Fact Sheet for State Waste Discharge Permit ST0007285

Hannegan Properties LLC

Public Notice Date: June 29, 2017

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed State Waste Discharge Permit for Hannegan Properties LLC (Hannegan Properties) that will allow land application of wastewater to a planted and harvested spray field.

State law requires any industrial facility to obtain a permit before discharging waste or chemicals to waters of the state, which includes groundwater.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for Hannegan Properties, State Waste Discharge Permit No. ST0007285, are available for public review and comment from June 29, 2017, until the close of business Monday, July 31, 2017. For more details on preparing and filing comments about these documents, please see *Appendix A - Public Involvement Information.*

Hannegan Properties reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions about the facility's location, history, product type or production rate, discharges or receiving water prior to publishing this draft fact sheet for public notice.

After the public comment period closes, Ecology will summarize substantive comments and our responses to them. Ecology will include our summary and responses to comments to the draft permit and fact sheet as *Appendix E - Response to Comments,* and publish it when we issue the final State Waste Discharge Permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

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I. Introduction

The legislature defined Ecology's authority and obligations for the wastewater discharge permit program in the Water Pollution Control law, chapter 90.48 RCW (Revised Code of Washington).

Ecology adopted rules describing how it exercises its authority:

- State waste discharge program (chapter 173-216 WAC).
- Water quality standards for ground waters of the state of Washington (chapter 173-200 WAC).
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC).

These rules require any industrial facility owner/operator to obtain a State Waste Discharge permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for performance requirements imposed by the permit.

Under the State Waste Discharge permit program and in response to a complete and accepted permit application, Ecology generally prepares a draft permit and accompanying fact sheet, and makes it available for public review before final issuance. If the volume of the discharge has not changed or if the characteristics of the discharge have not changed Ecology may choose not to issue a public notice. When Ecology publishes an announcement (public notice); it tells people where they can read the draft permit, and where to send their comments, during a period of thirty days. (See *Appendix A - Public Involvement Information* for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft State Waste Discharge permit in response to comment(s). Ecology will summarize the responses to comments and any changes to the permit in *Appendix E*.

II. Background Information

Table 1. General Facility Information

Facility Information	
Applicant	Andy J. Vitaljic, President
Facility Name and Address	Hannegan Properties LLC 6069 Hannegan Road Bellingham, WA 98226
Contact at Facility	Name: Garrett Reynolds, General Manager Telephone #: Telephone: (360) 398-1117, ext. 52
Responsible Official	Name: Andy J. Vitaljic Title: President Address: 6069 Hannegan Road Telephone #: Telephone: (360) 398-1117 FAX #: (360) 398-8801
Industry Type	Seafood Processing
Type of Treatment	Aerated lagoon before soil treatment
NAIC Codes	311710
Facility Location	Latitude: 48.850895 Longitude: -122.445464
Legal Description of Application Area	NE ¼ of the NE ¼ of Section 20, Township 39 N, Range 3 E, W.M. Latitude: 48.859799 Longitude: -122.444258

Groundwater Monitoring Well Information			
MW-1	Ecology Well ID # 368060	Lat: 48.8623 Long: -122.443	(NAD83)
MW-2	Ecology Well ID # 368061	Lat: 48.8608 Long: -122.443	(NAD83)
MW-3	Ecology Well ID # 368062	Lat: 48.8595 Long: -122.446	(NAD83)
MW-4	Ecology tag # APS 079	Lat: 48.8606 Long: -122.445	(NAD83)
MW-5	Ecology tag # APS 076	Lat: 48.8605 Long: -122.443	(NAD83)
MW-6	Ecology tag # APS 078	Lat: 48.8597 Long: -122.443	(NAD83)
MW-7	Ecology tag # APS 080	Lat: 48.859 Long: -122.444	(NAD83)
MW-8	Ecology tag # APS 077	Lat: 48.860 Long: -122.445	(NAD83)

Permit Status	
Issuance Date of Previous Permit	August 4, 2006
Application for Renewal Submittal Date	August 2, 2011
Date of Ecology Acceptance of Application	August 15, 2011
Industrial Stormwater General Permit	
Inspection Status	
Date of Last Non-sampling Inspection Date	July 23, 2012

Figure 1. Facility Location Map

Figure 2. Compliance Point Locations

A. Facility description

History

Hannegan Properties owns about 40 acres at the intersection of Hemmi Road and Hannegan Road east of Bellingham, Washington. Previously, this facility was operated as a meat rendering plant. Since then, salmon and herring roe are processed, frozen, stored, and sold to retail markets.

Operations at this facility have been covered under various names, including Q Sea, LLC (ST-7415), Ocean Beauty Seafoods, Inc. (ST-7285), and Ocean Star Seafoods, Inc. The name was changed to American Canadian Fisheries, and then Hannegan Properties. The following four companies currently operate at this location: American Canadian, Q Sea Specialty Services, Sonny Foods, and Pelican Packers. All companies are now covered under the Hannegan Properties' wastewater discharge permit, even though not all have a wastewater discharge.

Previous permits required Hannegan Properties to construct, and have fully operational, an approved wastewater treatment system, a Hydrogeologic Site Assessment Report for the land application site, and installation of groundwater monitoring wells.

An advanced wastewater treatment system was designed and installed between September 1995 and March 1996. The treatment system includes a side-hill screen for solids reduction, and oil/water separator for reduction of oil and grease, a sequential batch reactor (SBR) to reduce the organic content of the wastewater, and a 1.4-million-gallon capacity-aerated, lined lagoon for storage and further biological reduction.

Industrial process

Operations at this facility are covered under NAIC Code 311710, seafood product preparation and packaging. The primary products are lox and pet food. They accept fresh salmon on ice, then clean, process, and package them. Clean water is pumped from two wells located west of the plant for use in the processing operations. Water is stored in an 11,000-gallon above-ground storage tank.

Seafood processing is very seasonal. The busiest times for this facility are March and April (spring) and in September (fall) because of higher demand for lox. Other than when they are processing lox for Lent and Passover, wastewater volumes to the SBR and the lagoon are consistent. The fresh fish and herring processing operations formerly conducted at this site have been moved to the Q Sea facility located at the Squalicum Fill on Bellingham Bay, and are permitted under a separate state wastewater discharge permit.

Processes that generate wastewater are fish thawing and cleanup activities. Bins are filled with water for thawing and dumped after the fish are thawed. The thaw water is low in solids and BOD. The wastewater treatment system includes a side-hill screen for solids reduction, an oil/water separator for reduction of oil and grease, a sequential batch reactor (SBR) to reduce the organic content of the wastewater, and a 1.4-million-gallon capacity-aerated, lined lagoon for storage and further biological reduction. The lagoon water is land applied for further treatment.

Wastewater treatment processes (prior to land treatment)

The facility undertook a two-phased approach to improve the wastewater quality and reduce the amount of wastewater prior to land application. Phase I included separation of the storm and wastewater systems, and installation of a side-hill screen for solids removal. These improvements were completed and operational by July 15, 1995.

Phase II included a geologic and hydrogeologic investigation, and storage lagoon installation. The lagoon construction was completed in November 1995. The 200' x 175' x 8' (operational depth) lagoon is lined with 30 mL PVC liner and has a storage capacity of 1.5 million gallons. An aerator was added after construction to minimize odor generation.

The wastewater Ocean Star Phase I and Phase II, Engineering Report (August 14 and August 31, 1995, amended October 4, 1995) discussed wastewater flows and system loadings. The system was designed to treat 25,000 gallons per day at a BOD of 600 mg/L. The system was designed to produce treated wastewater effluent with less than 200 mg/L BOD, less than 200 mg/L TSS and less than 35 mg/L TKN.

Hannegan Properties' operation is categorized as a small, slow rate land application system by EPA document 625/R-06/016, *Process Design Manual for Land Treatment of Municipal Wastewater Effluents* (EPA 2006). Hannegan Properties own almost 40 acres of which 10 acres are currently used for spray irrigation of pretreated wastewater. BOD and TSS are removed by filtration and bacterial action as the treated wastewater percolates through the soil. Site soils are estimated to remove over 95 percent of BOD and TSS in the treated wastewater. Because of the high level of treatment in both the onsite treatment system and site soils, BOD and TSS are not constituents of concern if the system is correctly operated and maintained.

Wastewater treatment for nitrogen and BOD is expected to be accomplished in the SBR, aerated lagoon and via soil and crop uptake.

Stormwater discharges from building roofs, paved and unpaved areas is regulated under Industrial Stormwater General Permit No. WAR001210.

Land treatment and distribution system (spray field)

Pretreated wastewater is land applied via an above-ground fixed-head irrigation system, to ten acres of land located adjacent to Hannegan Road. The sprinkler system is composed of 172 sprinkler heads rated at 3.2 gpm each. The land application site is irrigated in sections on a rotating basis using an automatic timer. Wastewater application is not allowed during significant rainfall, and during December through February. The application rate is based on the groundwater levels as determined from groundwater monitoring wells.

A buffer zone was set aside adjacent to the surrounding ditches. The roadside ditches ultimately flow to Fish Trap Creek.

Soil characteristics of the ten-acre application site, as described in the Hydrogeologic Site Assessment Report, are 30 percent SCS soil type 62, Hale silt loam, and 70 percent SCS soil type 184, Whitehorn silt loam. Facility management consulted with the Natural Resources Conservation Service (NRCS) to obtain information on the optimal crop to grow. Redtop (Agrostis alba) was initially planted because it was salt tolerant and had a

high nutrient requirement. Problems occurred in the first year of operation because the crop grew so tall; it fell over and smothered the soil, creating an anaerobic condition. The crop is now cut periodically during the growing season to prevent recurrence.

Solid wastes

Solid waste from the fish processing operations consists of fish parts, scraps, and miscellaneous packaging materials.

Staff place incidental solid waste in a dumpster that is serviced by Sanitary Service Company, Inc. An exterior storage tank is used for all solid fish waste from the production processes. This tank is emptied twice a month by J.W. Septic in Everson, Washington.

B. Description of the groundwater

A Geologic and Hydrologic Analysis Report was prepared for the site (Merit Engineering, August 1995). The report indicates that ground water in the area is moving north to northwest. Based on the Merit report's characterization of the water table aquifer, three monitoring wells were installed at the site to track potential groundwater contamination, movement, and levels. The on-site well locations include one well up gradient of the land application area (designated as MW-3), and two wells down gradient of the land application area. The well designated as MW-2 is located 110 feet down gradient from the southern land application site. MW-1 is located at the northeast property boundary, near the intersection of Hemmi Road and Hannegan Road. Since there has not been any wastewater application to the eight acres in that quadrant, sampling at MW-1 has been suspended.

The ground water is characterized as a perched zone under the land application field. A thorough analysis by an Ecology hydrogeologist concluded that the ditch adjacent to MW-2 intercepts ground water leaving the field prior to reaching the well. MW-3 is located beyond the influence of the spray field and is useful as an up gradient well but is of no use for monitoring the activities on the spray field. Installation of additional monitoring wells was recommended. New wells were installed in May 2007. Past practices of herring slacking have subjected the application field soils to excessive TDS, specifically chlorides. Given the shallow depth to ground water and the permeable nature of the soil column, it is likely that the chlorides have moved through the soils. Soil sampling is required in this permit to verify the soils have not been compromised by past practices.

Current groundwater conditions based on monitoring data collected since May 2007 (after all wells were installed) clearly show two groundwater regimes for the parameters monitored. Monitoring wells MW-1 and MW-2 are located north of a ditch running the length of the spray field and show low chloride and conductivity values. Wells MW-4 and MW-5 show high chloride and conductivity values. The same low chloride and conductivity are also found in the up gradient well MW-3, suggest that there has been an impact to groundwater. This impact has been attributed to a previous accidental release of high chloride wastewater. Additional groundwater and soil sampling proposed in this permit will provide information as to whether there is an ongoing release of high chloride wastewater. The ground water enforcement limits apply to the wells around the spray field – wells MW-2, MW-4, MW-5, and MW-6.

C. Wastewater characterization

Hannegan Properties reported the concentration of pollutants in the discharge in the permit application and in monthly discharge monitoring reports. The tabulated data represents the quality of the wastewater discharged from January 1, 1996 to December 31, 2015. The wastewater prior to land application is characterized as follows:

Table 2. Wastewater Characterization

Parameter	Average Value	Units
	Lagoon (Outfall 004)	
Flow	714	gpd
Biochemical Oxygen Demand (BOD_5)	106	mg/L
Conductivity	5,217	µmhos/cm
Fecal Coliform	1,170	#/100 mL
Chloride	285	mg/L
TKN-N	64	mg/L
Nitrate (as Nitrogen)	4.25	mg/L
Total Suspended Solids (TSS)	139	mg/L
pH (minimum)	7.85	standard units
pH (maximum)	6.59	standard units

D. Summary of compliance with previous permit issued August 4, 2006

The most recent permit compliance inspection was conducted on July 23, 2012. Hannegan had all the required bench sheets and paperwork for the Discharge Monitoring Reports (DMRs) submittals.

The Permittee has a fair compliance history based on violations over the last five years (2011 to 2015). During that time, there have been 21 recorded permit violations, all for late DMR submittals. Over half of the violations occurred in 2011 and 2012.

The previous permit placed effluent limits on groundwater nitrate, TDS and chloride. During the last five years down gradient monitoring well MW-5 exceeded groundwater limits 42 times for TDS, 35 times for chloride, and once for nitrate. Over the same period the up gradient monitoring well (MW-3) had a total of 14 exceedances; eight for chloride and six for TDS.

E. State environmental policy act (SEPA) compliance

State law exempts the issuance, reissuance, or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

This is a permit renewal for an existing discharge at an existing facility.

III. Proposed Permit Limits

State regulations require that Ecology base limits in a State Waste Discharge permit on the:

- Technology and treatment methods available to treat specific pollutants (technology-based). Dischargers must treat wastewater using all known, available, reasonable methods of prevention, control, and treatment (AKART). Ecology has developed guidance describing technology-based (AKART) criteria for industrial/commercial systems that discharge to ground; (Ecology, 1993; 2004).
- Operations and best management practices necessary to meet applicable water quality standards to preserve or protect existing and future beneficial uses of the groundwater.
- Ground water quality standards (Ecology, 2005).
- Applicable requirements of other local, state and federal laws.

Ecology applies the most stringent of technology and water quality-based limits to each parameter of concern and further describes the proposed limits below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, monitoring, and irrigation/crop management). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the state of Washington. Ecology does not develop effluent limits for all reported pollutants. Some pollutants are not treatable at the concentrations reported, are not controllable at the source, and are not listed in regulation.

Ecology does not usually develop permit limits for pollutants not reported in the permit application but that may be present in the discharge. The permit does not authorize the discharge of the non-reported pollutants. During the five-year permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent. Until Ecology modifies the permit to reflect additional discharges of pollutants, a permitted facility could be violating its permit.

A. Technology-based effluent limits

Waste discharge permits issued by Ecology specify conditions requiring the facility to use AKART before discharging to waters of the state (RCW 90.48).

Ecology approved the engineering report titled *Ocean Star Seafood Phase II Engineering Report, Wastewater Treatment System and Storage Lagoon* dated 1995, and prepared by Leonard, Boudinot, Skodje, Inc.

Ecology evaluated the report using the:

- *Guidelines for the Preparation of Engineering Reports for Industrial Wastewater Land Application Systems*, Ecology, May 1993.

Ecology determined that the facility meets the minimum requirements demonstrating compliance with the AKART standard if Hannegan Properties operates the treatment and disposal system as described in the approved engineering report and any subsequent Ecology approved reports.

Ecology also evaluated the report for water quality based requirements which is described in the next section of the fact sheet.

Wastewater treatment (prior to land treatment) requirements

This facility mechanically processes gutted whole salmon: a process that has effluent guidelines in the Code of Federal Regulations Title 40 – Protection of the Environment, Chapter I – Environmental Protection Agency, Sub-chapter N – Effluent Guidelines and Standards, Part 408 – Canned and Preserved Seafood Processing Point Source Category, Subpart S – West Coast Mechanized Salmon Processing Subcategory. The technology-based effluent limits subject to discharges from this operation are presented in Table 3. These effluent limits apply only to discharges to surface water. Since this facility discharges to ground, these values are used as benchmark values.

Table 3. Technology-Based Effluent Limits

Effluent Limits		
Parameter	**Average Monthly**	**Maximum Daily**
Oil & Grease	44	NA
TSS	29	NA
pH	6.0 – 9.0	NA
NA	Not Applicable. 40 CFR 408 does not have values for the maximum daily discharge.	

Table 4. Reasonable Potential-Based Effluent Limits

Effluent Limits			
Parameter	**Units**	**Average Monthly** [a]	**Maximum Daily** [a]
Chloride	mg/L	18	26
TDS	mg/L	205	223
[a]	See Appendix D for calculations.		

Early warning values are established for constituents that may have a reasonable potential to pollute groundwater. However, these constituents are at levels that do not require an enforcement limit but do require monitoring to indicate any potential changes in groundwater conditions.

Table 5. Reasonable Potential-Based Effluent Early Warning Values

Effluent Limits			
Parameter	**Units**	**Average Monthly** [a]	**Maximum Daily** [a]
Biochemical Oxygen Demand	mg/L	12	17
Nitrate + Nitrite	mg/L	5	8
Specific Conductivity	µmhos/cm	440	642
[a]	See Appendix D for calculations.		

Land treatment requirements

Hannegan Properties must meet the following permit limits to satisfy the requirement for AKART:

- Application of wastewater via spray irrigation must not exceed agronomic rates (as defined in Ecology's groundwater implementation guidance) for total nitrogen and water. Wastewater application rates for other wastewater constituents must protect the background groundwater quality.

- Apply total nitrogen and water to the spray fields as determined by an Ecology approved and current Irrigation and Crop Management Plan.
- Operate the system to protect the existing and future beneficial uses of the groundwater and not cause a violation of the groundwater standards.

B. Groundwater quality-based effluent limits

In order to protect existing water quality and preserve the designated beneficial uses of Washington's groundwaters including the protection of human health, WAC 173-200-100 requires Ecology to condition discharge permits in such a manner as to authorize only activities that will not cause violations of the groundwater quality standards (GWQS). The goal of the groundwater quality standards is to maintain the highest quality of the State's groundwaters and to protect existing and future beneficial uses of the groundwater through the reduction or elimination of the discharge of contaminants to groundwater [WAC 173-200-010(4)]. Ecology achieves this goal by:

- Applying all known available and reasonable methods of prevention, control and treatment (AKART) to any discharge.
- Applying the antidegradation policy of the groundwater standards.
- Establishing numeric and narrative criteria for the protection of human health and the environment in the groundwater quality standards.

Ecology approved the engineering report as noted above in the technology based limits section. In addition, Ecology evaluated the report to ensure compliance with groundwater standards using the:

- *Guidance on Land Treatment of Nutrients in Wastewater, with Emphasis on Nitrogen, Ecology*, November 2004 (https://fortress.wa.gov/ecy/publications/SummaryPages/0410081.html)

Antidegradation policy

The state of Washington's GWQS require preservation of existing and future beneficial uses of groundwater through implementation of its antidegradation policy, which includes the two concepts of antidegradation and non-degradation. Antidegradation is not the same as non-degradation (see below).

Antidegradation

Antidegradation applies to calculation of permit limits in groundwater when background (see below) contaminant concentrations are less than criteria in the GWQS. Ecology has discretion to allow the concentrations of contaminants at the point of compliance to exceed background concentrations but not exceed criteria in the GWQS. Ecology grants discretion through an approved AKART engineering analysis of treatment alternatives. If the preferred treatment alternative predicts that discharges to groundwater will result in contaminant concentrations that fall between background concentrations and the criteria, then the preferred treatment alternative should protect beneficial uses and meet the antidegradation policy. In this case, the predicted concentrations become the permit limits. If the preferred alternative will meet background contaminant concentrations, background concentrations become the permit limits. Permit limits must protect groundwater quality by preventing degradation beyond the GWQS criteria. If discharges will result in exceedance of the criteria, facilities must apply additional treatment before Ecology can permit the discharge.

Non-degradation

Non-degradation applies to permit limits in groundwater when background contaminant concentrations exceed criteria in the GWQS. Non-degradation means that discharges to groundwater must not further degrade existing water quality. In this case, Ecology considers the background concentrations as the water quality criteria and imposes the criteria as permit limits. To meet the non-degradation policy, the facility must prepare an AKART engineering analysis that demonstrates that discharges to groundwater will not result in increasing background concentrations. Ecology must review and approve the AKART engineering analysis.

You can obtain more information on antidegradation and non-degradation by referring to the *Implementation Guidance for the Ground Water Quality Standards*, Ecology Publication #96-02 (Implementation Guidance) (available at: https://fortress.wa.gov/ecy/publications/SummaryPages/9602.html).

Background water quality

Background water quality is determined by a statistical calculation of contaminant concentrations without the impacts of the proposed activity. The calculation requires an adequate amount of groundwater quality data and determining the mean and standard deviation of the data, as described in the Implementation Guidance. Following the procedure in the Implementation Guidance, Ecology then defines background water quality for most contaminants as the 95 percent upper tolerance limit. This means that Ecology is 95 percent confident that 95 percent of future measurements will be less than the upper tolerance limit. There are a few exceptions to the use of the upper tolerance limit. For pH, Ecology will calculate both an upper and a lower tolerance limit resulting in an upper and lower bound to the background water quality. If dissolved oxygen is of interest, Ecology will calculate a lower tolerance limit without an upper tolerance limit.

Applicable groundwater criteria as defined in chapter 173-200 WAC and in RCW 90.48.520 for this discharge include those in the following table:

Table 6. Groundwater Quality Criteria

Parameter	Groundwater Criteria	95th Percentile Background Value [a]	Units
Chloride	250	49.5	mg/L
Specific Conductivity	700	391	µmhos/cm
Nitrate (as nitrogen)	10	2.46 [b]	mg/L
Total Dissolved Solids	500	224	mg/L
pH (Maximum / Minimum)	6.5 to 8.5	6.4 to 7.5	standard units
Toxics	No toxics in toxic amounts		
[a]	Background is determined from the up gradient well MW-3.		
[b]	Data suggest that MW-3 is being impacted by an off-site nitrate source. The background value for up gradient well MW-7 is provided instead.		

Ecology has reviewed existing records for the facility's land treatment site and there is sufficient data to determine the background groundwater quality as defined in chapter 173-200 WAC and described in the Implementation Guidance. *Appendix D* includes a summary of Ecology's calculations of background values.

Ecology established groundwater enforcement limits to protect the quality of the groundwater based on the background values in groundwater. The proposed groundwater enforcement limits establish the quantity and quality of the wastewater that Hannegan Properties may apply or discharge to the spray field.

The table below includes the groundwater enforcement limits for the discharge. Two consecutive exceedances of an enforcement limit for the same parameter at the same well constitutes a violation.

Table 7. Groundwater Quality-Based Effluent Limits

Parameter	Average Background Water Quality [a]	Groundwater Enforcement Limits [b]	Units
Two consecutive exceedances of an enforcement limit for the same parameter at the same well constitutes a violation.			
Chloride	7.95	9.80	mg/L
Nitrate [c] (as nitrogen)	1.30	2.14	mg/L
Total Dissolved Solids	197	206	mg/L

[a]	Background water quality is from well MW-3.
[b]	Groundwater Enforcement Limits are based on calculation of the average monthly concentration at the 95th percentile level using groundwater collected from the up gradient well MW-3. See Appendix D for calculation details.
[c]	Groundwater Enforcement Limit for nitrate is based on calculation of the daily maximum concentration at the 95th percentile level using nitrate + nitrite data collected from the up gradient well MW-7.

Parameter	Average Background Water Quality [a]	Daily Minimum	Daily Maximum	Units
pH	6.51 – 7.29	6.0	9.0	standard units

[a]	Background water quality is from well MW-3.

Early warning values are established for constituents that may have a reasonable potential to pollute groundwater. However, these constituents are at levels that do not require an enforcement limit but do require monitoring to indicate any potential changes in groundwater conditions.

Table 8. Performance-Based Effluent Early Warning Values

Effluent Limits			
Parameter	**Units**	**Average Monthly [a]**	**Maximum Daily [a]**
Specific Conductivity	µmhos/cm	356	400

[a]	See Appendix D for calculations.

C. Comparison of effluent limits with the previous permit issued on August 4, 2006

Table 9. Comparison of Previous and Proposed Effluent Limits

Parameter	Basis of Limit	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
		Previous Effluent Limits: Outfall # 001		Proposed Effluent Limits: Outfall # 001	
Flow		25,000 gpd	NA	25,000 gpd	
Chloride	RP [a]	None	NA	18 mg/L	26 mg/L
Total Nitrogen	RP/TSD [b]	TBD	NA	5 mg/L	8 mg/L
Total Suspended Solids	RP	None	NA	29 mg/L	NA
Total Dissolved Solids	RP	None	NA	205 mg/L	223 mg/L
pH	RP	6.0 – 9.0 S.U.	NA	6.0 – 9.0 S.U.	6.0 – 9.0 S.U.
[a]	RP = Reasonable potential calculation (see Appendix D, Table 7).				
[b]	TSD = Limit calculations (see Appendix D, Table 8).				
[c]	GWQS = Groundwater Quality Standard from WAC 173-200.				

Table 10. Comparison of Previous and Proposed Groundwater Limits

Parameter (GWQS)	Basis of Limit	Groundwater Quality Standard	Previous Effluent Limit	Proposed Effluent Limit	Units
Chloride	TSD	250	None	9.80	mg/L
Nitrate	TSD	10	1	2.14	mg/L
Total Dissolved Solids	TSD	500	500	206	mg/L
pH	RP	6.5 – 8.5	6.0 – 9.0	6.0 – 9.0	SU

IV. Monitoring Requirements

Ecology requires monitoring, recording, and reporting (WAC 173-216-110) to verify that the treatment process functions correctly, the discharge meets groundwater criteria and that the discharge complies with the permit's effluent limits.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, detection level (DL), and quantitation level (QL) on the discharge monitoring report or in the required report.

A. Lab accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters). This requirement is to ensure that data submitted by the Permittee is of a known and consistent quality, capable of meeting the needs of the Permittee and Ecology.

B. Irrigated wastewater monitoring

Ecology is requiring monitoring of the irrigated wastewater to ensure that discharge limits set in the permit are consistently met as wastewater is applied to the spray field. Constituent concentrations in excess of the discharge limits set in the permit have the potential to negatively impact groundwater of the state.

Ecology details the proposed monitoring schedule under Special Condition S2.A. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring.

Parameters selected for monitoring are consistent with those in previous permits. Common anions and cations are added to allow calculation of a charge balance.

C. Ditch water monitoring

Ecology is requiring monitoring of the water in the ditch along the North side of the application area to determine if groundwater is discharging to this surface water. Ecology details the proposed monitoring schedule under Special Condition S2.B. Specified monitoring frequencies take into account the quantity and variability of the discharge, significance of pollutants, and cost of monitoring.

D. Crop monitoring

Ecology is requiring monitoring of the harvested crop to ensure that the nutrient uptake of the crop used to calculate soil loading is occurring at the rate anticipated. Again if nutrient uptake is lower than that used in loading calculations there is a potential for negative impact. Constituents selected for monitoring are those that provide information for assessing the validity of calculations noted above.

Ecology details the proposed monitoring schedule under Special Condition S2.E. The facility and Ecology use the crop monitoring data to develop the nutrient and salt balances that are necessary to demonstrate compliance with the agronomic rate limit in Special Condition S1.

E. Soil monitoring

Ecology details the proposed monitoring schedule under Special Condition S2.D. The facility and Ecology use the soil monitoring data to monitor and evaluate wastewater application rates and to determine if salts and nutrients are flushing beyond the root zone and leaching to the groundwater. The presence and concentration of certain wastewater related parameters in the soils (e.g., nitrate and salts) can indicate over application of wastewater. The facility must follow the analytical methods provided in *Soil, Plant and Water Reference Methods for the Western Region* (2003).

Constituents proposed for monitoring are those that have the highest potential to result in an impact to soil and/or groundwater.

F. Groundwater monitoring

Ecology requires groundwater monitoring at the site in accordance with the Ground Water Quality Standards, chapter 173-200 WAC. Ecology has determined that this discharge has a potential to pollute the groundwater. Therefore, the Facility must evaluate the impacts on

groundwater quality. Ecology considers monitoring of the groundwater at the site boundaries and within the site an integral component of such an evaluation. Ecology details the proposed monitoring schedule under Special Condition S2.C.

Parameters selected for monitoring are consistent with the previous permit. The addition of common anions and cations are added to allow calculation of a charge balance. The charge balance will provide information for the comparison on groundwater from each well.

V. Other Permit Conditions

A. Reporting and record keeping

Ecology based Special Condition S3 on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-216-110).

B. Irrigation and crop management plans

Ecology requires the irrigation and crop management plan to support the engineering report and operations and maintenance manual. This plan must include a consideration of wastewater application at agronomic rates as required by Special Condition S1 and should describe and evaluate various irrigation controls.

Plans must comply with the requirements for an irrigation and crop management plan given in Ecology's guidance, *Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems.* (1993).

C. Operations and maintenance

Ecology requires dischargers to take all reasonable steps to properly operate and maintain their wastewater treatment system in accordance with state regulations (WAC 173-240-080 and WAC 173-216-110). The facility has prepared and must submit an update of an operation and maintenance (O&M) manual for the wastewater facility.

Implementation of the procedures in the operation and maintenance manual ensures the facility's compliance with the terms and limits in the permit and ensures the facility provides AKART to the waste stream.

D. Solid waste control plan

Hannegan Properties could cause pollution of the waters of the state through inappropriate disposal of solid waste or through the release of leachate from solid waste.

This proposed permit requires this facility to update the approved solid waste control plan designed to prevent solid waste from causing pollution of waters of the state. The facility must submit the updated plan to Ecology for review (RCW 90.48.080). You can obtain Ecology guidance document 07-10-024, *Focus Sheet on Solid Waste Control Plan, Developing a Solid Waste Control Plan for Industrial Wastewater Discharge Permittees* (Ecology, 2007), which describes how to develop a Solid Waste Control Plan, at: http://www.ecy.wa.gov/pubs/0710024.pdf.

E. Non routine and unanticipated wastewater

Occasionally, this facility may generate wastewater that was not characterized in the permit application because it is not a routine discharge and was not anticipated at the time of application. These wastes typically consist of waters used to pressure-test storage tanks or fire water systems or of leaks from drinking water systems.

The permit authorizes the discharge of non-routine and unanticipated wastewater under certain conditions. The facility must characterize these wastewaters for pollutants and examine the opportunities for reuse. Depending on the nature and extent of pollutants in this wastewater and on any opportunities for reuse, Ecology may:

- Authorize the facility to discharge the wastewater.
- Require the facility to treat the wastewater.
- Require the facility to reuse the wastewater.

F. Spill plan

This facility stores a quantity of chemicals on-site that have the potential to cause water pollution if accidentally released. Ecology can require a facility to develop best management plans to prevent this accidental release [Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) and RCW 90.48.080].

Hannegan Properties developed a plan for preventing the accidental release of pollutants to state waters and for minimizing damages if such a spill occurs. The proposed permit requires the facility to update this plan and submit it to Ecology for review.

G. Best management practices – general

Best management practices (BMPs) are the actions identified to manage, prevent contamination of groundwater. BMPs include schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment systems, operating procedures, and practices used to control plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage.

H. Best management practices – land treatment site

Best management practices (BMPs) are the actions identified to manage, prevent contamination of groundwater. BMPs include schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state.

I. General conditions

Ecology bases the standardized general conditions on state law and regulations. They are included in all individual industrial state waste discharge permits issued by Ecology.

VI. Permit Issuance Procedures

A. Permit modifications

Ecology may modify this permit to impose numerical limits, if necessary, to comply with water quality standards for groundwater, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state regulations.

B. Proposed permit issuance

This proposed permit meets all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of 5 years.

VII. References for Text and Appendices

Laws and Regulations (http://www.ecy.wa.gov/laws-rules/index.html)

Gavlak, R., D. Horneck, R.O. Miller, and J. Kotuby-Amacher. 3rd edition 2005. *Soil, Plant and Water Reference Methods for the Western Region* https://community.ipni.net/site/wera.nsf/home.xsp

EPA 2006. *Process Design Manual for Land Treatment of Municipal Wastewater Effluents*. EPA document 625/R-06/016. September 2006. http://nepis.epa.gov/Exe/ZyNET.exe/2000ZYD5.txt?ZyActionD=ZyDocument&Client=EPA&Index=2011%20Thru%202015%7C2006%20Thru%202010%7CHardcopy%20Publications&Docs=&Query=Process%20Design%20Manual%20Land%20Treatment%20Municipal%20Wastewater%20Effluent%20&Time=&EndTime=&SearchMethod=2&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000000%5C2000ZYD5.txt&User=ANONYMOUS&Password=anonymous&SortMethod=-%7Ch&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r85g16/r85g16/x150y150g16/i500&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x

Merit Engineering. August 1995.

Leonard, Boudinot, Skodje, Inc. 1995. *Ocean Star Seafood Phase II Engineering Report, Wastewater Treatment System and Storage Lagoon*

Washington State Department of Ecology.

Permit and Wastewater Related Information (http://www.ecy.wa.gov/programs/wq/permits/guidance.html)

October 2005. *Implementation Guidance for the Ground Water Quality Standards*, Ecology Publication Number 96-02. https://fortress.wa.gov/ecy/publications/SummaryPages/9602.html

August 2008. *Criteria for Sewage Works Design*, Ecology Publication Number 98-37 WQ. 567 pp. https://fortress.wa.gov/ecy/publications/documents/9837.pdf

May 1993. *Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems*, Ecology Publication Number 93-36. 20 pp. http://www.ecy.wa.gov/pubs/9336.pdf

December 2011. *Permit Writer's Manual*, Publication Number 92-109 (https://fortress.wa.gov/ecy/publications/SummaryPages/92109.html)

February 2007. *Focus Sheet on Solid Waste Control Plan, Developing a Solid Waste Control Plan for Industrial Wastewater Discharge Permittees*, Publication Number 07-10-024. http://www.ecy.wa.gov/pubs/0710024.pdf

November 2004. *Guidance on Land Treatment of Nutrients in Wastewater, with Emphasis on Nitrogen*, Ecology Publication #04-10-081; https://fortress.wa.gov/ecy/publications/SummaryPages/0410081.html

Appendix A--Public Involvement Information

Ecology proposes to reissue a permit to Hannegan Properties. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology will place a Public Notice of Draft on June 29, 2017, in the *Bellingham Herald* to inform the public and to invite comment on the proposed draft State Waste Discharge permit and fact sheet.

The notice:

- Tells where copies of the draft permit and fact sheet are available for public evaluation (a local public library, the closest Regional or Field Office, posted on our website).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period.
- Tells how to request a public hearing of comments about the proposed state waste discharge permit.
- Explains the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting*, which is available on our website at https://fortress.wa.gov/ecy/publications/SummaryPages/0307023.html.

You may obtain further information from Ecology by telephone, 425-649-7201, or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

The primary authors of this permit and fact sheet are Chris Martin.

Appendix B--Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Appendix C--Glossary

AKART -- The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance -- An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An "early warning value" must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ammonia -- Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Average monthly discharge limit -- The average of the measured values obtained over a calendar months' time.

Background water quality -- The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time up gradient of an activity that has not been affected by that activity, [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically up gradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best management practices (BMPs) -- Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs include treatment systems, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5 -- Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass -- The intentional diversion of waste streams from any portion of a treatment facility.

Chlorine -- A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Clean water act (CWA -- The federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance inspection-without sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance inspection-with sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

Construction activity -- Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

Continuous monitoring -- Uninterrupted, unless otherwise noted in the permit.

Date of receipt -- This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Detection limit -- The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Distribution uniformity -- The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value -- The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit -- The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a groundwater criterion will not be exceeded and that background water quality will be protected.

Grab sample -- A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Groundwater -- Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Industrial wastewater -- Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business; from the development of any natural resource; or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated stormwater and, also, leachate from solid waste facilities.

Maximum daily discharge limit -- The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Method detection level (MDL) -- See Detection Limit.

pH -- The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Point of compliance -- The location in the groundwater where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly down gradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Quantitation level (QL) -- Also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency, December 2007).

Reasonable potential -- A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible corporate officer -- A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sample Maximum -- No sample may exceed this value.

Soil scientist -- An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting

Scientists or who has the credentials for membership. Minimum requirements for eligibility are possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5, 3, or 1 year(s), respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid waste -- All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 -- Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

State waters -- Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater -- That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit -- A permit limit based on the ability of a treatment method to reduce the pollutant.

Total dissolved solids -- That portion of total solids in water or wastewater that passes through a specific filter.

Total suspended solids (TSS) -- Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

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

Appendix D--Technical Calculations

Determination of Permit Limits

Ecology has several tools available to assist with the calculation of limits for inclusion in permits. Each tool uses a slightly different method of calculation to arrive at a unique limit value and each tool has certain strengths and weaknesses. Two of the methods available (PermitCalcMarch9-2015 [PermitCalc] and TSDCalcOct11 [TSDCalc]) use data for effluent, receiving water, and water quality criteria; while the third method (TSD for WQ Limits) is a direct calculation method using all available effluent or groundwater data. PermitCalc and TSDCalc are written for discharges to surface water and require minor changes to calculate groundwater limits. The changes are adjusting the units on the worksheet (all values are in milligrams per liter [mg/L] instead of micrograms per liter [µg/L]), replacing the Aquatic Life Chronic Criteria value (row 19) with the 95th percentile value for that constituent in the up gradient well, and changing the Human Health Criteria (row 20) to the Groundwater Quality Standard values.

The strength of both PermitCalc and TSDCalc are that they use information from the receiving waters to arrive at a limit value. The weakness for both is that they require minor adjustments when groundwater is the receiving water. TSD for WQ Limits strength lies in the fact that is uses all available data to calculate a limit. The weakness lies with the fact that the limit value calculated may not be protective of groundwater.

Determination of Effluent Permit Limits and Early Warning Values

To expand the statistical strength for limit calculation and as a form of sensitivity analysis, multiple scenarios are run for the first two methods. The scenarios are common through each method. The scenarios used for this permit are provided in the table below.

Table D-11. Permit Limit Calculation Scenarios

PermitCalcMarch9-2015			
Effluent [a]	**Receiving Water [b]**	**Water Quality Criteria 1 [c]**	**Water Quality Criteria 2 [d]**
Maximum	MW-3	MW-3 95th Percentile	GWQS [e]
95th Percentile	MW-3	MW-3 95th Percentile	GWQS
95th Percentile	MW-3	GWQS	GWQS
95th Percentile	MW-3	MW-5 95th Percentile	GWQS
95th Percentile	MW-5	MW-5 95th Percentile	GWQS

[a]	Effluent ≡ value used for the effluent concentration (rows 14 and 15 in PermitCalc). Either the maximum value or the 95th percentile of the data from 1996 to 2015.
[b]	Receiving Water ≡ value used for receiving water in calculations (rows 16 and 17 in PermitCalc). Equal to the geometric mean when number of samples is greater than 10 (n > 10). Data is from the up gradient well MW-3 for the period 1996 to 2015.
[c]	Water Quality Criteria 1 ≡ assigned to the Chronic Aquatic Life Criteria (row 19) in the spreadsheet.
[d]	Water Quality Criteria 2 ≡ assigned to the Human Health Protection Criteria (row 20) in the spreadsheet.
[e]	GWQS ≡ Groundwater Quality Standard
[f]	Well MW-5 is down gradient. Calculations using this well were performed as a sensitivity check.

The different combinations of receiving water/ambient concentration and water quality are done as a form of sensitivity analysis to see if changes in one results in a significant change in the calculated final limit. Overall scenarios between each method yielded very similar results as to which constituents might pose a potential threat to groundwater quality. Only pH showed large differences in potential to contaminate between calculation methods (PermitCalc vs. TSDCalc).

Differences between scenarios within each calculation method varied widely, up to a 99% difference. For this reason, results from the most likely scenario (95th percentile effluent concentration and 95th percentile up gradient well (MW-3) concentration) are used to determine final effluent limit values.

As all methods yielded very similar limit values for this scenario PermitCalc was used to determine reasonable potential and appropriate limits. The use of receiving water data in the PermitCalc spreadsheet was seen as a larger strength than the weakness involved with resetting values. The final limit values are calculated using the 95th percentile for the effluent and the 95th percentile concentration in the up gradient well (MW-3). Permit limits are proposed for chloride and total suspended solids. The exiting limit for flow and oil & grease will remain in effect. In addition, noon-enforceable early warning values for biochemical oxygen demand, nitrate + nitrite, and specific conductivity are imposed. Exceedance of an early warning value may indicate a potential problem that will require further evaluation. All constituents will continue to be monitored. Table D-13 shows the PermitCalc spreadsheet calculations.

Determination of Groundwater Permit Limits and Early Warning Values

This facility has a total of eight monitoring wells on-site. However, although being down gradient wells MW-1 and MW-2 are on the north side of a ditch and show very different water quality than wells MW-4 and MW-5, which are on the south (land treatment area) side of the ditch. For this reason wells MW-1 and MW-2 are not considered viable monitoring points. Of the remaining wells MW-3 and MW-7 are up gradient, MW-4, MW-5, and MW-6 are down gradient, and MW-8 is cross-gradient.

Well MW-3 is used as the up gradient well and provides background groundwater concentrations. Wells MW-4, MW-5, and MW-6 are the down gradient points that will monitor constituent concentrations potentially impacted by land treatment.

Groundwater permit limits are determined using the same methodology as for effluent limit values. Scenarios used are also similar to those used for the effluent limit calculation.

Table D-12. Permit Limit Calculation Scenarios

PermitCalcMarch9-2015			
Effluent [a]	**Receiving Water** [b]	**Water Quality Criteria 1** [c]	**Water Quality Criteria 2** [d]
MW-3 max value	MW-3	MW-3 95th Percentile	GWQS [e]
MW-3 95th Percentile	MW-3	MW-3 95th Percentile	GWQS
MW-3 95th Percentile	MW-3	MW-5 95th Percentile [f]	GWQS
MW-5 95th Percentile	MW-3	MW-3 95th Percentile	GWQS
MW-3 95th Percentile	MW-3	GWQS	GWQS
MW-5 95th Percentile	MW-5	GWQS	GWQS

a	Effluent ≡ value used for the effluent concentration (rows 14 and 15 in PermitCalc). Either the maximum value from MW-3 data from 1996 to 2015, or the 95th percentile of that data.
b	Receiving Water ≡ value used for receiving water in calculations (rows 16 and 17 in PermitCalc). Equal to the geometric mean when number of samples is greater than 10 (n > 10).
c	Water Quality Criteria 1 ≡ assigned to the Chronic Aquatic Life Criteria (row 19 in PermitCalc) in the spreadsheet.
d	Water Quality Criteria 2 ≡ assigned to the Human Health Protection Criteria (row 20 in PermitCalc) in the spreadsheet.
e	GWQS ≡ Groundwater Quality Standard
f	MW-5 is a down gradient well. Calculations using this data are performed as a sensitivity check

As with the effluent workbook scenarios between methods yielded similar reasonable potential results, so no one method is better than another. Therefore the PermitCalc method is used to determine reasonable potential data. The down gradient well MW-5 provides the percentiles for the effluent values, while up gradient well MW-3 provides the percentiles for receiving water and groundwater criteria.

As shown in Section III.B.6 the 95th percentile values from the background well (MW-3) are below the groundwater quality standards. Under this condition the concept of anti-degradation is imposed, so the 95th percentile of the background well is used as the groundwater quality standard. Permit limits and early warning values are based on these values.

Using the above stated rational groundwater permit limits are proposed for chloride, nitrate/nitrite, total dissolved solids, and pH. A non-enforceable early warning value is also established for specific conductivity. Exceedance of an early warning value may indicate a potential problem that will require further evaluation. All constituents will continue to be monitored. Review of the data show that nitrate/nitrite levels in well MW-3 are being impacted by an off-site source. Therefore, the nitrate/nitrite values from up gradient well MW-7 are used to calculate the proposed limit.

Groundwater limit and early warning values are derived using the TSD for WQ Limits calculations. Ecology determined that the use of MW-3 data for both effluent, receiving water, and water quality criteria in the PermitCalc and TSDCalc spreadsheets has the potential to overestimate the resulting permit limit values. This workbook calculates limits for both a daily maximum and a monthly average. For the permit limits and early warning value we use the more conservative monthly average value at the 95% level.

Table D-14 shows the PermitCalc worksheet used to determine reasonable potential to contaminate groundwater. Table D-15 provides descriptions for variables shown in Table D-16, which presents the TSD for WQ Limits groundwater results.

Table D-13. Effluent Reasonable Potential and Limit Calculations from PermitCalcMarch9-2015.

Effluent Reasonable Potential Calculation

Facility	Hannegan Properties
Water Body Type	Groundwater
Rec. Water Hardness	

Dilution Factors:	95th Percentile
Background Groundwater	1.0
Human Health Carcinogenic	1.0
Human Health Non-Carcinogenic	1.0

Pollutant, CAS No. & NPDES Application Ref. No.		CHLORIDE (dissolved) in mg/L 16887006	NITRATE/NITRITE (N)	pH (high end)	pH (low end)	SPECIFIC CONDUCTIVITY					
Effluent Data	# of Samples (n)	91	211	200	206	205	-	-	-	-	-
	Coefficient of Variation (Cv)	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-
	Effluent Concentration, mg/L (Max. or 95th Percentile)	1,520.5	10.95	8.92	6.90	12,960	-	-	-	-	-
	Calculated 50th percentile Effluent Conc. (when n>10)	159	0.31	7.85	7.81	4,000	-	-	-	-	-
Receiving Water Data	90th Percentile Conc., mg/L	13.1	2.11	7.29	6.51	380	-	-	-	-	-
	Geo Mean, mg/L	7.19	1.06	6.89	6.89	332.78	-	-	-	-	-
Water Quality Criteria	95th Percentile Background Groundwater, mg/L	16	2.455	7.51	6.44	390.6					
	GWQ Criteria for Protection of Human Health, mg/L	250	10	8.5	6.5	700					-
	Metal Criteria Translator, decimal	-	-	-	-	-	-	-	-	-	-
	Carcinogen?	N	N	N	N	N	-				-

Table D-13. PermitCalcMarch9-2015 – Effluent (continued)

Effluent Reasonable Potential Calculation

Pollutant, CAS No. & NPDES Application Ref. No.	CHLORIDE (dissolved) in mg/L 16887006	NITRATE/NITRITE (N)	pH	pH	SPECIFIC CONDUCTIVITY					
Background Groundwater Reasonable Potential										
Effluent percentile value	0.950	0.950	0.950	0.950	0.950					
s $s^2=\ln(CV^2+1)$	0.555	0.555	0.555	0.555	0.555					
Pn $Pn=(1\text{-confidence level})^{1/n}$	0.968	0.986	0.985	0.985	0.985					
Multiplier	1.00	1.00	1.00	1.00	1.00					
Max concentration (mg/L) 95th Percentile	1,520.5	10.95	8.91	6.902	12,960					
Reasonable Potential? Limit Required?	**YES**	**YES**	**YES**	**YES**	**YES**					
Limit Calculation										
# of Compliance Samples Expected per month	1	1	1	1	1					
LTA Coefficient Variation (CV), decimal	0.6	0.6	0.6	0.6	0.6					
Permit Limit Coefficient Variation (CV), decimal	0.6	0.6	0.6	0.6	0.6					
Waste Load Allocations, mg/L 95th Percentile	16	4.76	7.50	6.4385	390.6					
Long Term Averages, mg/L 95th Percentile	8.44	2.51	3.96	3.39588	206.02					
Metal Translator or 1?	1.00	1.00	1.00	1.00	1.00					
Average Monthly Limit (AML), mg/L	**18.02**	**5.36**	**8.45**	**7.25**	**439.83**					
Maximum Daily Limit (MDL), mg/L	**26.28**	**7.82**	**12.33**	**10.58**	**641.63**					

Table D-13. PermitCalcMarch9-2015 – Effluent (continued)

Effluent Reasonable Potential Calculation

Pollutant, CAS No. & NPDES Application Ref. No.	CHLORIDE (dissolved) in mg/L 16887006	NITRATE/NITRITE (N)	pH	pH	SPECIFIC CONDUCTIVITY					
Human Health Reasonable Potential										
s $s^2=\ln(CV^2+1)$	0.555	0.555	0.555	0.555	0.555					
Pn $Pn=(1-\text{confidence level})^{1/n}$	0.968	0.986	0.985	0.986	0.985					
Multiplier	0.359	0.296	0.300	0.298	0.298					
Dilution Factor	1.00	1.00	1.00	1.00	1.00					
Max Concentration, mg/L	159	0.31	7.85	7.81	4,000					
Reasonable Potential? Limit Required?	**NO**	**NO**	**NO**	**YES**	**YES**					
Human Health Limit Calculation										
# of Compliance Samples Expected per month	1	1	1	1	1					
Average Monthly Effluent Limit, mg/L	**250**	**10**	**8.5**	**6.5**	**700**					
Maximum Daily Effluent Limit, mg/L	**364.70**	**14.59**	**12.40**	**9.48**	**1,021.3**					

Comments/Notes:

References: WAC 173-201A.
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Table D-14. Groundwater Reasonable Potential and Limit Calculations from PermitCalcMarch9-2015.

Groundwater Reasonable Potential Calculation

Facility	Hannegan Properties
Water Body Type	Groundwater
Rec. Water Hardness	

Dilution Factors:	95th Percentile
Background Groundwater	1.0
Human Health Carcinogenic	1.0
Human Health Non-Carcinogenic	1.0

Pollutant, CAS No. & NPDES Application Ref. No.		CHLORIDE (dissolved) in mg/L 16887006	NITRATE/NITRITE (N)	pH (high end)	pH (low end)	SPECIFIC CONDUCTIVITY	SOLIDS, TOTAL DISSOLVED AND SALINITY				
Effluent Data	# of Samples (n)	97	99	100	101	101	101	-	-	-	-
	Coefficient of Variation (Cv)	0.6	0.6	0.6	0.6	0.6	0.6	-	-	-	-
	Effluent Concentration, mg/L (Max. or 95th Percentile)	1,603	0.33	6.97	6.97	5,820	3,460	-	-	-	-
	Calculated 50th percentile Effluent Conc. (when n>10)	388	0.01	6.075	6.08	1,582	931	-	-	-	-
Receiving Water Data	90th Percentile Conc., mg/L	13.1	2.11	7.29	6.51	380	214	-	-	-	-
	Geo Mean, mg/L	7.19	1.06	6.89	6.89	332.78	196.72	-	-	-	-
Water Quality Criteria	95th Percentile Background Groundwater, mg/L	16	2.46	7.51	224	-	-		-	-	-
	GWQ Criteria for Protection of Human Health, mg/L	250	10	8.5	6.5	700	500				-
	Metal Criteria Translator, decimal	-	-	-	-	-	-		-	-	-
	Carcinogen?	N	-	N	N	-	N				-

Table D-14. PermitCalcMarch9-2015 – Groundwater (continued)

Groundwater Reasonable Potential Calculation

Pollutant, CAS No. & NPDES Application Ref. No.		CHLORIDE (dissolved) in mg/L 16887006	NITRATE/NITRITE (N)	pH	pH	SPECIFIC CONDUCTIVITY	SOLIDS, TOTAL DISSOLVED AND SALINITY				
Background Groundwater Reasonable Potential											
Effluent percentile value		0.950	0.950	0.950	0.950	0.950	.0950				
s	$s^2=\ln(CV^2+1)$	0.555	0.555	0.555	0.555	0.555	0.555				
Pn	$Pn=(1\text{-confidence level})^{1/n}$	0.970	0.970	0.970	0.971	0.971	0.971				
Multiplier		1.00	1.00	1.00	1.00	1.00	1.00				
Max concentration (mg/L)	95th Percentile	1,600.96	0.332	6.97	6.97	5,813	3,455.83				
Reasonable Potential? Limit Required?		**YES**	**NO**	**NO**	**YES**	**YES**	**YES**				
Limit Calculation											
# of Compliance Samples Expected per month		1	1	1	1	1	1				
LTA Coefficient Variation (CV), decimal		0.6	0.6	0.6	0.6	0.6	0.6				
Permit Limit Coefficient Variation (CV), decimal		0.6	0.6	0.6	0.6	0.6	0.6				
Waste Load Allocations, mg/L	95th Percentile	16	2.46	7.51	6.44	390.61	224.01				
Long Term Averages, mg/L	95th Percentile	8.44	1.29	3.96	3.40	206.016	118.15				
Metal Translator or 1?		1.00	1.00	1.00	1.00	1.00	1.00				
Average Monthly Limit (AML), mg/L		**18.02**	**2.76**	**8.45**	**7.25**	**252.23**	**439.83**				
Maximum Daily Limit (MDL), mg/L		**26.28**	**4.03**	**12.33**	**10.58**	**367.96**	**641.63**				

Table D-14. PermitCalcMarch9-2015 – Groundwater (continued)

Groundwater Reasonable Potential Calculation

Pollutant, CAS No. & NPDES Application Ref. No.	CHLORIDE (dissolved) in mg/L 16887006	NITRATE/NITRITE (N)	pH	pH	SPECIFIC CONDUCTIVITY	SOLIDS, TOTAL DISSOLVED AND SALINITY				
Human Health Reasonable Potential										
s $s^2=\ln(CV^2+1)$	0.555	0.555	0.555	0.555	0.555	0.555				
Pn $Pn=(1\text{-confidence level})^{1/n}$	0.970	0.985	0.970	0.971	0.971	0.971				
Multiplier	0.354	0.300	0.351	0.350	0.350	0.350				
Dilution Factor	1.00	1.00	1.00	1.00	1.00	1.00				
Max Concentration, mg/L	388	1.82	6.12	6.08	1,582	931				
Reasonable Potential? Limit Required?	**YES**	**NO**	**NO**	**NO**	**YES**	**YES**				
Human Health Limit Calculation										
# of Compliance Samples Expected per month	1	1	1	1	1	1				
Average Monthly Effluent Limit, mg/L	**250.44**	**10**	**8.5**	**6.5**	**701.09**	**500.55**				
Maximum Daily Effluent Limit, mg/L	**364.70**	**14.59**	**12.40**	**9.49**	**1,022.94**	**730.33**				

Comments/Notes:

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Table D-15. Limit Calculations from EPA/505/2-90-001, *Technical Support Document for Water Quality-based Toxics Control*

COLUMN	Where:	Description		
A	Location ≡	Location of the sampling point. LAGOON is the sample from the pump station after the treatment lagoon and before land application. MW-3 is the up gradient well, located outside the land application area at the west center of the area.		
B	Date ≡	The collection date of the sample.		
C	Parameter ≡	The parameter analyzed.		
D	Units ≡	The units of the parameter value.		
E	K ≡	Total number of results.		
F	ND ≡	Formula to determine if a value is a non-detect. Equation is: =IF((E2 = “ND”), “Y”, (IF((E2 = “B”), “Y”, “”)))		
		Where	E2 ≡	The value in the column E (Qlf).
			“ND” ≡	The designation for a non-detect in most samples.
			“B” ≡	The designation for a non-detect in nitrate samples.
G	r ≡	Total number of non-detects.		
H	k – r ≡	Total number of detected samples.		
I	δ = r / k ≡	The ratio of non-detected results to the total number of results.		
J	μ_y ≡	The estimated mean (average) of all results. Equation is: $\Sigma[x_i]/k$, 1 ≤ i ≤ k.		
		Where:	x_i =	The value in Colum E if parameter is normally distributed (e.g., pH).
			x_i =	The value in Column J (natural log) if the parameter is log-normally distributed (e.g., chloride).
			x_i =	The value in Column K (delta-lognormal [natural log without non-detects]) if the parameter results contain non-detects (r > 0) (e.g., BOD_5); OR if the parameter is some other distribution (e.g., TSS is a cube-root normal distribution).
K	σ^2_y ≡	The estimated variance of all results. Equation is: $\Sigma[(x_i - \hat{\mu})^2]/(k-1)$, 1 ≤ i ≤ k. x_i is the same as the mean, above.		
L	σ^y ≡	The standard deviation of all results. Equation is: $\sqrt{\hat{\sigma}^2}$.		
M	1 – δ ≡	Percent of parameters detected.		
N	E(x) ≡	The Daily Average of a log-normal distribution. Equation is: $e^{\left(\mu_y + \sigma^2_y/2\right)}$		
O	V(x) ≡	The Variance of a log-normal distribution. Equation is: $E(x) * \left(e^{\sigma^2_y} - 1\right)$		
P	cv(x) ≡	The Coefficient of Variation of a log-normal distribution. Equation is: $\sqrt{\left(e^{\sigma^2_y} - 1\right)}$		
Q	Ê(X*) ≡	The Daily Average of a delta-lognormal distribution (e.g., a log-normal distribution that contains both measured and non-detect values). Equation is: $\delta D + (1 - \delta)\, e^{\left(\mu_y + \sigma^2_y/2\right)}$		
R	V^(X*) ≡	The Variance of a delta-lognormal distribution. Equation is: $(1 - \delta)\, e^{\left(\mu_y + \sigma^2_y/2\right)} * \left[e^{\sigma^2_y} - (1 - \delta)\right] + \delta(1 - \delta) D\left[D - 2e^{\left(\mu_y + \sigma^2_y/2\right)}\right]$		
S	cv(X*) ≡	The Coefficient of Variation of a delta-lognormal distribution. Equation is: $\sqrt{V^(X^*)}/\hat{E}(X^*)$		
T	$Z^*_{(0.95)}$ ≡	Z-score determined from a standard table of percentiles. For a parameter WITH NO non-detects $z^*_{(0.95)} = 1.6449$. For a parameter WITH non-detects $z^*_{(0.95)} = \varphi^{-1}\left[(0.95 - \delta)/(1 - \delta)\right]$; where φ^{-1} is the mathematical notation for z-score, δ is from Column P, and 1 – δ is from Column T.		
U	$Z^*_{(0.99)}$ ≡	Z-score determined from a standard table of percentiles. For a parameter WITH NO non-detects $z^*_{(0.99)} = 2.3263$. For a parameter WITH non-detects $z^*_{(0.99)} = \varphi^{-1}\left[(0.99 - \delta)/(1 - \delta)\right]$; where φ^{-1} is the mathematical notation for z-score, δ is from Column P, and 1 – δ is from Column T.		
V	Daily Max ($X_{.95}$) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + 1.6449\hat{\sigma}$, for a normal distribution; or $exp^{[\widehat{\mu_y} + 1.6449\hat{\sigma}_y]}$, for a log-normal distribution.		

Table D-15. Limit Calculations from EPA/505/2-90-001, *Technical Support Document for Water Quality-based Toxics Control*

COLUMN	Where:	Description
W	Daily Max ($X_{.99}$) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + 2.3263\hat{\sigma}$, for a normal distribution; or $exp^{[\widehat{\mu_y} + 2.3263\hat{\sigma}_y]}$, for a log-normal distribution.
X	Daily Max ($X_{.95}$) (w NDs) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + z^*_{0.95}\hat{\sigma}$, for a delta-normal distribution; or $exp^{[\widehat{\mu_y} + z^*_{0.95}\hat{\sigma}_y]}$, for a delta-lognormal distribution.
Y	Daily Max ($X_{.99}$) (w NDs) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + z^*_{0.99}\hat{\sigma}$, for a delta-normal distribution; or $exp^{[\widehat{\mu_y} + z^*_{0.99}\hat{\sigma}_y]}$, for a delta-lognormal distribution.
Z	Daily Max 0.95 Variability Factor ≡	The ratio of the calculated Daily Maximum to the average value for that parameter. The larger the value the more likely the calculated value may be biased high. For a normal distribution the equation is: $\widehat{X}_{0.95}/\hat{\mu}$, where X^$_{0.95}$ is the calculated Daily Max ($X_{0.95}$). For log-normal distributions the equation is: $\widehat{X}_{0.95}/\widehat{E}(X)$. For delta-lognormal distributions the equation is: $\widehat{X}_{0.95}/\widehat{E}(X^*)$.
AA	Daily Max 0.99 Variability Factor ≡	The ratio of the calculated Daily Maximum to the average value for that parameter. The larger the value the more likely the calculated value may be biased high. For a normal distribution the equation is: $\widehat{X}_{0.99}/\hat{\mu}$, where X^$_{0.99}$ is the calculated Daily Max ($X_{0.99}$). For log-normal distributions the equation is: $\widehat{X}_{0.99}/\widehat{E}(X)$. For delta-lognormal distributions the equation is: $\widehat{X}_{0.99}/\widehat{E}(X^*)$.
AB	n ≡	The average of yearly sample size. This value of "n" is the one denoted in the variables and equations.
AC	$\sigma^{\wedge 2}_n$ ≡	Variance of the distribution of the n-day monthly average. The equation is: σ^2/n, where σ^2 is the estimated variance (Column S), and n is the average of yearly sample size in cell AJ4.
AD	$\mu^{\wedge}_n$ ≡	Mean of the distribution of the n-day monthly average. The equation is: μ^, the estimated mean from Column Q.
AE	$\sigma^{\wedge}_n$ ≡	Standard deviation of the distribution of the n-day monthly average. The equation is: $\sqrt{\hat{\sigma}^2_n}$, where $\sigma^{\wedge 2}_n$ is from Column AJ.
NOTE: Values for $\sigma^{\wedge 2}_n$, μ_n, and $\sigma^{\wedge}_n$ are used for normal distribution ONLY.		
AF	$\hat{E}(X_n)$ ≡	E(x). From Column U for a log-normal distribution, or Column X for a delta-lognormal distribution (log-normal WITH non-detects).
AG	$V^{\wedge}(X_n)$ ≡	$\widehat{V}(x)/n$, where V^(x) is from Column V for a log-normal distribution, or Column Y for a delta-lognormal distribution; and n is from cell AK4.
AH	X_n ≡	Average of the n-day monthly average values. N-day monthly average values are in Column AJ for log-normal distributions and other distribution types, and Column AK for delta-lognormal distributions.
AI	$cv^{\wedge}(X_n)$ ≡	Coefficient of variation of the distribution of the n-day monthly average. The equation is: $\hat{\sigma}^2_n/\hat{\mu}_n$, where $\sigma^{\wedge 2}_n$ is from Column AJ and $\mu^{\wedge}_n$ is from Column AK for a normal distribution. Equation is $\sqrt{V(X_n)}/X_n$ for log-normal and delta-lognormal distribiutions.
AJ	Average Monthly 0.95 ($X_{0.95(n)}$) ≡	The average monthly value at the 95 percent confidence interval. Equation is: $\hat{\mu}_n + 1.6449\hat{\sigma}_n$ for a normal distribution; or, $\widehat{E}(X_n) + 1.6449\sqrt{\widehat{V}(X_n)}$ for a log-normal distribution or other distribution type.
AK	Average Monthly 0.99 ($X_{0.99(n)}$) ≡	The average monthly value at the 95 percent confidence interval. Equation is, $\hat{\mu}_n + 2.3263\hat{\sigma}_n$ for a normal distribution; or, $\widehat{E}(X_n) + 2.3263\sqrt{\widehat{V}(X_n)}$ for a log-normal distribution or other distribution type.
AL	Average Monthly 0.95 ($X_{0.95(n)}$) (w/ NDs) ≡	The average monthly value at the 95 percent confidence interval. Equation is $\hat{\mu}_n + z^*_{0.95}\hat{\sigma}_n$, for a delta-normal distribution; or, $\widehat{E}(X_n) + z^*_{0.95}\sqrt{\widehat{V}(X_n)}$ for a delta-lognormal distribution.
AM	Average Monthly 0.99 ($X_{0.99(n)}$) (w/ NDs) ≡	The average monthly value at the 95 percent confidence interval. Equation is $\hat{\mu}_n + z^*_{0.99}\hat{\sigma}_n$, for a delta-normal distribution; or, $\widehat{E}(X_n) + z^*_{0.99}\sqrt{\widehat{V}(X_n)}$ for a delta-lognormal distribution.
AN	Comments ≡	Miscellaneous notations from the original DMR data set.
AO	Normality ≡	List the normality of the distribution type (normal, log-normal, etc.).

Table D-16. Groundwater Limit Calculation Results from TSD for WQ Limits for Groundwater.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Location	Date Range	Parameter	Units	k	NDs	r	k - r	δ = r / k	$\hat{\mu}_y$	$\hat{\sigma}^2_y$	$\hat{\sigma}_y$	1 - δ	E(X)	V(X)	cv(X)	$\hat{E}(X^*)$	$\hat{V}(X^*)$	cv(X*)
WELL 3	03/01/1996 – 12/01/20015	Chloride	mg/L	180		0	180	0	1.97	0.180950584	0.425383		7.87	12.297	0.445372			
WELL 7	06/01/2007 – 12/01/2015	Nitrate, Total	mg/L	91		0	91	0	0.055413	0.625168537	0.790676		1.44	1.81	0.931966			
WELL 3	03/01/1996 – 12/01/20015	pH, Daily Max	SU	198		0	198	0	6.899	0.100994799	0.317797							
WELL 3	03/01/1996 – 12/01/20015	pH Daily Min	SU	198		0	198	0	6.899	0.100994799	0.317797							
WELL 3	03/01/1996 – 12/01/20015	Specific Conductance	µmhos/cm	183		0	183	0	335.003	1,553.54	39.41							
WELL 3	03/01/1996 – 12/01/20015	Total Dissolved Solids	mg/L	91		0	91	0	197.32	238.38	15.44							

A	B	C	D	T	U	V	W	X	Y	Z	AA
Location	Date Range	Parameter	Units	Z* (0.95)	Z* (0.99)	Daily Max ($X_{.95}$)	Daily Max ($X_{.99}$)	Daily Max ($X_{.95}$) (w NDs)	Daily Max ($X_{.99}$) (w/ NDs)	Daily Max 0.95 Variability Factor	Daily Max 0.99 Variability Factor
WELL 3	03/01/1996 – 12/01/20015	Chloride	mg/L	1.6449	2.3263	14.48	19.35			1.84	2.46
WELL 7	06/01/2007 – 12/01/2015	Nitrate, Total	mg/L			3.88	6.65			2.69	4.603
WELL 3	03/01/1996 – 12/01/20015	pH, Daily Max	SU			7.42	7.64			1.08	1.11
WELL 3	03/01/1996 – 12/01/20015	pH Daily Min	SU			6.38	6.16			1.08	1.11
WELL 3	03/01/1996 – 12/01/20015	Specific Conductance	µmhos/cm			399.84	426.69			1.19	1.274
WELL 3	03/01/1996 – 12/01/20015	Total Dissolved Solids	mg/L			222.71	233.24			1.13	1.18

A	B	C	D	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
Location	Date Range	Parameter	Units	n	σ^2_n	μ_n	σ_n	$E(X_n)$	$V(X_n)$	X_n	$cv(X_n)$	Average Monthly 0.95 ($X_{.95(n)}$)	Average Monthly 0.99 ($X_{.99(n)}$)	Average Monthly 0.95 ($X_{.95(n)}$) (w/ NDs)	Average Monthly 0.99 ($X_{.99(n)}$) (w/ NDs)
WELL 3	03/01/1996 – 12/01/20015	Chloride	mg/L	9				7.87	1.37	1.9998	0.58	9.797	10.59		
WELL 7	06/01/2007 – 12/01/2015	Nitrate, Total	mg/L	10.11	10	10		1.44	0.17932	0.06407	6.61	2.14	2.43		
WELL 3	03/01/1996 – 12/01/20015	pH, Daily Max	SU	9.9	0.0102	6.899	0.101				0.01464	7.06	7.13		
WELL 3	03/01/1996 – 12/01/20015	pH Daily Min	SU	9.9	0.0102	6.899	0.101				0.01464	6.73	6.66		
WELL 3	03/01/1996 – 12/01/20015	Specific Conductance	µmhos/cm	9.15	169.79	335.003	13.03				0.03889	356.44	365.32		
WELL 3	03/01/1996 – 12/01/20015	Total Dissolved Solids	mg/L	9.1	26.195	197.32	5.12				0.02593	205.74	209.22		

A	B	C	D	AN	AO	AP
Location	Date Range	Parameter	Units	Comments	Normality	
WELL 3	03/01/1996 – 12/01/20015	Chloride	mg/L		Log-normal W/O non-detects	
WELL 7	06/01/2007 – 12/01/2015	Nitrate, Total	mg/L	Nitrogen, Nitrate (As NO_3) (Total)	Log-normal W/O non-detects	
WELL 3	03/01/1996 – 12/01/20015	pH, Daily Max	SU	Hydrogen Ion	Normal W/O non-detects	
WELL 3	03/01/1996 – 12/01/20015	pH Daily Min	SU		Normal W/O non-detects	
WELL 3	03/01/1996 – 12/01/20015	Specific Conductance	µmhos/cm	Conductivity	Normal W/O non-detects	
WELL 3	03/01/1996 – 12/01/20015	Total Dissolved Solids	mg/L	Solids (Residue), (TDS)	Normal W/O non-detects	

Appendix E--Response to Comments

Ecology will complete this section after the public notice of draft period.