	ug/l	0.083 lbs/day	20.00	ug/l	0.361 lbs/day
Silver	N/A	ug/l	N/A lbs/day	0.48	ug/l	0.009 lbs/day
Zinc	43.28	ug/l	0.781 lbs/day	43.28	ug/l	0.781 lbs/day

* Allowed below discharge

**Chronic Aluminum standard applies only to waters with a pH < 7.0 and a Hardness < 50 mg/l as CaCO3

Metals Standards Based upon a Hardness of 30.07 mg/l as CaCO3

Organics [Pesticides]

Parameter	4 Day Average (Chronic) Standard Concentration		Load*	1 Hour Average (Acute) Standard Concentration		Load*
Aldrin				1.500	ug/l	0.027 lbs/day
Chlordane	0.004	ug/l	0.773 lbs/day	1.200	ug/l	0.022 lbs/day
DDT, DDE	0.001	ug/l	0.180 lbs/day	0.550	ug/l	0.010 lbs/day
Dieldrin	0.002	ug/l	0.341 lbs/day	1.250	ug/l	0.023 lbs/day
Endosulfan	0.056	ug/l	10.064 lbs/day	0.110	ug/l	0.002 lbs/day
Endrin	0.002	ug/l	0.413 lbs/day	0.090	ug/l	0.002 lbs/day
Guthion				0.010	ug/l	0.000 lbs/day
Heptachlor	0.004	ug/l	0.683 lbs/day	0.260	ug/l	0.005 lbs/day
Lindane	0.080	ug/l	14.377 lbs/day	1.000	ug/l	0.018 lbs/day
Methoxychlor				0.030	ug/l	0.001 lbs/day
Mirex				0.010	ug/l	0.000 lbs/day
Parathion				0.040	ug/l	0.001 lbs/day
PCB's	0.014	ug/l	2.516 lbs/day	2.000	ug/l	0.036 lbs/day
Pentachlorophenol	13.00	ug/l	2336.240 lbs/day	20.000	ug/l	0.361 lbs/day
Toxephene	0.0002	ug/l	0.036 lbs/day	0.7300	ug/l	0.013 lbs/day

IV. Numeric Stream Standards for Protection of Agriculture

	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard	
	Concentration	**Load***	**Concentration**	**Load***
Arsenic			100.0 ug/l	lbs/day
Boron			750.0 ug/l	lbs/day
Cadmium			10.0 ug/l	0.09 lbs/day
Chromium			100.0 ug/l	lbs/day
Copper			200.0 ug/l	lbs/day
Lead			100.0 ug/l	lbs/day
Selenium			50.0 ug/l	lbs/day
TDS, Summer			1200.0 mg/l	10.83 tons/day

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

	4 Day Average (Chronic) Standard		1 Hour Average (Acute) Standard	
Metals	**Concentration**	**Load***	**Concentration**	**Load***
Arsenic			ug/l	lbs/day
Barium			ug/l	lbs/day
Cadmium			ug/l	lbs/day
Chromium			ug/l	lbs/day
Lead			ug/l	lbs/day
Mercury			ug/l	lbs/day
Selenium			ug/l	lbs/day
Silver			ug/l	lbs/day
Fluoride (3)			ug/l	lbs/day
to			ug/l	lbs/day
Nitrates as N			ug/l	lbs/day
Chlorophenoxy Herbicides				
2,4-D			ug/l	lbs/day
2,4,5-TP			ug/l	lbs/day
Endrin			ug/l	lbs/day
ocyclohexane (Lindane)			ug/l	lbs/day
Methoxychlor			ug/l	lbs/day
Toxaphene			ug/l	lbs/day

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

	Maximum Conc., ug/l - Acute Standards			
	Class 1C		**Class 3A, 3B**	
Toxic Organics	[2 Liters/Day for 70 Kg Person over 70 Yr.]		[6.5 g for 70 Kg Person over 70 Yr.]	
Acenaphthene	ug/l	lbs/day	2700.0 ug/l	485.22 lbs/day
Acrolein	ug/l	lbs/day	780.0 ug/l	140.17 lbs/day
Acrylonitrile	ug/l	lbs/day	0.7 ug/l	0.12 lbs/day
Benzene	ug/l	lbs/day	71.0 ug/l	12.76 lbs/day
Benzidine	ug/l	lbs/day	0.0 ug/l	0.00 lbs/day
Carbon tetrachloride	ug/l	lbs/day	4.4 ug/l	0.79 lbs/day
Chlorobenzene	ug/l	lbs/day	21000.0 ug/l	3773.93 lbs/day
1,2,4-Trichlorobenzene				
Hexachlorobenzene	ug/l	lbs/day	0.0 ug/l	0.00 lbs/day
1,2-Dichloroethane	ug/l	lbs/day	99.0 ug/l	17.79 lbs/day

1,1,1-Trichloroethane					
Hexachloroethane	ug/l	lbs/day	8.9	ug/l	1.60 lbs/day
1,1-Dichloroethane					
1,1,2-Trichloroethane	ug/l	lbs/day	42.0	ug/l	7.55 lbs/day
1,1,2,2-Tetrachloroethai	ug/l	lbs/day	11.0	ug/l	1.98 lbs/day
Chloroethane			0.0	ug/l	0.00 lbs/day
Bis(2-chloroethyl) ether	ug/l	lbs/day	1.4	ug/l	0.25 lbs/day
2-Chloroethyl vinyl ether	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
2-Chloronaphthalene	ug/l	lbs/day	4300.0	ug/l	772.76 lbs/day
2,4,6-Trichlorophenol	ug/l	lbs/day	6.5	ug/l	1.17 lbs/day
p-Chloro-m-cresol			0.0	ug/l	0.00 lbs/day
Chloroform (HM)	ug/l	lbs/day	470.0	ug/l	84.46 lbs/day
2-Chlorophenol	ug/l	lbs/day	400.0	ug/l	71.88 lbs/day
1,2-Dichlorobenzene	ug/l	lbs/day	17000.0	ug/l	3055.08 lbs/day
1,3-Dichlorobenzene	ug/l	lbs/day	2600.0	ug/l	467.25 lbs/day
1,4-Dichlorobenzene	ug/l	lbs/day	2600.0	ug/l	467.25 lbs/day
3,3'-Dichlorobenzidine	ug/l	lbs/day	0.1	ug/l	0.01 lbs/day
1,1-Dichloroethylene	ug/l	lbs/day	3.2	ug/l	0.58 lbs/day
1,2-trans-Dichloroethyle	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
2,4-Dichlorophenol	ug/l	lbs/day	790.0	ug/l	141.97 lbs/day
1,2-Dichloropropane	ug/l	lbs/day	39.0	ug/l	7.01 lbs/day
1,3-Dichloropropylene	ug/l	lbs/day	1700.0	ug/l	305.51 lbs/day
2,4-Dimethylphenol	ug/l	lbs/day	2300.0	ug/l	413.33 lbs/day
2,4-Dinitrotoluene	ug/l	lbs/day	9.1	ug/l	1.64 lbs/day
2,6-Dinitrotoluene	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
1,2-Diphenylhydrazine	ug/l	lbs/day	0.5	ug/l	0.10 lbs/day
Ethylbenzene	ug/l	lbs/day	29000.0	ug/l	5211.61 lbs/day
Fluoranthene	ug/l	lbs/day	370.0	ug/l	66.49 lbs/day
4-Chlorophenyl phenyl ether					
4-Bromophenyl phenyl ether					
Bis(2-chloroisopropyl) e	ug/l	lbs/day	170000.0	ug/l	30550.83 lbs/day
Bis(2-chloroethoxy) met	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Methylene chloride (HM	ug/l	lbs/day	1600.0	ug/l	287.54 lbs/day
Methyl chloride (HM)	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Methyl bromide (HM)	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Bromoform (HM)	ug/l	lbs/day	360.0	ug/l	64.70 lbs/day
Dichlorobromomethane	ug/l	lbs/day	22.0	ug/l	3.95 lbs/day
Chlorodibromomethane	ug/l	lbs/day	34.0	ug/l	6.11 lbs/day
Hexachlorobutadiene(c)	ug/l	lbs/day	50.0	ug/l	8.99 lbs/day
Hexachlorocyclopentadi	ug/l	lbs/day	17000.0	ug/l	3055.08 lbs/day
Isophorone	ug/l	lbs/day	600.0	ug/l	107.83 lbs/day
Naphthalene					
Nitrobenzene	ug/l	lbs/day	1900.0	ug/l	341.45 lbs/day
2-Nitrophenol	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
4-Nitrophenol	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
2,4-Dinitrophenol	ug/l	lbs/day	14000.0	ug/l	2515.95 lbs/day
4,6-Dinitro-o-cresol	ug/l	lbs/day	765.0	ug/l	137.48 lbs/day
N-Nitrosodimethylamine	ug/l	lbs/day	8.1	ug/l	1.46 lbs/day
N-Nitrosodiphenylamine	ug/l	lbs/day	16.0	ug/l	2.88 lbs/day
N-Nitrosodi-n-propylami	ug/l	lbs/day	1.4	ug/l	0.25 lbs/day
Pentachlorophenol	ug/l	lbs/day	8.2	ug/l	1.47 lbs/day

Phenol	ug/l	lbs/day	4.6E+06	ug/l	8.27E+05 lbs/day
Bis(2-ethylhexyl)phthala	ug/l	lbs/day	5.9	ug/l	1.06 lbs/day
Butyl benzyl phthalate	ug/l	lbs/day	5200.0	ug/l	934.50 lbs/day
Di-n-butyl phthalate	ug/l	lbs/day	12000.0	ug/l	2156.53 lbs/day
Di-n-octyl phthlate					
Diethyl phthalate	ug/l	lbs/day	120000.0	ug/l	21565.30 lbs/day
Dimethyl phthlate	ug/l	lbs/day	2.9E+06	ug/l	5.21E+05 lbs/day
Benzo(a)anthracene (P/	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Benzo(a)pyrene (PAH)	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Benzo(b)fluoranthene (F	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Benzo(k)fluoranthene (F	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Chrysene (PAH)	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Acenaphthylene (PAH)					
Anthracene (PAH)	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Dibenzo(a,h)anthracene	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Indeno(1,2,3-cd)pyrene	ug/l	lbs/day	0.0	ug/l	0.01 lbs/day
Pyrene (PAH)	ug/l	lbs/day	11000.0	ug/l	1976.82 lbs/day
Tetrachloroethylene	ug/l	lbs/day	8.9	ug/l	1.60 lbs/day
Toluene	ug/l	lbs/day	200000	ug/l	35942.16 lbs/day
Trichloroethylene	ug/l	lbs/day	81.0	ug/l	14.56 lbs/day
Vinyl chloride	ug/l	lbs/day	525.0	ug/l	94.35 lbs/day
					lbs/day
Pesticides					lbs/day
Aldrin	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Dieldrin	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Chlordane	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
4,4'-DDT	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
4,4'-DDE	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
4,4'-DDD	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
alpha-Endosulfan	ug/l	lbs/day	2.0	ug/l	0.36 lbs/day
beta-Endosulfan	ug/l	lbs/day	2.0	ug/l	0.36 lbs/day
Endosulfan sulfate	ug/l	lbs/day	2.0	ug/l	0.36 lbs/day
Endrin	ug/l	lbs/day	0.8	ug/l	0.15 lbs/day
Endrin aldehyde	ug/l	lbs/day	0.8	ug/l	0.15 lbs/day
Heptachlor	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Heptachlor epoxide					
PCB's					
PCB 1242 (Arochlor 12	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
PCB-1254 (Arochlor 12	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
PCB-1221 (Arochlor 12	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
PCB-1232 (Arochlor 12	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
PCB-1248 (Arochlor 12	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
PCB-1260 (Arochlor 12	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
PCB-1016 (Arochlor 10	ug/l	lbs/day	0.0	ug/l	0.00 lbs/day
Pesticide					
Toxaphene	ug/l		0.0	ug/l	0.00 lbs/day
Dioxin					
Dioxin (2,3,7,8-TCDD)	ug/l	lbs/day			

Metals				
Antimony	ug/l	lbs/day		
Arsenic	ug/l	lbs/day	4300.00 ug/l	772.76 lbs/day
Asbestos	ug/l	lbs/day		
Beryllium				
Cadmium				
Chromium (III)				
Chromium (VI)				
Copper				
Cyanide	ug/l	lbs/day	2.2E+05 ug/l	39536.37 lbs/day
Lead	ug/l	lbs/day		
Mercury			0.15 ug/l	0.03 lbs/day
Nickel			4600.00 ug/l	826.67 lbs/day
Selenium	ug/l	lbs/day		
Silver	ug/l	lbs/day		
Thallium			6.30 ug/l	1.13 lbs/day
Zinc				

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

VII. Mathematical Modeling of Stream Quality

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

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

(1) The Utah River Model, Utah Division of Water Quality, 1992. Based upon STREAMDO IV (Region VIII) and Supplemental Ammonia Toxicity Models; EPA Region VIII, Sept. 1990 and QUAL2E (EPA, Athens, GA).

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

(3) AMMTOX Model, University of Colorado, Center of Limnology, and EPA Region 8

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

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

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

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

VIII. Modeling Information

The required information for the model may include the following information for both the upstream conditions at low flow and the effluent conditions:

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

Other Conditions

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

Model Inputs

The following is upstream and discharge information that was utilized as inputs for the analysis.

Current Upstream Information

	Stream Critical Low Flow cfs	Temp. Deg. C	pH	T-NH3 mg/l as N	BOD5 mg/l	DO mg/l	TRC mg/l	TDS mg/l
Summer (Irrig. Season)	30.00	13.0	7.9	0.05	1.00	7.94	0.00	227.0
Fall	30.00	6.9	7.7	0.05	1.00	---	0.00	378.0
Winter	30.00	3.1	7.5	0.07	1.00	---	0.00	419.0
Spring	30.00	9.7	7.9	0.06	1.00	---	0.00	273.0

Dissolved Metals	Al ug/l	As ug/l	Cd ug/l	CrIII ug/l	CrVI ug/l	Copper ug/l	Fe ug/l	Pb ug/l
All Seasons	54.20	1.32	0.05	3.00	3.975*	1.32	53.1	0.05

Dissolved Metals	Hg ug/l	Ni ug/l	Se ug/l	Ag ug/l	Zn ug/l	Boron ug/l	
All Seasons	0.0000	2.50	1.18	0.25	10.94	57.8	* ~80% MDL

Projected Discharge Information

Season	Flow, MGD	Temp.
Summer	2.16000	13.8
Fall	2.16000	12.7
Winter	2.16000	12.6
Spring	2.16000	13.1

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

Current State water quality standards are required to be met under a variety of conditions including in-stream flows targeted to the 7-day, 10-year low flow (R317-2-9).

Other conditions used in the modeling effort coincide with the environmental conditions expected at low stream flows.

Effluent Limitation for Flow based upon Water Quality Standards

In-stream criteria of downstream segments will be met with an effluent flow maximum value as follows:

Season	Daily Average	
Summer	2.160 MGD	3.342 cfs
Fall	2.160 MGD	3.342 cfs
Winter	2.160 MGD	3.342 cfs
Spring	2.160 MGD	3.342 cfs

Flow Requirement or Loading Requirement

The calculations in this wasteload analysis utilize the maximum effluent discharge flow of 2.16 MGD. If the discharger is allowed to have a flow greater than 2.16 MGD during 7Q10 conditions, and effluent limit concentrations as indicated, then water quality standards will be violated. In order to prevent this from occuring, the permit writers must include the discharge flow limititation as indicated above; or, include loading effluent limits in the permit.

Effluent Limitation for Whole Effluent Toxicity (WET) based upon WET Policy

Effluent Toxicity will not occur in downstream segements if the values below are met.

WET Requirements	LC50 >	100.0% Effluent	[Acute]
	IC25 >	10.0% Effluent	[Chronic]

Effluent Limitation for Biological Oxygen Demand (BOD) based upon Water Quality Standards or Regulations

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent BOD limitation as follows:

Season	Concentration	
Summer	25.0 mg/l as BOD5	450.3 lbs/day
Fall	25.0 mg/l as BOD5	450.3 lbs/day
Winter	25.0 mg/l as BOD5	450.3 lbs/day
Spring	25.0 mg/l as BOD5	450.3 lbs/day

Effluent Limitation for Dissolved Oxygen (DO) based upon Water Quality Standards

In-stream criteria of downstream segments for Dissolved Oxygen will be met with an effluent

Season	**Concentration**
Summer	4.50
Fall	4.50
Winter	4.50
Spring	4.50

In-stream criteria of downstream segments for Total Ammonia will be met with an effluent limitation (expressed as Total Ammonia as N) as follows:

Season		**Concentration**	**Load**
Summer	4 Day Avg. - Chronic	30.30 mg/l as N	545.8 lbs/day
	1 Hour Avg. - Acute	51.0 mg/l as N	917.7 lbs/day
Fall	4 Day Avg. - Chronic	29.7 mg/l as N	534.7 lbs/day
	1 Hour Avg. - Acute	47.5 mg/l as N	856.3 lbs/day
Winter	4 Day Avg. - Chronic	41.7 mg/l as N	750.3 lbs/day
	1 Hour Avg. - Acute	75.8 mg/l as N	1,364.4 lbs/day
Spring	4 Day Avg. - Chronic	35.6 mg/l as N	640.7 lbs/day
	1 Hour Avg. - Acute	59.6 mg/l as N	1,074.3 lbs/day

Acute limit calculated with an Acute Zone of Initial Dilution (ZID) to be equal to 50.%.

Effluent Limitation for Total Residual Chlorine based upon Water Quality Standards

In-stream criteria of downstream segments for Total Residual Chlorine will be met with an effluent limitation as follows:

Season		Concentration		Load	
Summer	4 Day Avg. - Chronic	0.101	mg/l	1.81	lbs/day
	1 Hour Avg. - Acute	0.100	mg/l	1.79	lbs/day
Fall	4 Day Avg. - Chronic	0.101	mg/l	1.81	lbs/day
	1 Hour Avg. - Acute	0.100	mg/l	1.79	lbs/day
Winter	4 Day Avg. - Chronic	0.101	mg/l	1.81	lbs/day
	1 Hour Avg. - Acute	0.100	mg/l	1.79	lbs/day
Spring	4 Day Avg. - Chronic	0.101	mg/l	1.81	lbs/day
	1 Hour Avg. - Acute	0.100	mg/l	1.79	lbs/day

Effluent Limitations for Total Dissolved Solids based upon Water Quality Standards

Season		Concentration		Load	
Summer	Maximum, Acute	9935.5	mg/l	89.47	tons/day
Fall	Maximum, Acute	8579.9	mg/l	77.27	tons/day
Winter	Maximum, Acute	8211.8	mg/l	73.95	tons/day
Spring	Maximum, Acute	9522.6	mg/l	85.75	tons/day

Colorado Salinity Forum Limits — Determined by Permitting Section

Effluent Limitations for Total Recoverable Metals based upon Water Quality Standards

In-stream criteria of downstream segments for Dissolved Metals will be met with an effluent limitation as follows (based upon a hardness of 30.07 mg/l):

	4 Day Average Concentration		Load	1 Hour Average Concentration		Load
Aluminum*	N/A		N/A	3,873.4	ug/l	69.9 lbs/day
Arsenic*	1,883.96	ug/l	21.9 lbs/day	1,860.3	ug/l	33.6 lbs/day
Cadmium	2.71	ug/l	0.0 lbs/day	2.9	ug/l	0.1 lbs/day
Chromium III	294.43	ug/l	3.4 lbs/day	3,685.2	ug/l	66.5 lbs/day
Chromium VI*	74.07	ug/l	0.9 lbs/day	70.0	ug/l	1.3 lbs/day
Copper	21.48	ug/l	0.3 lbs/day	18.8	ug/l	0.3 lbs/day
Iron*	N/A		N/A	5,250.6	ug/l	94.8 lbs/day
Lead	6.43	ug/l	0.1 lbs/day	96.8	ug/l	1.7 lbs/day
Mercury*	0.12	ug/l	0.0 lbs/day	13.2	ug/l	0.2 lbs/day
Nickel	165.86	ug/l	1.9 lbs/day	920.5	ug/l	16.6 lbs/day
Selenium*	35.30	ug/l	0.4 lbs/day	104.5	ug/l	1.9 lbs/day
Silver	N/A	ug/l	N/A lbs/day	1.5	ug/l	0.0 lbs/day

Zinc	333.63 ug/l	3.9 lbs/day	188.5	ug/l	3.4 lbs/day
Cyanide*	51.89 ug/l	0.6 lbs/day	120.8	ug/l	2.2 lbs/day

*Limits for these metals are based on the dissolved standard.

Effluent Limitations for Heat/Temperature based upon Water Quality Standards

Summer	52.9 Deg. C.	127.2 Deg. F
Fall	46.8 Deg. C.	116.2 Deg. F
Winter	43.0 Deg. C.	109.4 Deg. F
Spring	49.6 Deg. C.	121.2 Deg. F

Effluent Limitations for Organics [Pesticides] Based upon Water Quality Standards

In-stream criteria of downstream segments for Organics [Pesticides] will be met with an effluent limit as follows:

	4 Day Average		1 Hour Average	
	Concentration	Load	Concentration	Load
Aldrin			1.5E+00 ug/l	4.19E-02 lbs/day
Chlordane	4.30E-03 ug/l	7.74E-02 lbs/day	1.2E+00 ug/l	3.35E-02 lbs/day
DDT, DDE	1.00E-03 ug/l	1.80E-02 lbs/day	5.5E-01 ug/l	1.54E-02 lbs/day
Dieldrin	1.90E-03 ug/l	3.42E-02 lbs/day	1.3E+00 ug/l	3.49E-02 lbs/day
Endosulfan	5.60E-02 ug/l	1.01E+00 lbs/day	1.1E-01 ug/l	3.07E-03 lbs/day
Endrin	2.30E-03 ug/l	4.14E-02 lbs/day	9.0E-02 ug/l	2.51E-03 lbs/day
Guthion	0.00E+00 ug/l	0.00E+00 lbs/day	1.0E-02 ug/l	2.79E-04 lbs/day
Heptachlor	3.80E-03 ug/l	6.84E-02 lbs/day	2.6E-01 ug/l	7.26E-03 lbs/day
Lindane	8.00E-02 ug/l	1.44E+00 lbs/day	1.0E+00 ug/l	2.79E-02 lbs/day
Methoxychlor	0.00E+00 ug/l	0.00E+00 lbs/day	3.0E-02 ug/l	8.38E-04 lbs/day
Mirex	0.00E+00 ug/l	0.00E+00 lbs/day	1.0E-02 ug/l	2.79E-04 lbs/day
Parathion	0.00E+00 ug/l	0.00E+00 lbs/day	4.0E-02 ug/l	1.12E-03 lbs/day
PCB's	1.40E-02 ug/l	2.52E-01 lbs/day	2.0E+00 ug/l	5.58E-02 lbs/day
Pentachlorophenol	1.30E+01 ug/l	2.34E+02 lbs/day	2.0E+01 ug/l	5.58E-01 lbs/day
Toxephene	2.00E-04 ug/l	3.60E-03 lbs/day	7.3E-01 ug/l	2.04E-02 lbs/day

Effluent Targets for Pollution Indicators
Based upon Water Quality Standards

In-stream criteria of downstream segments for Pollution Indicators will be met with an effluent limit as follows:

	1 Hour Average	
	Concentration	Loading
Gross Beta (pCi/l)	50.0 pCi/L	
BOD (mg/l)	5.0 mg/l	90.2 lbs/day
Nitrates as N	4.0 mg/l	72.2 lbs/day
Total Phosphorus as P	0.05 mg/l	0.9 lbs/day
Total Suspended Solids	90.0 mg/l	1624.1 lbs/day

Note: Pollution indicator targets are for information purposes only.

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

In-stream criteria of downstream segments for Protection of Human Health [Toxics] will be met with an effluent limit as follows:

	Maximum Concentration	
	Concentration	**Load**
Toxic Organics		
Acenaphthene	2.69E+04 ug/l	4.85E+02 lbs/day
Acrolein	7.78E+03 ug/l	1.40E+02 lbs/day
Acrylonitrile	6.59E+00 ug/l	1.19E-01 lbs/day
Benzene	7.08E+02 ug/l	1.28E+01 lbs/day
Benzidine	ug/l	lbs/day
Carbon tetrachloride	4.39E+01 ug/l	7.91E-01 lbs/day
Chlorobenzene	2.10E+05 ug/l	3.77E+03 lbs/day
1,2,4-Trichlorobenzene		
Hexachlorobenzene	7.68E-03 ug/l	1.38E-04 lbs/day
1,2-Dichloroethane	9.88E+02 ug/l	1.78E+01 lbs/day
1,1,1-Trichloroethane		
Hexachloroethane	8.88E+01 ug/l	1.60E+00 lbs/day
1,1-Dichloroethane		
1,1,2-Trichloroethane	4.19E+02 ug/l	7.55E+00 lbs/day
1,1,2,2-Tetrachloroethane	1.10E+02 ug/l	1.98E+00 lbs/day
Chloroethane		
Bis(2-chloroethyl) ether	1.40E+01 ug/l	2.52E-01 lbs/day
2-Chloroethyl vinyl ether		
2-Chloronaphthalene	4.29E+04 ug/l	7.73E+02 lbs/day
2,4,6-Trichlorophenol	6.49E+01 ug/l	1.17E+00 lbs/day
p-Chloro-m-cresol		
Chloroform (HM)	4.69E+03 ug/l	8.45E+01 lbs/day
2-Chlorophenol	3.99E+03 ug/l	7.19E+01 lbs/day
1,2-Dichlorobenzene	1.70E+05 ug/l	3.06E+03 lbs/day
1,3-Dichlorobenzene	2.59E+04 ug/l	4.67E+02 lbs/day

1,4-Dichlorobenzene	2.59E+04 ug/l	4.67E+02 lbs/day
3,3'-Dichlorobenzidine	7.68E-01 ug/l	1.38E-02 lbs/day
1,1-Dichloroethylene	3.19E+01 ug/l	5.75E-01 lbs/day
1,2-trans-Dichloroethylene1		
2,4-Dichlorophenol	7.88E+03 ug/l	1.42E+02 lbs/day
1,2-Dichloropropane	3.89E+02 ug/l	7.01E+00 lbs/day
1,3-Dichloropropylene	1.70E+04 ug/l	3.06E+02 lbs/day
2,4-Dimethylphenol	2.29E+04 ug/l	4.13E+02 lbs/day
2,4-Dinitrotoluene	9.08E+01 ug/l	1.64E+00 lbs/day
2,6-Dinitrotoluene		
1,2-Diphenylhydrazine	5.39E+00 ug/l	9.70E-02 lbs/day
Ethylbenzene	2.89E+05 ug/l	5.21E+03 lbs/day
Fluoranthene	3.69E+03 ug/l	6.65E+01 lbs/day
4-Chlorophenyl phenyl ether		
4-Bromophenyl phenyl ether		
Bis(2-chloroisopropyl) ether	1.70E+06 ug/l	3.06E+04 lbs/day
Bis(2-chloroethoxy) methane		
Methylene chloride (HM)	1.60E+04 ug/l	2.88E+02 lbs/day
Methyl chloride (HM)		
Methyl bromide (HM)		
Bromoform (HM)	3.59E+03 ug/l	6.47E+01 lbs/day
Dichlorobromomethane(HM)	2.20E+02 ug/l	3.95E+00 lbs/day
Chlorodibromomethane (HM)	3.39E+02 ug/l	6.11E+00 lbs/day
Hexachlorocyclopentadiene	1.70E+05 ug/l	3.06E+03 lbs/day
Isophorone	5.99E+03 ug/l	1.08E+02 lbs/day
Naphthalene		
Nitrobenzene	1.90E+04 ug/l	3.41E+02 lbs/day
2-Nitrophenol		
4-Nitrophenol		
2,4-Dinitrophenol	1.40E+05 ug/l	2.52E+03 lbs/day
4,6-Dinitro-o-cresol	7.63E+03 ug/l	1.37E+02 lbs/day
N-Nitrosodimethylamine	8.08E+01 ug/l	1.46E+00 lbs/day
N-Nitrosodiphenylamine	1.60E+02 ug/l	2.88E+00 lbs/day
N-Nitrosodi-n-propylamine	1.40E+01 ug/l	2.52E-01 lbs/day
Pentachlorophenol	8.18E+01 ug/l	1.47E+00 lbs/day
Phenol	4.59E+07 ug/l	8.27E+05 lbs/day
Bis(2-ethylhexyl)phthalate	5.89E+01 ug/l	1.06E+00 lbs/day
Butyl benzyl phthalate	5.19E+04 ug/l	9.34E+02 lbs/day
Di-n-butyl phthalate	1.20E+05 ug/l	2.16E+03 lbs/day
Di-n-octyl phthlate		
Diethyl phthalate	1.20E+06 ug/l	2.16E+04 lbs/day
Dimethyl phthlate	2.89E+07 ug/l	5.21E+05 lbs/day
Benzo(a)anthracene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day
Benzo(a)pyrene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day
Benzo(b)fluoranthene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day
Benzo(k)fluoranthene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day
Chrysene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day
Acenaphthylene (PAH)		
Anthracene (PAH)		
Dibenzo(a,h)anthracene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day
Indeno(1,2,3-cd)pyrene (PAH)	3.09E-01 ug/l	5.57E-03 lbs/day

Pyrene (PAH)	1.10E+05 ug/l	1.98E+03 lbs/day
Tetrachloroethylene	8.88E+01 ug/l	1.60E+00 lbs/day
Toluene	2.00E+06 ug/l	3.59E+04 lbs/day
Trichloroethylene	8.08E+02 ug/l	1.46E+01 lbs/day
Vinyl chloride	5.24E+03 ug/l	9.43E+01 lbs/day
Pesticides		
Aldrin	1.40E-03 ug/l	2.52E-05 lbs/day
Dieldrin	1.40E-03 ug/l	2.52E-05 lbs/day
Chlordane	5.89E-03 ug/l	1.06E-04 lbs/day
4,4'-DDT	5.89E-03 ug/l	1.06E-04 lbs/day
4,4'-DDE	5.89E-03 ug/l	1.06E-04 lbs/day
4,4'-DDD	8.38E-03 ug/l	1.51E-04 lbs/day
alpha-Endosulfan	2.00E+01 ug/l	3.59E-01 lbs/day
beta-Endosulfan	2.00E+01 ug/l	3.59E-01 lbs/day
Endosulfan sulfate	2.00E+01 ug/l	3.59E-01 lbs/day
Endrin	8.08E+00 ug/l	1.46E-01 lbs/day
Endrin aldehyde	8.08E+00 ug/l	1.46E-01 lbs/day
Heptachlor	2.10E-03 ug/l	3.77E-05 lbs/day
Heptachlor epoxide		
PCB's		
PCB 1242 (Arochlor 1242)	4.49E-04 ug/l	8.09E-06 lbs/day
PCB-1254 (Arochlor 1254)	4.49E-04 ug/l	8.09E-06 lbs/day
PCB-1221 (Arochlor 1221)	4.49E-04 ug/l	8.09E-06 lbs/day
PCB-1232 (Arochlor 1232)	4.49E-04 ug/l	8.09E-06 lbs/day
PCB-1248 (Arochlor 1248)	4.49E-04 ug/l	8.09E-06 lbs/day
PCB-1260 (Arochlor 1260)	4.49E-04 ug/l	8.09E-06 lbs/day
PCB-1016 (Arochlor 1016)	4.49E-04 ug/l	8.09E-06 lbs/day
Pesticide		
Toxaphene	7.48E-03 ug/l	1.35E-04 lbs/day
Metals		
Antimony	ug/l	lbs/day
Arsenic	ug/l	lbs/day
Asbestos	ug/l	lbs/day
Beryllium		
Cadmium		
Chromium (III)		
Chromium (VI)		
Copper	ug/l	lbs/day
Cyanide	ug/l	lbs/day
Lead		
Mercury	ug/l	lbs/day
Nickel	ug/l	lbs/day
Selenium		
Silver		
Thallium	ug/l	lbs/day
Zinc		

Dioxin		
Dioxin (2,3,7,8-TCDD)	1.40E-07 ug/l	2.52E-09 lbs/day

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

	Class 4 Acute Agricultural ug/l	Class 3 Acute Aquatic Wildlife ug/l	Acute Toxics Drinking Water Source ug/l	Acute Toxics Wildlife ug/l	1C Acute Health Criteria ug/l	Acute Most Stringent ug/l	Class 3 Chronic Aquatic Wildlife ug/l
Aluminum		3873.4				3873.4	N/A
Antimony				42905.2		42905.2	
Arsenic	997.8	1860.3				997.8	1884.0
Barium							
Beryllium						0.0	
Cadmium	99.3	2.9				2.9	2.7
Chromium (III)		3685.2				3685.2	294.4
Chromium (VI)	970.9	70.0				69.98	74.07
Copper	1983.7	18.8				18.8	21.5
Cyanide		120.8	2195149.0			120.8	51.9
Iron		5250.6				5250.6	
Lead	997.3	96.8				96.8	6.4
Mercury		13.17		1.50		1.50	0.120
Nickel		920.5		45898.6		920.5	165.9
Selenium	488.3	104.5				104.5	35.3
Silver		1.5				1.5	
Thallium				62.9		62.9	
Zinc		188.5				188.5	333.6
Boron	6964.5					6964.5	
Sulfate	19955.9					19955.9	

Summary Effluent Limitations for Metals [Wasteload Allocation, TMDL]
[If Acute is more stringent than Chronic, then the Chronic takes on the Acute value.]

	WLA Acute ug/l	WLA Chronic ug/l	
Aluminum	3873.4	N/A	
Antimony	42905.19		
Arsenic	997.8	1884.0	Acute Controls
Asbestos			
Barium			
Beryllium			
Cadmium	2.9	2.7	
Chromium (III)	3685.2	294	
Chromium (VI)	70.0	74.1	Acute Controls
Copper	18.8	21.5	Acute Controls

Cyanide	120.8	51.9	
Iron	5250.6		
Lead	96.8	6.4	
Mercury	1.497	0.120	
Nickel	920.5	166	
Selenium	104.5	35.3	
Silver	1.5	N/A	
Thallium	62.9		
Zinc	188.5	333.6	Acute Controls
Boron	6964.54		
Sulfate	19955.9		N/A at this Waterbody

Other Effluent Limitations are based upon R317-1.

E. coli	126.0	organisms per 100 ml

X. Antidegradation Considerations

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

An Antidegradation Level I Review was conducted on this discharge and its effect on the receiving water. Based upon that review, it has been determined that an Antidegradation Level II Review is not required. The proposed permit is a simple renewal, with no increase in flow or concentration over that which was approved in the existing permit.

XI. Colorado River Salinity Forum Considerations

Discharges in the Colorado River Basin are required to have their discharge at a TDS loading of less than 1.00 tons/day unless certain exemptions apply. Refer to the Forum's Guidelines for additional information allowing for an exceedence of this value.

XII. Summary Comments

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

Prepared by:
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EB_SpanishForkWLA_3-7-19.xls

ALLOWABLE EFFLUENT CONCENTRATION/LOADING FOR CONSERVATIVE SUBSTANCES

Date of Analysis: 3/7/2019

This Calculates the Allowable Effluent Concentration/Loading for Conservative Substances in a Receiving Water Discharge 001

Conservative Substance:	Nitrate Nitrogen
Acute or Chronic Standard	Chronic
Discharger:	Ensign Bickford
Receiving Water:	Spanish Fork River
Classification:	2B, 3B, 3D, 4
For the Season / Year	Yearly Average

Assumptions:
1) Conservative Substance
2) Complete mixing
3) Background Flow 7Q10 =30 mg/l
4) Background Concentration 1 mg/l
5) Calculation utilizes 100% of mixed assimilative capacity

Receiving Water Information - Spanish Fork River

Flow, cfs	30.000
Flow, cfs (Acute)	15.000
Nitrate Nitrogen, mg/l	1.00000
Nitrate Nitrogen Load, lbs/day	161.70

Stream Standard

Nitrate Nitrogen, mg/l	10.0000
Allowable Loading Before Mix:	1617.00 lbs/day
Acute / Chronic Standard [Toxics]	Chronic

Combined Effluent/Receiving Water Information

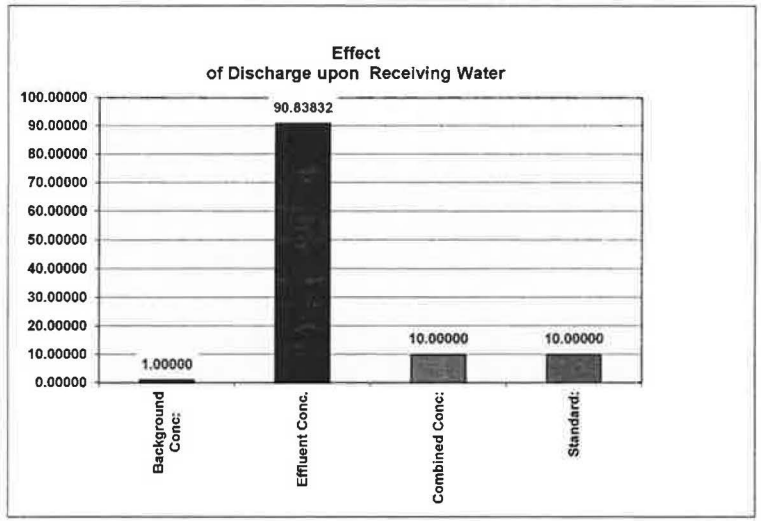
Flow, cfs	33.340 cfs
Nitrate Nitrogen, mg/l	**10.00000** mg/l
Concentration Delta Increase, mg/l	9.00000 mg/l [Delta]
Percent Increase:	9.00

Summary

Background Conc:	1.00000 mg/l
Effluent Conc.	90.83832 mg/l
Combined Conc:	10.00000 mg/l
Standard:	10.00000 mg/l
Percent Change	9.00

Effluent Information [Proposed] Ensign Bickford

Flow, cfs	3.3400
Flow, MGD	
Flow, cfs	3.340
Nitrate Nitrogen, mg/l	90.83832
Nitrate Nitrogen Load, lbs/day	1635.33
Nitrate Nitrogen Load, kg/day	741.78
Nitrate Nitrogen Load, lbs/year	596,893.99
Nitrate Nitrogen Load, kg/year	270,751.11
Nitrate Nitrogen Load, tons/day	0.8177
Nitrate Nitrogen Load, tons/year	298.4
Dilution Ratio: (background:discharge)	8.98
Percent of Stream Flow Used in Calc.	100%



Flow Range Dependent Nitrate Nitrogen Effluent Limits

Flow (cfs)	Nitrate N
0.00 -0.56	492.1429
0.57 -1.11	253.2432
1.12-1.67	171.6766
1.68-2.23	131.0762
2.24-2.79	106.7742
2.8-3.34	90.8383

ALLOWABLE EFFLUENT CONCENTRATION/LOADING FOR CONSERVATIVE SUBSTANCES

Date of Analysis: 3/7/2019

This Calculates the Allowable Effluent Concentration/Loading for Conservative Substances in a Receiving Water — Discharge 001

Conservative Substance:	RDX
Acute or Chronic Standard	Chronic
Discharger:	Ensign Bickford
Receiving Water:	Spanish Fork River
Classification:	2B, 3B, 3D, 4
For the Season / Year	Yearly Average

Assumptions:
1) Conservative Substance
2) Complete mixing
3) Background Flow 7Q10 =30 mg/l
4) Background Concentration 0.000001 mg/l
5) Calculation utilizes 100% of mixed assimilative capacity

Receiving Water Information - Spanish Fork River

Flow, cfs	30.000
Flow, cfs (Acute)	15.000
RDX, mg/l	0.00000
RDX Load, lbs/day	0.00

Stream Standard

RDX, mg/l	0.0020
Allowable Loading Before Mix:	0.32 lbs/day
Acute / Chronic Standard [Toxics]	Chronic

Effluent Information [Proposed] Ensign Bickford

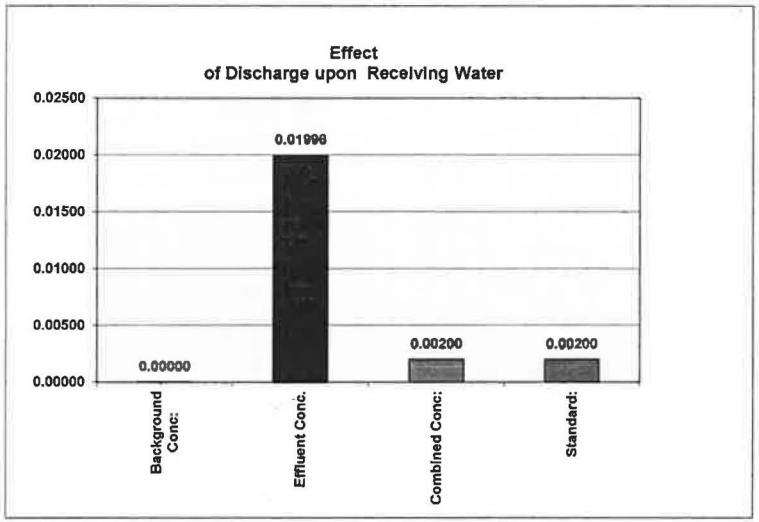
Flow, cfs	3.3400
Flow, MGD	
Flow, cfs	3.340
RDX, mg/l	0.01996
RDX Load, lbs/day	0.36
RDX Load, kg/day	0.16
RDX Load, lbs/year	131.12
RDX Load, kg/year	59.48
RDX Load, tons/day	0.0002
RDX Load, tons/year	0.1
Dilution Ratio: (background:discharge)	8.98
Percent of Stream Flow Used in Calc.	100%

Combined Effluent/Receiving Water Information

Flow, cfs	33.340 cfs
RDX, mg/l	**0.00200** mg/l
Concentration Delta Increase, mg/l	0.00200 mg/l [Delta]
Percent Increase:	1999.00

Summary

Background Conc:	0.00000 mg/l
Effluent Conc.	0.01996 mg/l
Combined Conc:	0.00200 mg/l
Standard:	0.00200 mg/l
Percent Change	1999.00



Flow Range Dependent RDX Effluent Limits

Flow (cfs)	RDX mg/l
0.00 -0.56	0.1091
0.57 -1.11	0.0560
1.12-1.67	0.0379
1.68-2.23	0.0289
2.24-2.79	0.0235
2.8-3.34	0.0200