Jacobs

Memorandum

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Subject	**Supporting Information for Level II Antidegradation Review Great Salt Lake Outfall Relocation Project**
Attention	North Davis Sewer District
From	Jacobs Engineering Group Inc.
Date	January 21, 2021
Copies to	Utah Division of Water Quality

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1/21/21
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The purpose of this memorandum is to provide documentation in support of the Level II Antidegradation Review (ADR) application form prepared and submitted by the North Davis Sewer District (NDSD) to the Utah Division of Water Quality (DWQ) in support of its Great Salt Lake Outfall Relocation Project. The memorandum is organized to provide an overview of the background, need & purpose for the project and address each of the relevant sections of the application form.

1. Background, Need & Purpose

CH2M 2017a provides a summary of the background, need, purpose and rational for NDSD's original request for a variance from the Technology Based Phosphorus Effluent Limit (TBPEL) (NDSD 2017). NDSD's variance request was approved by DWQ on March 11, 2019 (DWQ 2019). Jacobs 2019d also provides an overview of the background, need and purpose for the proposed project.

1.1 Background

The need to protect the water quality of waterbodies downstream of the communities it serves (such as Farmington Bay and Great Salt Lake) was the genesis of NDSD and remains its primary purpose. Even as NDSD meets and/or exceeds regulatory requirements for the quality of its treated effluent, the existing water quality of Farmington Bay remains a concern to Great Salt Lake stakeholders including the surrounding communities, land owners, conservation groups and resource and regulatory agencies.

1.2 Need

NDSD initiated the development of a Nutrient Management Master Plan study in 2017 to define an effective and efficient strategy to meet the TBPEL and other future potential regulatory requirements. NDSD sought a cost-effective alternative that provided it with regulatory certainty while protecting its effluent flows to Great Salt Lake. CH2M 2017a and Jacobs 2019d provide further discussion of the need for this project.

1.3 Purpose

"The purpose [and objective] of the project is to develop and implement a nutrient management plan that does the following:

1. Identifies [and implements] alternatives that meet the impending regulatory requirements of the TBPEL and other potential future effluent limits for nutrients. NDSD's mission is to meet and/or exceed regulatory requirements and protect the water quality of receiving water bodies. This project explores alternatives that may be more beneficial than a No-Action Alternative.

2. Maximizes the benefit of NDSD's effluent to Great Salt Lake and the public. NDSD seeks to invest in alternatives that (1) improve the water quality of Farmington Bay and (2) maximize the probability that NDSD's effluent will continue to flow into Great Salt Lake into the future.

3. Guides capital investment. NDSD does not want to make short-sighted or unnecessary water reclamation facility (WRF) improvements that need to be torn out, abandoned, and replaced because of new, more stringent nutrient regulatory requirements in the near future (Jacobs 2019d)."

2. Part A, Applicant Information

See the application form.

3. Part B, Is a Level II ADR Required?

DWQ's Level I ADR (DWQ 2020) determined that a Level II ADR is required for this project.

4. Part C, Is Degradation from the Project Socially and Economically Necessary?

This section provides information in support of the requirements in DWQ's Level II ADR application form, Part C.

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

Ensuring fiscal responsibility and maximizing the benefits of its facilities and operations to the communities within its service area and surrounding environment is critical to NDSD's mission. The stated mission of the NDSD is to: "Operate and maintain wastewater collection and treatment facilities to exceed regulatory requirements; serve the public with integrity and skill; develop, challenge, and reward an outstanding work team; and foster a commitment to excellence, value, continuous improvement, and pride in the operation of all aspects of the District's facilities with a goal of creating and sustaining a world class operation."

NDSD evaluated numerous alternatives to achieve the stated objective of this project. These alternatives were aggregated into six primary alternatives and were evaluated for their potential benefits and impacts to the communities NDSD serves and to Great Salt Lake and the environment. A complete analysis of the six alternatives, including an evaluation of their social and economic benefits is included in Jacobs 2019d. The six alternatives included:

1. No-Action Alternative: Chemical removal of total phosphorus to comply with the TBPEL at Outfall 001.

2. No-Action Alternative: A new Water Reclamation Facility to comply with the TBPEL and potential future, more stringent nutrient limits at Outfall 001.
3. No-Action Alternative: A new Water Reclamation Facility to limit water quality impacts to Farmington Bay by treating effluent to be "reused" in the communities for potential potable or non-potable uses.
4. Alternative No. 1. Relocate the discharge of treated effluent to a new Outfall 002 to Ogden Spur in Gilbert Bay, Great Salt Lake.
5. Alternative No. 2. Relocate the discharge of treated effluent to a new Outfall 002 to Ogden Spur and Outfall 003 in Gilbert Bay, Great Salt Lake.
6. Alternative No. 3. Relocate the discharge of treated effluent to a new Outfall 003 in Gilbert Bay, Great Salt Lake.

These alternatives were discussed with DWQ and Great Salt Lake stakeholders via individual conversations, meetings with groups of stakeholders and resource and regulatory agencies, and at the Great Salt Lake Advisory Council. Alternative No. 3 was developed as a result of this collaboration and selected by NDSD and DWQ as providing the maximum social and economic benefit and minimum impact among the alternatives considered.

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

"As stated in its mission statement, NDSD's intent is not to simply meet regulatory requirements but to exceed them. Rather than simply meet an end-of-pipe TBPEL, NDSD proposes an "innovative alternative approach" to the TBPEL designed to both offset benefits from simply meeting the TBPEL in Farmington and maximize the benefit to and long-term protection of the beneficial uses in both Farmington Bay and Gilbert Bay (CH2M 2017a)". CH2M 2017a provides the key rationale for NDSD's request for a variance from the TBPEL (NDSD 2017) and anticipated environmental benefits. This variance request was reviewed by DWQ, modified to address concerns and remaining questions, finalized as part of the variance request (CH2M 2017a and NDSD 2017), and approved by DWQ on March 11, 2019 (DWQ 2019).

As stated above, Jacobs 2019d provides an overview of the numerous alternatives that were considered. The document also provides an analysis of the potential benefits and impacts to Great Salt Lake and the environment and illustrates that the proposed project (Alternative No. 3 – New Outfall 003 to Gilbert Bay) provides the maximum social and economic benefit and minimum impact among the alternatives considered. Further, Jacobs 2020d provides an overview of the rationale and design considerations for Outfall 003 to Gilbert Bay, including how potential impacts to Gilbert Bay were considered and addressed.

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

Jacobs 2019d provides an overview of the numerous alternatives that were considered and an analysis of the potential benefits and impacts to NDSD and its constituents. The No-Action Alternative provides the required certainty of meeting current and future water quality regulations only at the highest expense and the likely loss of all flow contributing to Farmington Bay and Great Salt Lake. Alternative No. 3 provides the required regulatory certainty while maximizing social and economic benefits, minimizing social and economic impacts and balancing these with benefits and impacts to the environment (Jacobs 2019d).

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

As described in CH2M 2017a, Jacobs 2019d, and Jacobs 2020d, the selected alternative (Alternative No. 3 - New Outfall 003 to Gilbert Bay) provides the most significant removal of pollutant loads from Farmington Bay at the least cost and relocates the pollutant load to the much larger, naturally nitrogen limited and less sensitive Gilbert Bay. There are already concerns about the impacts that growth has had upon Farmington Bay. Alternative No. 3 (New Outfall 003 to Gilbert Bay) effectively offsets benefits from simply meeting the TBPEL in Farmington Bay and provides NDSD with capacity (Jacobs 202c) and regulatory certainty well into the future.

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

Jacobs 2019d provides an overview of the proposed facilities for each of the alternatives considered. The no-action alternatives (treatment process upgrades) generally do not change facilities within or adjacent to the receiving water, however, will likely lead to the loss of treated effluent contributed to both Farmington Bay and Great Salt Lake. Alternative Nos. 1, 2 and 3 each include a new outfall(s) to Great Salt Lake. Jacobs 2020c and 2020e provide a more detailed description of the structures that are part of the selected alternative (Alternative No. 2 - New Outfall 003 to Gilbert Bay).

Jacobs 2020d provides an overview of the rationale and design considerations for Outfall 003 to Gilbert Bay. The outfall structure at Outfall 003 has been designed so that the ultimate invert elevation of the channel will be ~4190 feet (NVGD 29). A shallow ditch will be excavated downstream of the riprap channel to extend the outfall to the open water if lake levels are below 4194.0 feet (NVGD 29). The objective of the ditch is to facilitate a direct connection of the outfall structure to the open water of Gilbert Bay.

5. Part D, Identify and Rank Parameters of Concern

This section provides an overview of the analysis completed to identify, evaluate, and rank parameters of concern (POC). POC are parameters in the treated effluent that have concentrations that exceed ambient concentrations in the receiving water, such as Gilbert Bay.

Table 1 provides a summary of potential POC including a comparison of effluent concentrations versus ambient concentrations in Gilbert Bay, NDSD's permitted UPDES effluent limits, and Gilbert Bay and freshwater water quality criteria. As highlighted in Table 1, only copper, ammonia, chromium^{3+}, chromium^{6+}, nickel and zinc have effluent concentrations that exceed available data describing ambient concentrations in Gilbert Bay and thus are considered POC. Table 1 includes a ranking of all potential POC based first upon prioritization by DWQ (2020) and then the computed toxic weighting assimilative capacity factor. Note that the ranking of potential POC in Table 1 includes parameters that were not defined as POC. Table 2 provides a summary of analytical results from NDSD's required quarterly discharge monitoring reports.

A key objective of this project (Alternative No. 3 – New Outfall 003 to Gilbert Bay) is to relocate the vast majority of NDSD's treated effluent, along with all of its potential pollutants and POC, from the potentially impaired waters of Farmington Bay to the much larger, naturally nitrogen limited, and less sensitive Gilbert Bay. As discussed in CH2M 2017a and DWQ 2020, although the effluent concentration of some POC do exceed ambient concentrations from available data describing Gilbert Bay (copper, ammonia, chromium^{3+}, chromium^{6+}, nickel and zinc), all POC had a very low toxic weighting assimilative capacity factor (Table 1) and are expected to have minimal impacts to uses in the less sensitive Gilbert Bay. This project provides a direct and significant benefit to Farmington Bay with minimal impact to Gilbert Bay.

Table 1. Summary of Results of Determination of POC Assimilative Capacity

All potential parameters of concern are listed; proposed parameters of concern are highlighted.

Parameter of Concern	Effluent Concentration[a] (mg/L)	Ambient Concentration[d] (mg/L)	UPDES Effluent Limit[f] (mg/L)	Gilbert Bay Water Quality Criteria[g] (mg/L)	Freshwater Water Quality Criteria[h] (mg/L)	Assimilative Capacity		Toxic Weighting Factor[i]	Toxic Weighting-Assimilative Capacity Factor	Rank[j]
						Used	Available			
Copper	0.0091	0.0069			0.0293	24%	76%	0.630	0.15	1
Cyanide	0.0038				0.0052			1.1	0.00	2
Free Cyanide	0.0074				0.0052			1.1	0.00	3
Ammonia[e]	5.73	1.18	4.4		4.4	27%	73%	0.0025	0.00	4
Mercury[b]	0.0000016	0.0000075			0.000012	63%	38%	120.00	75.00	5
Arsenic	0.0081	0.112			0.15	75%	25%	3.5	2.61	6
Lead[b]	0.002	0.0028			0.0109	26%	74%	2.2	0.56	7
Selenium	0.0008	0.0009			0.0046	20%	80%	1.1	0.22	8
Cadmium	0.0001	0.0001			0.0020	5%	95%	2.6	0.13	9
Cr VI	0.0019	0.0005			0.011	5%	95%	0.51	0.02	10
Nickel	0.0023	0.0014			0.1680	1%	99%	0.11	0.00	11
Zinc	0.025	0.0047			0.3824	1%	99%	0.047	0.00	12
Cr III	0.0014	0.0005			0.2307	0%	100%	0.076	0.00	12
Silver	0.0006				0.03491	0%	100%	16	0.00	12
Molybdenum[c]	0.0037	0.046						0.2	0.00	12
Total Res. Chlorine	0.73				0.011			0.5	0.00	12
E. coli	11.46		126						0.00	12
pH	7.53		6.5-9		6.5-9				0.00	12
Total Phosphorus	1.5	0.3						0	0.00	12
TKN	7.42								0.00	12
Nitrate	14.16							0.0007467	0.00	12
Nitrite	0.54							0.0032	0.00	12

Assimilative Capacity Used = (Ambient Concentration/Water Quality Criteria) * 100

Assimilative Capacity Available = 100 – Assimilative Capacity Used

Legend	
	Parameter of Concern

[a] Mean value from NDSD Quarterly Reports (Sept 2015 - Jun 2020), non-detect values were treated as 0.5*MDL.

[b] 80th percentile value reported for bioaccumulative toxics rather than the mean value, non-detect values were treated as 0.5*MDL.

[c] Ambient value for molybdenum from Johnson et al. 2008

[d] Taken from Adams et al. 2015. Ambient values not available for the remaining parameters.

[e] Ambient value from sample of Gilbert Bay water collected by NDSD 2020.

[f] From existing North Davis Sewer District UPDES permit

[g] The only numeric water quality criteria for Gilbert Bay is a selenium tissue standard.

[h] Water quality criteria for dissolved metals adjusted for hardness of 400 mg/L, Note that hardness in Gilbert Bay= 18,350 mg CaCO3/L (USGS NWIS Site 4)

[i] Toxic Weighting Factor taken from udwq_adr_spreadsheet_tools_v1.0_v1.xls and WQ Reference Pollutant Parameters (https://echo.epa.gov/trends/loading-tool/resources#pollutant)

[j] Ranked first by parameters identified by DWQ's Reasonable Potential analysis (each had individual samples that exceeded DWQ screening limits) and second by the toxic weighting assimilative capacity factor.

Table 2. Quarterly Analytical Results from NDSD effluent Discharge Monitoring Reports

	CN	Free CN	As	Cd	Cr III	Cr VI	Cu	Pb	Ni	Ag	Zn	Mo	Se	Hg[a]
Sep-2015		0.0138	0.00911	0.0000371	0.000955	0.00246	0.00477	0.000224	0.00204	0.0000391	0.0298	0.00339	0.000411	0.0000001
Dec-2015		0.00557	0.00704	0.0000371	0.000955	0.00246	0.00596	0.000224	0.00166	0.000116	0.0137	0.00328	0.000301	0.0000015
Mar-2016		0.0103	0.00758	0.0000371	0.00333	0.00333	0.0121	0.00264	0.00202	0.0000244	0.0258	0.00454	0.0000634	0.0000035
Jun-2016		0.0118	0.00667	0.0000371	0.000955	0.00246	0.00673	0.000235	0.00284	0.000116	0.0229	0.00358	0.000254	0.0000018
Sep-2016	0.00181	0.00976	0.0102	0.0000371	0.000955	0.00246	0.00362	0.000224	0.0015	0.000116	0.0165	0.00367	0.000322	0.0000001
Dec-2016	0.00181	0.005	0.00765	0.0000371	0.000955	0.00246	0.00574	0.000188	0.00202	0.000116	0.016	0.00419	0.000497	0.0000001
Mar-2017		0.00948	0.00889	0.0000371	0.000229	0.000229	0.00567	0.000224	0.00192	0.000116	0.0282	0.00428	0.000602	0.00000127
Jun-2017		0.0138	0.00755	0.0000371	0.00037	0.00037	0.00717	0.000224	0.0017	0.000116	0.0207	0.0031	0.000272	0.0000013
Sep-2017	0.00181	0.00181	0.0088	0.0000371	0.00053	0.00053	0.00668	0.000224	0.00325	0.000116	0.0216	0.00324	0.000419	0.0000025
Dec-2017	0.00224	0.0104	0.00748	0.0000371	0.000396	0.000396	0.00876	0.000224	0.00264	0.000116	0.0216	0.00358	0.000478	0.0000001
Mar-2018	0.00181	0.00181	0.00592	0.0000371	0.000893	0.000893	0.0046	0.000224	0.0028	0.000116	0.0332	0.00387	0.000333	0.0000001
Jun-2018	0.0157	0.00181	0.00712	0.0001	0.00198	0.00198	0.00733	0.000224	0.00223	0.000116	0.0241	0.00316	0.000404	0.0000001
Sep-2018	0.00181	0.00181	0.0083	0.0000371	0.000955	0.00246	0.00361	0.000224	0.00217	0.000116	0.018	0.00277	0.000254	0.0000001
Dec-2018	0.00181	0.00415	0.00728	0.0000371	0.000955	0.00246	0.00396	0.000224	0.00202	0.000506	0.0188	0.00331	0.000461	0.0000001
Mar-2019	0.00181	0.005	0.00934	0.00005	0.002	0.002	0.00685	0.002	0.00161	0.002	0.0243	0.00399	0.002	0.0000012
Jun-2019	0.00181	0.005	0.00934	0.0005	0.002	0.002	0.00685	0.002	0.00161	0.002	0.0243	0.00399	0.002	0.0000012
Sep-2019	0.00181	0.00854	0.0133	0.000164	0.00407	0.00407	0.066	0.000999	0.00431	0.002	0.0672	0.00433	0.002	0.0000015
Dec-2019	0.00362	0.00362	0.00743	0.0000445	0.000956	0.000956	0.00448	0.000224	0.00282	0.000116	0.0193	0.00328	0.000287	0.000001
Mar-2020	0.00181	0.0102	0.00578	0.0005	0.002	0.002	0.00563	0.002	0.00239	0.002	0.0293	0.00326	0.002	0.000001
Jun-2020	0.0132	0.0149	0.00688	0.0005	0.002	0.002	0.0058	0.002	0.00299	0.002	0.0248	0.00422	0.002	0.0000198
Mean	0.0038	0.0074	0.0081	0.0001	0.0014	0.0019	0.0091	0.0007	0.0023	0.0006	0.0250	0.0037	0.0008	0.0000019
8oth %	0.002792	0.01068	0.009156	0.0001128	0.002	0.00246	0.007202	0.002	0.002824	0.002	0.02842	0.004196	0.002	0.00000156

[a] Note that NDSD completed mercury analyses prior to June 2020; AWAL started mercury analyses in June 2020. AWAL's MDL for mercury is higher than DWQ's screening limits. NDSD is updating methods to address this.

Legend

Light blue	No data
Red	Exceeds both acute and chronic limits
Green	Nondetect (0.5*MDL)
Yellow	Exceeds chronic limit

Note: all values are mg/L

DWQ's Screening Limits per Waste Load Allocation

	CN	Free CN	As	Cd	Cr III	Cr VI	Cu	Pb	Ni	Ag	Zn	Mo	Se	Hg
Acute Criteria	0.022	0.022	0.1	0.007	5.612	0.016	0.0517	0.1	1.516	0.0411	0.3879		0.02	0.0015
Chronic Criteria	0.0052	0.0052	0.19	0.0025	0.268	0.011	0.0305	0.0186	0.0169		0.3879		0.0046	0.000012

Laboratory Analytical Limits

	CN	Free CN	As	Cd	Cr III	Cr VI	Cu	Pb	Ni	Ag	Zn	Mo	Se	Hg
AWAL MDL (mg/L)	0.00362	0.00362	0.000298	0.0000742	0.00191	0.00492	0.00166	0.000448	0.000728	0.000232	0.00418	0.000652	0.000508	0.0000396
AWAL RL (mg/L)	0.005	0.005	0.002	0.0005	0.002	0.005	0.003	0.002	0.002	0.002	0.006	0.002	0.002	0.00009
NDSD MDL mg/L (NDSD completed mercury analyses prior to June 2020)														0.0000002

DWQ completed a Reasonable Potential analysis and Level I ADR for Outfall 003 and identified potential POC that exceed EPA screening criteria (DWQ 2020). These included:

1. **Ammonia**: While there is very limited data on ambient ammonia concentrations in Gilbert Bay, ammonia concentrations in the treated effluent are expected to exceed ambient concentrations in Gilbert Bay and 2013 EPA ammonia screening criteria for freshwater. Thus, ammonia is included as a POC in Table 1.

   As described in DWQ 2020, no data is available to describe the toxicity of ammonia in Gilbert Bay, but the toxicity of ammonia is expected to decrease in marine waters and decreases with increasing salinity. Thus, ammonia would be expected to be less toxic in Farmington Bay than in freshwater and less toxic in Gilbert Bay than in Farmington Bay. Further, unpublished data suggest that brine shrimp may be more tolerant of ammonia than most aquatic organisms. This rationale, along with expected dilution of the treated effluent with the open waters of Gilbert Bay, lead to a determination that current effluent concentrations will have minimal impact in Gilbert Bay and much less of an impact than they currently do in Farmington Bay.

2. **Chromium**: Initial chromium^{3+} and chromium^{6+} concentrations submitted to DWQ included one data point (June 2019) that exceeded the screening criterion (Table 2). NDSD has been able to verify that this was a data transcription error and all chromium concentrations fall below screening criterion and freshwater numeric water quality criteria.

   Effluent concentrations do, however, exceed available ambient concentrations for chromium in Gilbert Bay, thus both chromium^{3+} and chromium^{6+} are listed as POC in Table 1. An evaluation of toxicity using freshwater toxic weighting factors indicates that these concentrations will likely have minimal impact to the uses of Gilbert Bay (Table 1), especially if one considers likely dilution and the typically even lower sensitivities of uses in the high salinities of Gilbert Bay. Thus, current effluent concentrations are expected to have minimal impact in Gilbert Bay and much less of an impact than they currently do in Farmington Bay.

3. **Copper**: One NDSD sample had a copper concentration (September 2019) that exceeded screening criterion (Table 2). This one datapoint was more than seven times the average concentration reported by NDSD. NDSD will increase the frequency of its monitoring for copper to determine if this was an outlier and, if it does represent a concern, develop a strategy to control copper concentrations of influent to the WRF.

   NDSD's average effluent copper concentration exceeded the available ambient concentrations for copper in Gilbert Bay, thus is listed as a POC in Table 1. Even so, DWQ determined in its analysis that this one datapoint of 66 ug/L was less than the no-observed-effects-concentration of 459 ug/L and thus would not adversely impact the uses of Gilbert Bay. An evaluation of toxicity using freshwater toxic weighting factors indicates that these concentrations will likely have minimal impact to the uses of Gilbert Bay (Table 1), especially if one considers likely dilution and the typically even lower sensitivities of uses in the high salinities of Gilbert Bay. Thus, current effluent concentrations are expected to have minimal impact in Gilbert Bay and much less of an impact than they currently do in Farmington Bay.

4. **Mercury**: Initial mercury concentrations submitted to DWQ included one data point (June 2020) that exceeded the screening criterion (Table 2). NDSD has been able to confirm that this water sample was analyzed using a different method with a method detection limit that exceeds screening criterion (the analyzer that had been previously used had broken down). Thus, this June 2020 value was reported using the reporting limit and exceeded the screening criterion. NDSD is in the process of modifying its methods to report concentrations below the screening criterion and confirm its effluent is still following its historic pattern of mercury concentrations that are well below screening criterion.

   NDSD's effluent concentrations are below the available ambient concentrations for mercury in Gilbert Bay, thus, although it has the potential for toxicity, mercury is not considered a POC in Table 1.

5. **Cyanide**: NDSD's dataset includes multiple data points that exceed chronic screening criterion for cyanide and free cyanide (Table 2). Free cyanide is the only parameter that had a reported average concentration that exceeded chronic screening criterion. NDSD will be increasing the frequency of its monitoring program for cyanide and free cyanide to determine if and how to further minimize potential risks associated with these parameters.

   No ambient concentrations of cyanide or free cyanide in Gilbert Bay are available. Cyanide and free cyanide are not identified as POC in Table 1, however, are ranked high in the list potential POC and will be further examined in the future. While free cyanide can be toxic to a wide variety of organisms, no toxicity has been observed in NDSD effluent during acute or chronic WET testing. Further, an evaluation of toxicity using freshwater toxic weighting factors indicates that these concentrations will likely have minimal impact to the uses of Gilbert Bay (Table 1), especially if one considers likely dilution and the typically even lower sensitivities of uses in the high salinities of Gilbert Bay. The proposed project is expected to significantly reduce potential impacts of cyanide and free cyanide in Farmington Bay with minimal impacts in Gilbert Bay.

6. **Chlorine**: NDSD's reported effluent concentrations of total residual chlorine (TRC) exceed acute and chronic screening criteria but are below its permitted effluent limits. No ambient concentrations of TRC in Gilbert Bay are available, however, although Gilbert Bay has high NaCl concentrations, effluent concentrations of TRC are expected to be higher than ambient conditions. As a result, TRC was identified by DWQ as a POC. Effluent TRC concentrations are expected to decline as the effluent is aerated through the new Outfall 003 energy dissipator before flowing into Gilbert Bay. Dilution of the effluent is also expected to be greater at Outfall 003 than at Outfall 001.

Effluent concentrations of both nickel and zinc do exceed available ambient concentrations in Gilbert Bay and thus are identified as POC in Table 1. An evaluation of toxicity using freshwater toxic weighting factors indicates that the concentrations for both nickel and zinc will likely have minimal impact to the uses of Gilbert Bay (Table 1), especially if one considers likely dilution and the typically even lower sensitivities of uses in the high salinities of Gilbert Bay. Thus, current effluent concentrations are expected to have minimal impact in Gilbert Bay and much less of an impact than they currently do in Farmington Bay.

Nutrients in Gilbert Bay are a subject of current research. However, as discussed in CH2M 2017a, DWQ 2019 and Jacobs 2019d, Gilbert Bay is known to be naturally nitrogen limited and less sensitive to nutrients than Farmington Bay. The proposed project is an "innovative, alternative approach" to meeting current and likely future nutrient effluent limits with minimal impacts to Gilbert Bay and much less of an impact than they currently do in Farmington Bay.

The remaining parameters were not considered as POCs as they are below screening criterion, below ambient concentrations in Gilbert Bay and are expected to have minimal impact in Gilbert Bay and much less of an impact than they currently do in Farmington Bay.

6. Part E, Alternative Analysis

This section provides information in support of the requirements in DWQ's Level II ADR application form, Part E. NDSD initially considered various treatment alternatives to meet current TBPEL and likely future nutrient limit requirements, but then began evaluation of alternatives for the relocation of its outfall when doing so appeared justifiable. Although NDSD can answer "Yes" to E1 and proceed to Section F, the following narrative is provided to answer each of the questions.

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

Yes, NDSD's proposed project does not change flow or effluent concentrations. NDSD has fully considered its treatment and discharge options including changes in treatment process, operations and maintenance. Pollutant trading, water recycling/reuse, land application, facility upgrades, improved operations and maintenance, seasonal or controlled discharges, new construction and no discharge (i.e., reuse) were all options that were considered in terms of benefits and impacts to NDSD, the communities it serves and the environment it is part of.

NDSD uniquely considered the water quality and ecology downstream of its outfall location and determined that the proposed alternative (Alternative No. 3 – New Outfall 003 to Gilbert Bay) is the least degrading, the least polluting and provides the most benefit and least impact to NDSD and the communities it represents, Farmington Bay and Great Salt Lake (Jacobs 2019d).

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

NDSD completed a draft nutrient management plan (CH2M 2017b) that resulted in the recommendation of pursuing an "innovative, alternative approach" as proposed in CH2M 2017a and NDSD 2017. As a result of pursuing Alternative Nos. 1-3 and relocating the outfall to Gilbert Bay, the draft nutrient management plan was not finished or published.

Jacobs 2021a provides an updated evaluation of potential total phosphorus loads to Farmington Bay for four scenarios (Table 3):

- Scenario 1—NDSD continues to use Outfall 001 (no new outfalls to Gilbert Bay) without any new TP reductions.
- Scenario 2—NDSD continues to use Outfall 001 (no new outfalls to Gilbert Bay) with a new effluent TP limit of 1.0 milligrams per liter (mg/L).
- Scenario 3—NDSD continues to use Outfall 001 (no new outfalls to Gilbert Bay) with a new effluent TP limit of 0.1 mg/L.

- Scenario 4—NDSD implements Alternative No. 3 with a new Outfall 003 to Gilbert Bay sized for a capacity of 34 mgd with peak flows greater than 34 mgd directed to Outfall 001 without any new TP reductions.

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

NDSD completed a draft nutrient management plan (CH2M 2017b) that resulted in the recommendation of pursuing an "innovative, alternative approach" as proposed in CH2M 2017a and NDSD 2017. As a result of pursuing Alternative Nos. 1-3 and relocating the outfall to Gilbert Bay, the draft nutrient management plan was not finished or published. Estimated costs for the conceptual design of treatment alternatives (as provided in CH2M 2017b and updated to 2020 dollars) and proposed Outfall 003 are provided in Table 4.

Table 3. Estimated NDSD Total Phosphorus Loading to Farmington Bay Under Each Scenario (Existing Outfall 001 to Farmington Bay)

Scenario	TP Effluent Conc. (mg/L)	Total Annual Load (kg)	Total Annual Load (lbs)
NDSD Continues to Use Outfall 001 Without Any New TP Reductions	1.5	41,973	92,341
NDSD Continues to Use Outfall 001 with a New Effluent TP Limit of 1.0 mg/L	1.0	28,346	62,361
NDSD Continues to Use Outfall 001 with a New Effluent TP Limit of 0.1 mg/L	0.1	2,835	6,236
NDSD Implements Alternative No. 3 with a New Outfall 003 to Gilbert Bay	1.5	104	229

Table 4. Updated Costs from Conceptual Analysis of No-Action Treatment Alternatives versus Proposed Alternative No. 3

Cost	No-Action Treatment Alternatives			Proposed Alternative No. 3 New Outfall 003 to Gilbert Bay
	Option 1 – Chemical P Removal with Tertiary Filters (TP < 0.1 mg/L)	Option 2 – EBPR removal with Tertiary Filters (TP < 0.1 mg/L)	Option 3 - BNR with Tertiary Filters (TP < 0.1 mg/L, TN < 10 mg/L)	
Construction Cost	$42,000,000	$71,200,000	$117,000,000	$45,700,000
Annual O&M Cost	$2,246,000	$2,171,000	$3,458,000	$238,500
20-year Life Cycle Cost	$78,933,000	$106,899,000	$173,879,000	$49,622,000

Note: I = 5%, n = 20, annual inflation = 3%

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

See E1 and the table on application form. All suggested alternatives were considered and none were found to be feasible, affordable or met the stated project purpose.

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

The proposed alternative (Alternative No. 3 – New Outfall 003 to Gilbert Bay) is the least degrading, the least polluting and provides the most benefit and least impact to Farmington Bay and Great Salt Lake (Jacobs 2019d).

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

The proposed alternative (Alternative No. 3 – New Outfall 003 to Gilbert Bay) is the least degrading, the least polluting and provides the most benefit and least impact to Farmington Bay and Great Salt Lake (Jacobs 2019d).

7. Part F, Optional Information

F1. Does the applicant want to conduct optional public review(s) in addition to the mandatory public review?

No additional public review is requested. NDSD has made it a priority to communicate and collaborate with interested stakeholders throughout project development to identify and then develop the proposed alternative. Alternative No. 3 is what it is because of input from the public, communities, Great Salt Lake stakeholders, and State agencies.

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

NDSD has proposed to implement a 3-year phragmites control program (with State oversight) to significantly reduce or eliminate 500 acres of existing phragmites downstream of Outfall 001. The intent is to re-open historic shorebird habitat that can be supported by flows that will continue from the existing irrigation return ditch. This could be considered new habitat that will not be as susceptible to Great Salt Lake water elevation fluctuations.

NDSD has proposed to monitor for and control the propagation of phragmites at Outfall 003 and maintain the ditch downstream of Outfall 003 to maintain a direct connection to the open water of Gilbert Bay.

8. Part G. Certification of Antidegradation Review

See the application form.

9. References

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