September 23, 2019
H&S Bosma Dairy Lagoon No. 6
Administrative Order on Consent Docket No. SDWA-10-2013-0080

ANCHOR QEA

H&S Bosma Dairy Lagoon No. 6
Basis of Design Report
100% Design Submittal

Prepared for Liberty/H&S Bosma Dairies

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Prepared for
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ABBREVIATIONS

ASTM	ASTM International
bgs	below ground surface
Dairy	H&S Bosma Dairy
EPA	U.S. Environmental Protection Agency
FML	flexible membrane liner
GCL	geosynthetic clay liner
H:V	horizontal to vertical (ratio)
HDPE	high-density polyethylene
mil	thousandth of an inch
psf	pounds per square foot
QA	quality assurance
SPT	standard penetration test
WA NRCS	Washington State Natural Resources Conservation Service

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1 Introduction

1.1 Purpose

This *Basis of Design Report* was prepared by Anchor QEA, LLC, on behalf of Liberty/H&S Bosma Dairies as required by the U.S. Environmental Protection Agency (EPA) Region 10 Administrative Order on Consent SDWA-10-2013-0080. Under the Administrative Order on Consent, H&S Bosma Dairy (herein referred to as the Dairy) will be lining one existing lagoon (historically designated as Lagoon No. 6).

1.2 Design Objective

The objective of the lagoon liner system design is to meet the requirements of Washington State Natural Resources Conservation Service (WA NRCS) *Conservation Practice Standard 521A – Pond Sealing or Lining – Flexible Membrane* (WA NRCS 2013) and demonstrate compliance with permeability requirements of WA NRCS *Conservation Practice Standard No. 313 – Waste Storage Facility* (WA NRCS 2015). Lagoon consolidation and lining will also include design criteria contained in the *Agricultural Waste Management Field Handbook* (NRCS 2009).

1.3 Report Organization

The remaining sections of this report are organized as follows:

- **Section 2 – Existing Conditions.** This section describes the existing conditions of the proposed lagoon lining areas and details the pre-design geotechnical investigations.
- **Section 3 – Basis of Design.** This section discusses the basis of design components of the Lagoon No. 6 lining.
- **Section 4 – Compliance Monitoring.** This section outlines the procedures for quality assurance (QA) during construction activities and the details of the long-term monitoring program.
- **Section 5 – Construction Schedule.** This section outlines the design and construction schedule.
- **Section 6 – References.** This section provides references for the materials cited in this report.

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2 Existing Conditions

This section describes the existing conditions of the site, as well as the geotechnical investigation conducted as part of the lagoon lining design. The geotechnical investigation was conducted at the Dairy between January 24 and January 25, 2018, per the EPA-approved *Lagoon Pre-Design Data Collection Quality Assurance Project Plan* (Anchor QEA 2017a). The purpose of the geotechnical investigation was to confirm the soil handling properties within the lagoons to be consolidated and/or lined. The geotechnical investigation did not include permeability testing, as previous permeability tests have indicated that the soil present does not meet the requirements for a compacted soil liner.

As part of the investigation, standard penetration tests (SPTs) were conducted every 5 feet for each of the borings, while soil samples were collected along the entire depth of the boring for subsequent laboratory analysis. The standard penetration resistance (N-value) was calculated as the total number of blows needed (using a 140-pound hammer falling a distance of 30 inches) for the sampler to penetrate the final 12 inches of an 18-inch sampler. Results of the SPT (included on the boring logs) and laboratory testing is included in Appendix A.

2.1 Lagoon No. 6

Lagoon No. 6 is located at the Dairy (823 N Liberty Road in Granger, Washington), southeast of the Dairy's main operation (Figure 1).

2.1.1 Existing Site Conditions

Lagoon No. 6 will be within the footprint of the existing lagoon. The existing dimensions of Lagoon No. 6 are approximately 300 feet long by 190 feet wide by 10 feet deep. The maximum capacity of the lagoon without freeboard is approximately 9.3 acre-feet (3.0 million gallons). The lagoon is constrained by a berm, an access road, and utilities to the east; an access road and utilities to the west; an access road to the south; and an access road and a corral to the north. The width of the access roads around the lagoon is approximately 20 to 30 feet wide, with some sharp corners. The interior side slopes of the lagoon have a slope inclination of approximately 2 horizontal to 1 vertical (2H:1V). Exterior slopes are nominal to the west and north, while the berms to the north and south of the existing lagoon have slope inclinations of approximately 2H:1V.

Lagoon No. 6's waste management operations include collection, storage, and treatment. The lagoon currently receives liquid manure and stores the liquid until it can be used to fertilize crops. A pumping system is used to convey the liquid manure to the irrigation system. Following lining, Lagoon No. 6 will continue to have the same inputs and should require infrequent cleaning under continued operations.

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2.1.2 Soil Conditions

The geotechnical investigation included a total of four soil borings along the proposed perimeter of Lagoon No. 6 (Figure 2). The four borings were extended to depths of 16.5 to 21.5 feet below ground surface (bgs).

The general lithology of the subsurface for Lagoon No. 6 consists of silty sand overlying sandy silt on the south and west sides and sandy silt on the north and east sides, as shown in Figures 3 and 4. Based on this soil lithology, as well as the results of the SPT and laboratory analysis, engineering parameters were defined for each soil layer for subsequent analysis.[1] The soil characteristics and engineering properties of each soil layer are described as follows:

- **Gravelly Silty Sand.** The surface layer observed at the north boring was gravelly silty sand, which serves as a roadway surface. Layers of gravelly silty sand were also observed in the west boring at depths of 5.7 and 7.5 feet bgs and are assumed to be fill layers. This fill material was found to have an inflated N-value due to the gravel content. Due to this and the amount of silt present, the internal friction angle is assumed to be 32 degrees.
- **Sandy Silt.** The most predominant layer, identified to a depth of 5.7 to 21.5 feet bgs, is sandy silt. It is grey to brown, firm to stiff, and has no plasticity. The average N-value for this material was 12, which correlated to an undrained shear strength of approximately 1,500 pounds per square foot (psf). Due to the amount of sand that likely increased the blow counts, a value of 1,250 psf was used for the slope stability analysis.
- **Silty Sand.** Underlying the sandy silt and gravelly silty sand layers in the west boring and underlying the sand silt in the south boring is a silty sand. The silty sand layer was identified to be poorly graded and dense, with N-values ranging from 35 to 60. Due to the amount of silt present, the internal friction angle is assumed to be 30 degrees.

2.1.3 Groundwater Conditions

Groundwater is approximately located at an elevation of 842 feet North American Vertical Datum of 1983 near Lagoon No. 6 based on groundwater elevation measurements taken in the first quarter of 2018 at the closest monitoring well (DC-07), which is located south of the lagoon. Groundwater levels in monitoring well DC-07 exhibit seasonal fluctuations of approximately 1 foot (Anchor QEA 2017b). The designed bottom elevation of Lagoon No. 6 is 908 feet, approximately 62 feet above the observed groundwater level.

[1] The SPT N-values were correlated to drained friction angles and undrained shear strengths using methods by Terzaghi and Peck (1967) and Peck, Hanson, and Thornburn (1974).

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3 Basis of Design

Major components of the lagoon liner design were selected and developed to do the following: 1) comply with design criteria and additional considerations identified in WA NRCS *Conservation Practice Standard No. 313 – Waste Storage Facility* (WA NRCS 2015) and the *Agricultural Waste Management Field Handbook* (NRCS 2009); and 2) to address EPA/Natural Resources Conservation Service requirements to include a double-liner system. These components, as well as other analyses conducted, are described in the subsequent sections.

3.1 Lagoon Preparation and Consolidation

3.1.1 Lagoon No. 6

Lagoon No. 6 will be prepared for liner installation by regrading the lagoon bottom and side slopes and adjusting and replacing inlet and outlet pipes as necessary. Lagoon No. 6 will be approximately 210 feet long (as measured from north to south) and 280 feet wide (as measured from east to west), with an 8.2-foot operating level depth and 2 feet of freeboard. The approximate capacity at the maximum operating level is 7.52 acre-feet (2.45 million gallons). See Sheet C-03 in Appendix B-1 for more details regarding the layout of the lagoon. The interior side slopes of Lagoon No. 6 will be 3H:1V to improve constructability and promote liner longevity.

3.2 Liner Design

Based on historical field observations and permeability results of similar site soils, the lagoon liner selected for Lagoon No. 6 will be a flexible membrane liner (FML) over a geosynthetic clay liner (GCL).

In the FML/GCL combination design, the GCL will be used as the secondary liner in combination with a high-density polyethylene (HDPE) primary liner. The FML/GCL design, from the bottom layer up, will consist of the following at Lagoon No. 6:

- A compacted soil base
- A grid of geocomposite gas vent strips
- A GCL secondary liner
- A 60-thousandth of an inch (mil) welded-seam HDPE primary liner

The GCL will be placed over a compacted soil foundation consistent with the requirements of WA NRCS *Conservation Practice Standard No. 521A – Pond Sealing or Lining – Flexible Membrane* (WA NRCS 2013) and WA NRCS *Material Specification MS-223: Geosynthetic Clay Liner* (WA NRCS 2002).

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The 60-mil HDPE geomembrane will be placed directly over the GCL and welded per WA NRCS *Conservation Standard No. 521A – Pond Sealing or Lining – Flexible Membrane* (WA NRCS 2013), *Material Specification MS-594: Geomembrane Liner* (WA NRCS 2014), and the *Technical Specifications* (Appendix C).

3.3 Anchor Trench

The dimensions of the anchor trench will meet WA NRCS standards and will be between 18 and 24 inches deep, between 18 and 24 inches wide, and located 3 feet from the top of the slope. To further validate the anchor trench design, geotechnical analysis was conducted on the proposed anchor trench dimensions. The anchor trench design was evaluated to determine the amount of resistance present on the 60-mil HDPE geomembrane liner. For this analysis, it was assumed that all lagoon slopes are 3H:1V and the anchor trench will be backfilled with site material with a unit weight of 115 pounds per cubic foot and an internal friction angle of 26 degrees, representative of the sandy silt observed. The HDPE was assumed to have an interface friction angle with the soil of 18 degrees and a tensile yield strength of 1,000 pounds per foot width (Koerner 2012). A 3-foot run-out length of liner will extend beyond the crest of the lagoon slope. An anchor trench with dimensions of 24 inches deep and 24 inches wide resulted in a pull-out resistance of 772 pounds per linear foot. As indicated by Koerner (2012), the resistance should be equal to or less than the yield strength of the geomembrane liner to mitigate tearing or ripping. Results from the analysis indicated that the proposed dimensions meet the design criteria and are consistent with general practice.

3.4 Foundation Preparation

Liquid and solid manure will have been removed from the existing lagoon by the Dairy owner prior to liner installation. Manure solids will either be removed to the facility composting area, placed in an area that drains to another lagoon, or placed in another lagoon that is not currently identified for lining. Solids will be removed down to the soil foundation material. Grading Lagoon No. 6 will achieve the designed side slopes, lagoon bottom, and embankment conditions. The existing subgrade will be prepared as required by the lining design and site conditions. Sections 3.4.1 through 3.4.3 include additional details on foundation preparation.

In areas where fill is required to meet the final grade, fill will be compacted to at least 92% of the maximum dry density and to within 2% of the optimum moisture content as determined using the Modified Proctor (ASTM International [ASTM] D1557); this will reduce the potential for settlement, reduce soil permeability, and provide a suitable subgrade for liner construction. Subgrades in excavation areas will be proof-rolled using construction equipment to verify the subgrade is in a non-yielding condition. Areas with soils that are soft (yielding) will be over-excavated, and suitable fill material will be placed, compacted, and tested as described in this section.

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3.4.1 Side Slopes

Interior and exterior side slopes have been evaluated for compliance with requirements contained in WA NRCS *Conservation Practice Standard No. 313 – Waste Storage Facility* (WA NRCS 2015). Current standards for embankments require that the combined side slopes for the embankment shall not be less than 5H:1V and neither slope shall be steeper than 2H:1V unless additional slope stability provisions are provided. As stated previously, the interior side slopes of Lagoon No. 6 will be 3H:1V. Exterior slopes for Lagoon No. 6 shall not be steeper than 2H:1V.

Slope stability modeling was performed using Rocscience Slide 7.0© software that uses limit equilibrium methods of analysis. The soil model for limit equilibrium analysis assumes rigid, perfectly plastic soil behavior, which is a simplification of real soil behavior. The assumptions inherent to this model are that the anticipated sliding mass remains rigid (i.e., non-deformable) and the soil strength along the slip plane is fully mobilized at failure. Although this analysis method does not directly represent the true behavior of the soil during a slope failure, it is intended to provide a reasonable indication of the overall stability of a slope and is generally accepted as the standard of practice for this type of assessment.

The slope stability was evaluated for Lagoon No. 6 under three conditions, as summarized in Table 1. The three conditions include the short-term condition during lagoon grading, the long-term condition following construction, and the expected condition when Lagoon No. 6 is filled. The target factors of safety consider the intended use of the structure, the potential consequences of failure, and the limitations and understanding of the anticipated subgrade soils. Target factors of safety of 1.3 for the short-term condition and 1.5 for the long-term and filled conditions were considered appropriate for use in this analysis based on U.S. Army Corps of Engineers-recommended slope stability guidelines (USACE 2003). Slope stability was also evaluated for the existing exterior berm slopes to determine if construction would adversely affect them. It was determined that the regrading and liner installation would not decrease the stability of the exterior slopes.

Table 1
Lagoon No. 6 Slope Stability Analysis

Boring Reference	Proposed Lagoon Side Slope	Proposed Lagoon Depth (feet)	Short-Term Factor of Safety	Long-Term Factor of Safety	Filled Lagoon Factor of Safety
LD-L6W	3H:1V	14.0	1.7	1.5	1.8
LD-L6E	3H:1V	14.0	5.3	1.5	6.1

Note:

1. Assumes slopes above anchor trench are at 3H:1V or are backfilled with granular material and compacted to 92% Modified Proctor (ASTM D1557).

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Fill material will be compacted to a level equal to or greater than 92% of the Modified Proctor (ASTM D1557) density for those soils to reduce the potential for settlement, promote slope stability, reduce soil permeability below the lagoons, and provide a suitable subgrade for liner construction. Additionally, fill material placed above the anchor trenches that serve as access roadways will need to meet the same compaction requirements.

3.4.2 Lagoon Bottom

As described in Section 2.1.3, groundwater is not anticipated to influence the performance of Lagoon No. 6. The lagoon bottom will be regraded to create a relatively uniform bottom with a slight grade to promote the migration of gases produced underneath the liner system. The lagoon bottom foundation material is expected to be either in situ soil or soil generated from on-site earthwork that is suitable for reuse.

3.4.3 Embankment

The maximum height of the Lagoon No. 6 embankment (e.g., berm) is 8 feet from the surrounding grade and is located near the southeast corner of the lagoon. Based on the criteria contained in WA NRCS *Conservation Practice Standard No. 313 – Waste Storage Facility* (WA NRCS 2015), the minimum top width for an embankment of this height should be 8 feet. The design top width of the embankment along the north and west sides of Lagoon No. 6 will be 15 feet for vehicular access. The remainder of the embankment of Lagoon No. 6 shall have a width of at least 10 feet. No vehicle access will be permitted on the portions of the embankment less than 15 feet in width.

The top of the lagoon liner system at Lagoon No. 6 will extend 2 feet above the consolidated lagoon's maximum operating level as freeboard depth to reduce the potential for overflow and account for settlement that may occur. The minimum freeboard depth included in WA NRCS *Conservation Practice Standard No. 313 – Waste Storage Facility* (WA NRCS 2015) is 1 foot plus an additional depth not less than 5%.

3.5 Gas Venting

Aerobic and anaerobic degradation of organic material can produce gases at the manure storage lagoons. This can also occur underneath the lagoon liner system if organic matter is present. Gas production below the liner system can lead to damage or failure of the FML and may present itself as an uplift or bubbling of the liners. To minimize this condition, the liquid and solid manure will be removed from the existing lagoon to native foundation material prior to installation of the lagoon liner system. While every effort will be made to remove the presence of organic matter from the lagoons, some organic matter may be present below the liner. As such, a gas venting system will be constructed below the secondary GCL to collect and convey soil gases under the liner to vent pipes located along the crest of the lagoon.

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The venting system will consist of a grid of 200-mil geocomposite strips between 3 and 5 feet wide that will be spaced 50 feet apart and vented to the atmosphere. The geocomposite is a geonet that is encapsulated with geotextiles to minimize the potential for soil to clog the geonet, which serves as the vent conveyance. To further protect the geocomposite from clay intrusion (from the GCL above the geocomposite), a strip of HDPE liner will be placed between the geocomposite and the GCL.

Vents will be located at or above the lagoons' freeboard height (i.e., above the maximum operating level at the top of the embankment). Vents will be constructed above holes cut in the GCL and HDPE liners. The bottom of the vent pipe includes a base constructed of thick HDPE stock that will be welded to the primary liner. The vent pipe will be a 2-inch-diameter HDPE pipe that will be fabricated to the base. The vent pipe will have a downturned 180-degree bend to minimize the potential for precipitation and debris entering the vent system.

3.6 Inlet and Outlet Piping

Inlet and outlet piping associated with Lagoon No. 6 will be minimized to that which is necessary for the proper functioning of the lagoons. Anticipated modifications to the existing inlet and outlet piping will include extending the existing 8-inch pipe in the southeastern portion of the berm that will overflow into Lagoon No. 5 and extending the existing 12-inch pipe in the southwest portion of the berm used to connect to a floating pump. Three existing inlet pipes on the northern half of the berm will be abandoned or removed. An existing 3-inch inlet pipe in the southwest portion of the berm and an existing 6-inch inlet pipe in the northwest portion of the berm will remain. The inlet pipes will convey runoff from the compost stockpile areas to the west and north of Lagoon No. 6. The maximum anticipated inflow from the inlet pipes is estimated at 450 gallons per minute. The capacity of the 8-inch outlet pipe is estimated at 940 gallons per minute. See Sheet C-03 in Appendix B for the location of the inlet and outlet piping.

Penetrations in the lagoon liner will be constructed in accordance with manufacturer recommendations and WA NRCS *Conservation Standard No. 521A – Pond Sealing or Lining – Flexible Membrane* (WA NRCS 2013). HDPE pipe joints and connections will be joined together by thermal butt-fusion, electrofusion, or couplers. At the locations where HDPE piping penetrates the liner, a pipe sleeve (constructed of the same material as the HDPE liner) will be installed around the HDPE piping. Once secured, a continuous extrusion weld will be applied along the perimeter of the skirt, at the location where the skirt and sleeve meet, and at the location where the pipe and the sleeve meet. Each pipe penetration will undergo construction quality control/construction QA testing to ensure no leaks are present at the interface between the pipe and the liner.

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Periodic cleanouts of Lagoon No. 6 to remove liquid and suspended solids will occur as necessary for crop fertilization and liner inspection and maintenance. It is anticipated that the lagoon will be equipped with a floating pontoon agitator pump to remove liquid and solids from the lagoon.[2]

3.7 Lagoon Access, Safety, and Protection

Lagoon access by a ramp will not be necessary for Lagoon No. 6. Solids buildup will be removed with a floating agitator.

Proposed safety features include a barrier or fencing and posted warning signs around the perimeter of the lagoon to discourage unauthorized access to the lagoon.

The following measures will be taken to minimize the risk of the liner being punctured after installation:

- **No Vehicle Traffic on Liner.** Following construction, vehicle traffic will not be allowed on the liner system.
- **Perimeter Protection.** A fence or barrier will be installed along the lagoon perimeter to deter access to the lagoon by animals, personnel, and vehicles.
- **Signage.** Signs will be placed around the lagoon notifying individuals to stay off the liner. Foot traffic on the liner will be permitted on an as-needed basis for operational and maintenance needs only.
- **HDPE Rub Sheets.** Rub sheets will be installed in a location on Lagoon No. 6 designated for the floating agitator pump's entrance to and exit from the lagoon. These sheets will be installed on the primary liner from the edge of the anchor trench, downslope, and along the bottom of the lagoon. Rub sheets are anticipated to be made of smooth 60-mil HDPE liner and will be installed one on top of the other.

3.8 Washington State Dam Safety Act

Waste storage ponds that impound 10 acre-feet or more of liquid are regulated by the Washington Dam Safety Office through the Washington State Department of Ecology. Per WA NRCS standards, the impounded volume used to determine whether the lagoon exceeds the 10 acre-feet threshold is the volume of water stored behind the embankment from the elevation measured from the lowest point of the outside embankment to the maximum attainable water surface elevation of the lagoon that could occur during extreme operating conditions.

[2] The floating pontoon agitator pump will be connected to an aboveground pipe to convey lagoon contents to various application fields, depending on the need. This system was selected to eliminate traffic on the liner, eliminate the need for a ramp, and allow the pump to sit on the pontoons when the lagoon is empty. HDPE geomembrane rub sheet(s) will be used to protect the primary liner as the agitator enters and exits the lagoon or as the lagoon empties. Prior to emptying the lagoon, the agitator will be positioned above the rub sheet so the pontoons sit on the rub sheet when the lagoon is empty.

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Lagoon No. 6 was analyzed using recent topographical survey data and was estimated to impound a volume of 8.34 acre-feet, with a maximum lagoon impoundment depth of 8 feet. This impoundment depth is measured from the lowest point along the exterior of the berm to the top of the liner, which includes the freeboard depth of 2 feet. The impoundment depth does not include the lagoon depth below the lowest point in the berm. Lagoon No. 6 will not impound over 10 acre-feet of water and therefore does not fall under the Washington Dam Safety Office jurisdiction. A gate valve will be installed on the outlet pipe of the lined lagoon. This valve shall always remain fully open during normal operating conditions. The valve will be closed temporarily only if necessary for maintenance activities.

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4 Compliance Monitoring

4.1 Construction Quality Assurance

QA measures will be implemented during construction of the liner system at Lagoon No. 6 to confirm that the liner is installed in accordance with the *Construction Drawings* in Appendix B, *Technical Specifications* in Appendix C, and manufacturer recommendations. The *Construction Quality Assurance Plan* in Appendix D identifies the roles and responsibilities of the project team during construction. It also describes the performance monitoring of the construction activities in accordance with the 100% design documents through a QA program. Further, it delineates the QA methods and protocols for the project team to encourage a thorough understanding of construction monitoring, feedback, and adjustments.

4.2 Long-Term Monitoring Program

A long-term monitoring program will be implemented to verify the effectiveness of the lagoon lining and demonstrate that design objectives are being attained. The long-term monitoring program is outlined in the *Operations, Maintenance, and Monitoring Plan* in Appendix E. Provisions for leak detection include weekly visual inspections of the lagoon and exposed portions (freeboard areas) of the lagoon liner, annual internal inspections when the lagoon is empty, and periodic (every 2 years) electronic testing of the upper geomembrane liner using ASTM Methods D-7002-16 or D-7007-16. The weekly and annual inspections will be performed by trained Dairy personnel. Periodic electronic testing will be performed by a qualified leak detection contractor.

Results of the annual internal inspection and the periodic electronic testing of the upper liner will be submitted to EPA in the monthly progress reports within 2 months of completion of the inspections/testing. If one or more leaks are identified, the type and location of the leak(s) will be reported, along with the schedule and approach for leak repair. Repairs will be conducted by a qualified liner installer and will generally involve welding a patch over the affected area and verifying the completeness of the repair using a vacuum test.

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5 Construction Schedule

Construction is anticipated to start by July 2019 with the target of completing construction before the end of September 2019. The EPA deadline for commencing construction is August 1, 2019, and construction must be completed by December 1, 2019. Considerations that have determined the timing of the construction include design and EPA review time, bidding timing, procurement, and acceptable field conditions (i.e., before the ground freezes). Based on these considerations, construction is estimated to occur between July and October 2019. EPA has set a deadline for submittal of an As-Built Report no later than December 31, 2019.

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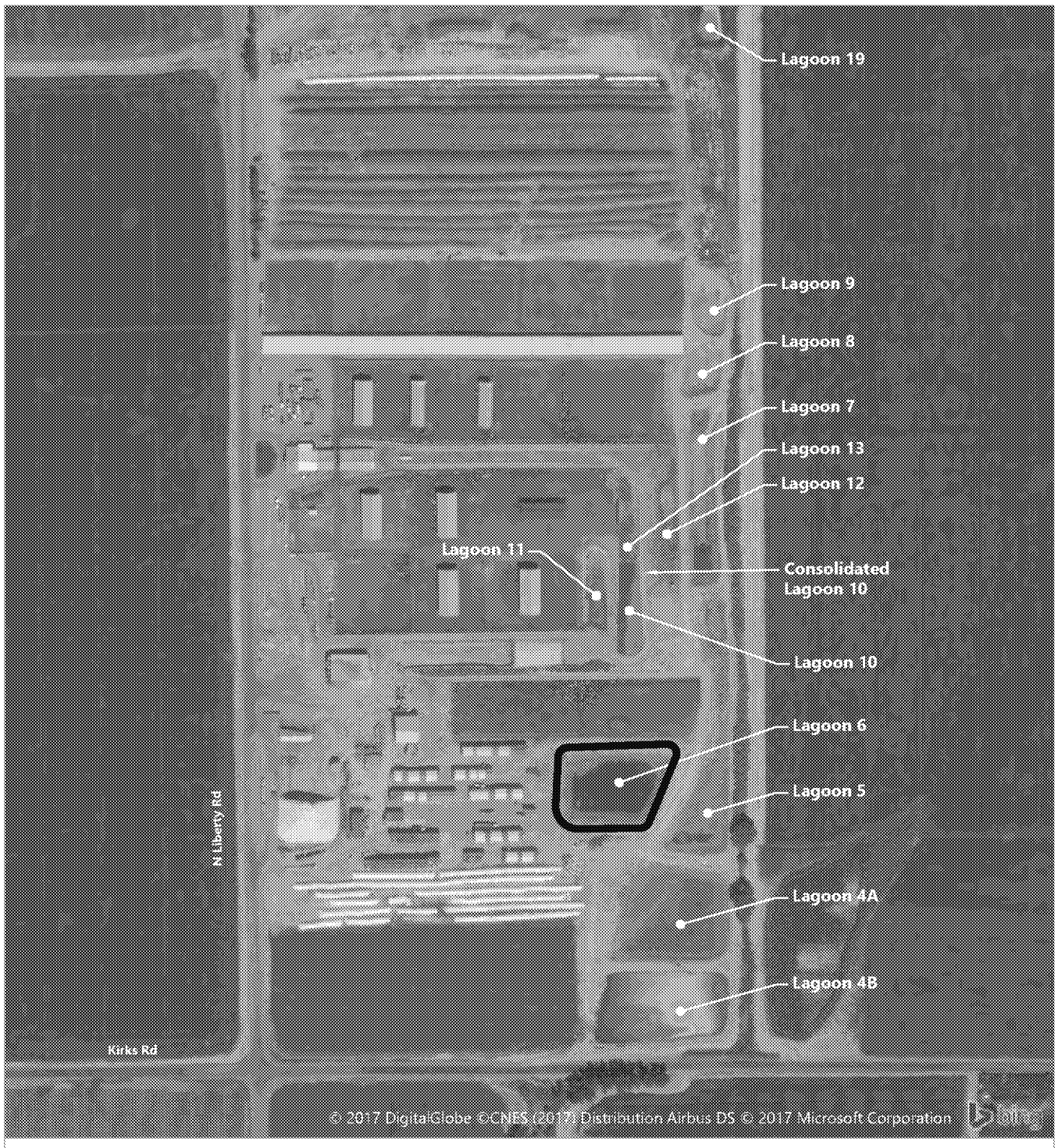
Figures



SOURCE: Aerial from Microsoft (Bing) 4/11/2018
HORIZONTAL DATUM: Washington State Plane South, NAD83, U.S. ft

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Feet

Publish Date: 2019/06/20 4:21 PM | User: rperdie
Filepath: K:\Projects\0996-Perkins Cole\Yakima Dairies Project\Lagoons - 2019\Lagoon 6 - Borings\0996-RP-001 (2018 BODR Maps).dwg Bosma-BODR

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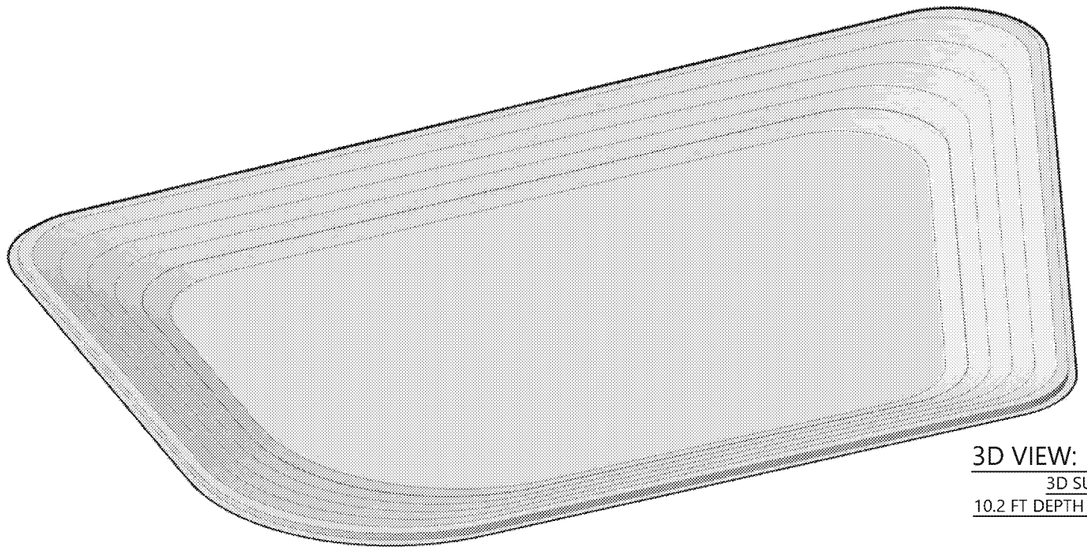
Figure 1
H&S Bosma Dairy Lagoon Map

Basis of Design Report
H&S Bosma Dairy Lagoon No. 6

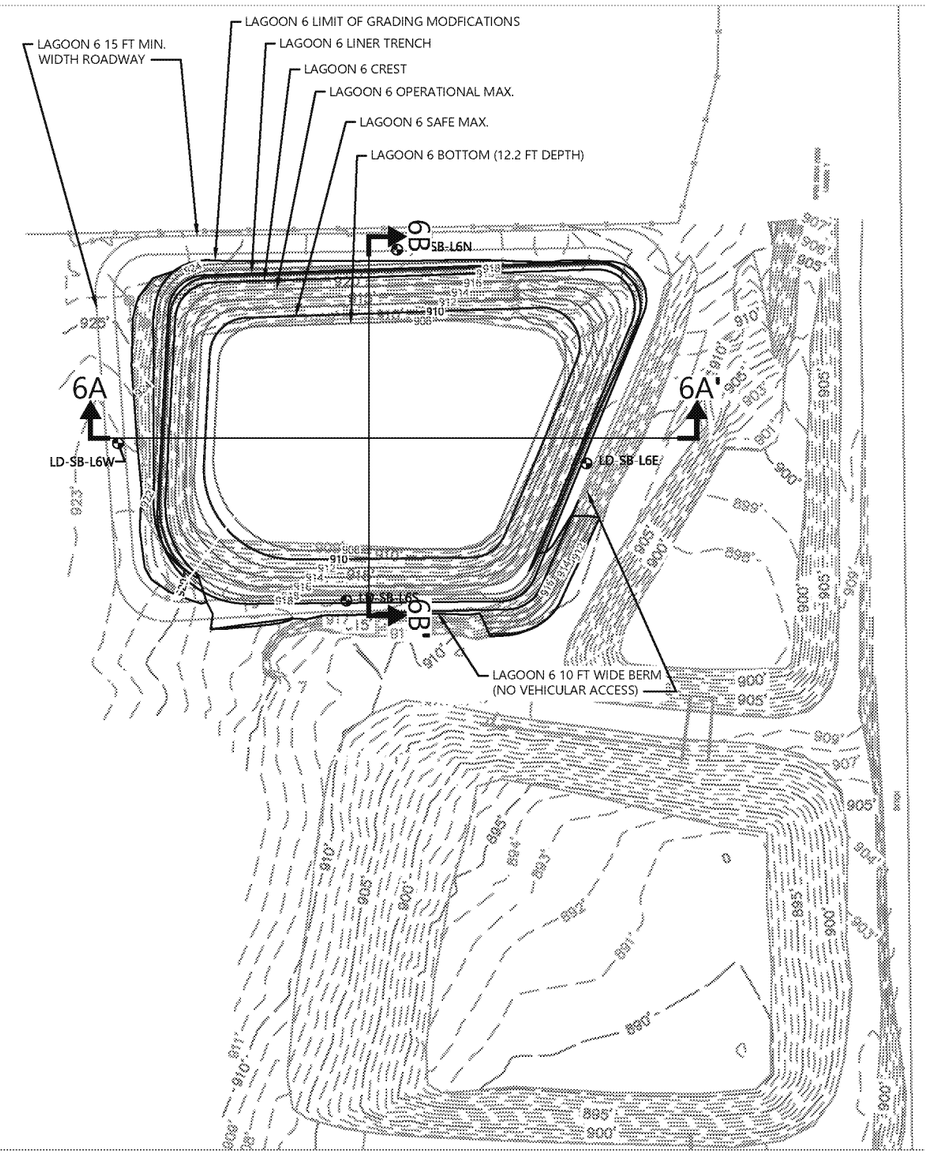


3D VIEW: BOTTOM LINER

3D SURFACE AREA

10.2 FT DEPTH = 64706 SQUARE FEET

LAGOON 6				
	(Fill) DEPTH (FEET)	VOLUME (CUBIC YARD)	VOLUME (MILLION GALLONS)	VOLUME (ACRE-FEET)
LAGOON MAX.	10.2	16108	3.25	9.98
OPERATIONAL MAX.	8.2	12139	2.45	7.52
EMERGENCY VOL. (TYPICAL)	10	13455	2.72	8.34



SOURCE: PLSA Survey dated 1/8 to 1/16 2018
HORIZONTAL DATUM: Washington State Plane South, NAD83, U.S. ft
VERTICAL DATUM: NAVD88, ft

NOTE: Soil boring locations and ground surface elevations are approximate.

LEGEND:

Soil Boring Location

A A' Cross Section Location (See Figure 3)

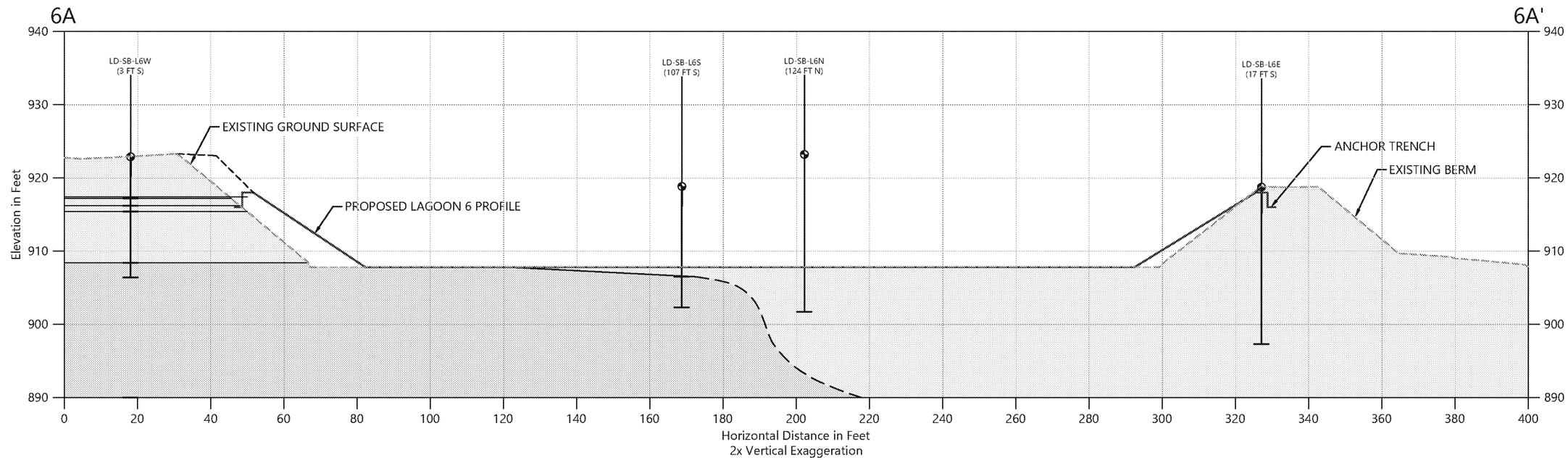
0 100 Feet

Publish Date: 2019/06/24 1:16 PM | User: jsexton
Filepath: K:\Projects\0996-Perkins Coie\Yakima Dairies Project\Lagoons - 2019\Lagoon 6 - Borings\0996-RP-002 (2019 BODR Lagoon 6 Borings).dwg Bosma-6-Plan

ANCHOR QEA

Figure 2
H&S Bosma Dairy Lagoon No. 6 Soil Boring Locations

Basis of Design Report
H&S Bosma Dairy Lagoon No. 6



LEGEND:

- Sandy Silt
- Gravelly Silty Sand
- Silty Sand
- Lithologic Contact (Dashed where inferred)
- Existing Ground Surface
- Proposed Lagoon Profile
- LD-SB-L6S (107.1 FT S) — Boring Identification (Approximate Distance in Feet and Direction)
- Boring Location

Stratigraphy Note:
Soil layers presented are based on a limited number of subsurface explorations; therefore conditions during construction may vary from that shown.

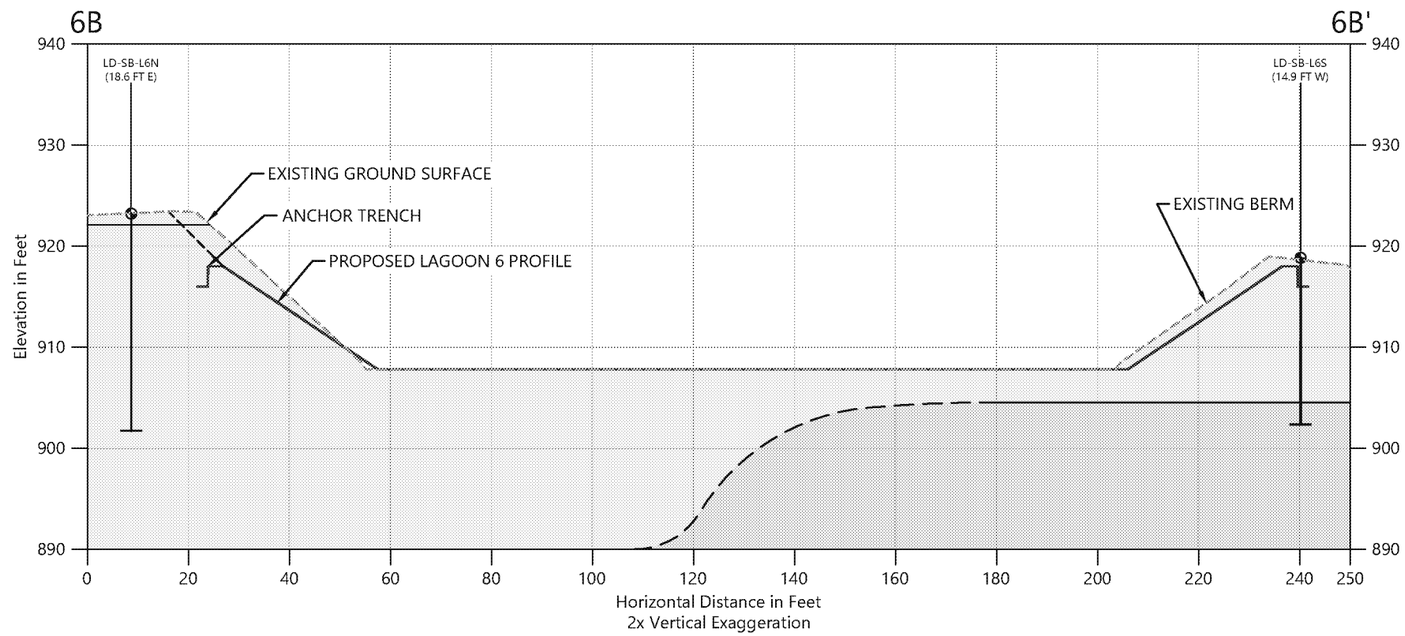
Horizontal Scale in Feet
0 30 60
0 15 30
Vertical Scale in Feet
Vertical Exaggeration x 2

HORIZONTAL DATUM: Washington State Plane NAD83 South, US ft
VERTICAL DATUM: NAVD88, ft

ANCHOR QEA

Figure 3
H&S Bosma Dairy Lagoon No. 6 Subsurface Soil Characteristics Cross Section 6A-6A'

Basis of Design Report
H&S Bosma Dairy Lagoon No. 6



LEGEND:

- Sandy Silt (Fill)
- Gravelly Silty Sand (Fill)
- Silty Sand (Fill)
- Lithologic Contact (Dashed where inferred)
- Existing Ground Surface
- Proposed Lagoon Profile
- LD-SB-L6S (14.9 FT W) — Boring Identification (Approximate Distance in Feet and Direction)
- Boring Location

Stratigraphy Note:
Soil layers presented are based on a limited number of subsurface explorations; therefore conditions during construction may vary from that shown.

Horizontal Scale in Feet
0 30 60
0 15 30
Vertical Scale in Feet
Vertical Exaggeration x 2

HORIZONTAL DATUM: Washington State Plane NAD83 South, US ft
VERTICAL DATUM: NAVD88, ft

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Figure 4
H&S Bosma Dairy Lagoon No. 6 Subsurface Soil Characteristics Cross Section 6B-6B'

Basis of Design Report
H&S Bosma Dairy Lagoon No. 6

Appendix A
Soil Boring Logs and Geotechnical Laboratory Results

LOG OF EXPLORATORY BORING

PROJECT NAME	**Yakima Valley Dairies**	BORING NO.	**LD-SB-L6E**
LOCATION	**Outlook, Washington**	PAGE	**1 of 2**
DRILLED BY	**Cascade Drilling, Inc.**	GROUND SURFACE ELEVATION	
DRILLING METHOD	**Geoprobe Direct Push 7730 DT**	TOP OF CASING ELEVATION	
LOGGED BY	**James Melton**	TOTAL DEPTH	**21.5 ft.**
BOREHOLE DIAMETER	**2.25 inches**	DATE COMPLETED	**1/25/18**
SAMPLING METHOD	**1.875-in by 5-ft core barrel (CB)**	PERMIT/STARTCARD NO.	
		WA STATE DEPT OF ECOLOGY WELL ID	

SAMPLING METHOD	RECOVERY (FEET)	DEPTH SAMPLED (FEET)	BLOW COUNTS	SAMPLE ID	DEPTH (FEET)	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION	GRA %	SAND %	FINES %
SS	1.5/1.5	0-1.5	2 4 5	LD-SB-L6E 0-5-180125 @1400			0 to 21.5 feet: **SANDY SILT (ML)**, with trace gravels, brown, soft, dry, no plasticity, rounded and angular gravels when present, sand is fine-grained, no odor. (FILL) Existing ground elevation = 918.75' (NAVD88)	<5	30	65
CB	2.4/3.5	1.5-5.0					@ 3.8 feet: rust colored sandy silt, the sand is rust colored.			
SS	1.5/1.5	5.0-6.5	4 8 8	LD-SB-L6E 5-10-180125 @1405	5					
CB	3.5/3.5	6.5-10.0					@ 7.7 feet: becomes more firm, no gravels.	0	30	70
SS	1.5/1.5	10.0-11.5	8 9 8	LD-SB-L6E 10-15-180125 @1415	10		@ 10.6 feet: grayish/olive laminations. @ 11.2 feet: grayish/olive color mixed in.			
CB	2.7/3.5	11.5-15.0					@ 13.2 feet: color changes to grayish/olive color, no odor.			
SS	1.4/1.5	15.0-16.5	2 4 6	LD-SB-L6E 15-21.5-180125 @1425	15		@ 15.0 to 16.5 feet: organic material, rootlets, rootlets continue through 21.5 feet.			
CB	2.9/3.5	16.5-20.0					@ 17.5 to 18.0 feet: brown color. @ 18.0 feet: back to gray color.			
					20					

REMARKS

No picture of SPT sample 5.0 to 6.5 feet.

ANCHOR QEA

YAKIMA5.gds:2.2/26/18.YAKIMA5...180996-03

LOG OF EXPLORATORY BORING

PROJECT NAME	**Yakima Valley Dairies**	BORING NO.	**LD-SB-L6E**
LOCATION	**Outlook, Washington**	PAGE	**2 of 2**
DRILLED BY	**Cascade Drilling, Inc.**	GROUND SURFACE ELEVATION	
DRILLING METHOD	**Geoprobe Direct Push 7730 DT**	TOP OF CASING ELEVATION	
LOGGED BY	**James Melton**	TOTAL DEPTH	**21.5 ft.**
BOREHOLE DIAMETER	**2.25 inches**	DATE COMPLETED	**1/25/18**
SAMPLING METHOD	**1.875-in by 5-ft core barrel (CB)**	PERMIT/STARTCARD NO.	
		WA STATE DEPT OF ECOLOGY WELL ID	

SAMPLING METHOD	RECOVERY (FEET)	DEPTH SAMPLED (FEET)	BLOW COUNTS	SAMPLE ID	DEPTH (FEET)	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION	GRA %	SAND %	FINES %
SS	1.5/1.5	20.0-21.5	4 6 5				0 to 21.5 feet: **SANDY SILT (ML)**, continued.	0	30	70
							Total Depth = 21.5 feet.			
					25					
					30					
					35					
					40					

REMARKS

No picture of SPT sample 5.0 to 6.5 feet.

ANCHOR QEA

YAKIMA5.gds:2.2/26/18.YAKIMA5...180996-03

LOG OF EXPLORATORY BORING

PROJECT NAME	**Yakima Valley Dairies**	BORING NO.	**LD-SB-L6N**
LOCATION	**Outlook, Washington**	PAGE	**1 of 2**
DRILLED BY	**Cascade Drilling, Inc.**	GROUND SURFACE ELEVATION	
DRILLING METHOD	**Geoprobe Direct Push 7730 DT**	TOP OF CASING ELEVATION	
LOGGED BY	**James Melton**	TOTAL DEPTH	**21.5 ft.**
BOREHOLE DIAMETER	**2.25 inches**	DATE COMPLETED	**1/25/18**
SAMPLING METHOD	**1.875-in by 5-ft core barrel (CB)**	PERMIT/STARTCARD NO.	
		WA STATE DEPT OF ECOLOGY WELL ID	

SAMPLING METHOD	RECOVERY (FEET)	DEPTH SAMPLED (FEET)	BLOW COUNTS	SAMPLE ID	DEPTH (FEET)	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION	GRA %	SAND %	FINES %
SS	1.0/1.5	0-1.5	8 11 10	LD-SB-L6N 0-5-180125 @1300			0 to 1.1 feet: **GRAVELLY SILTY SAND (SP)**, damp, large and small rounded/angular gravels, loose, no odor, brown, well sorted. Existing ground elevation = 923.22' (NAVD88)	25	60	15
CB	2.8/3.5	1.5-5.0					1.1 to 21.5 feet: **SANDY SILT (ML)**, brown, dry, soft, fine-grained sand, no odor, no plasticity.	0	25	75
SS	0.9/1.5	5.0-6.5	2 3 2	LD-SB-L6N 5-10-180125 @1305	5		@ 5.0 feet: firm. @ 5.7 feet: rounded gravels.	0	<1	99
CB	3.5/3.5	6.5-10.0					@ 8.6 feet: more firm, more plasticity (still low), very little sand.			
SS	1.4/1.5	10.0-11.5	4 8 12	LD-SB-L6N 10-15-180125 @1315	10		@ 10.3 feet: more sand, trace gravels to 11.2 feet.	<1	15	85
CB	3.5/3.5	11.5-15.0								
SS	1.5/1.5	15.0-16.5	5 11 17	LD-SB-L6N 15-21.2-180125 @1325	15		@ 15.1 feet: trace rounded gravels.			
CB	3.5/3.5	16.5-20.0					@ 18.2 feet: large rounded gravels.			
					20					

REMARKS

ANCHOR QEA

YAKIMA5.gds:2.2/26/18.YAKIMA5...180996-03

LOG OF EXPLORATORY BORING

PROJECT NAME	**Yakima Valley Dairies**	BORING NO.	**LD-SB-L6N**
LOCATION	**Outlook, Washington**	PAGE	**2 of 2**
DRILLED BY	**Cascade Drilling, Inc.**	GROUND SURFACE ELEVATION	
DRILLING METHOD	**Geoprobe Direct Push 7730 DT**	TOP OF CASING ELEVATION	
LOGGED BY	**James Melton**	TOTAL DEPTH	**21.5 ft.**
BOREHOLE DIAMETER	**2.25 inches**	DATE COMPLETED	**1/25/18**
SAMPLING METHOD	**1.875-in by 5-ft core barrel (CB)**	PERMIT/STARTCARD NO.	
		WA STATE DEPT OF ECOLOGY WELL ID	

SAMPLING METHOD	RECOVERY (FEET)	DEPTH SAMPLED (FEET)	BLOW COUNTS	SAMPLE ID	DEPTH (FEET)	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION	GRA %	SAND %	FINES %
SS		20.0-21.5	14 30 42				1.1 to 21.5 feet: **SANDY SILT (ML)**, continued. @ 21.2 feet: angular and rounded gravels, very hard to STP. Possible where transitions into gravelly layer. Did not include in sample.	<1	15	85
							Total Depth = 21.5 feet.			
					25					
					30					
					35					
					40					

REMARKS

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YAKIMA5.gds:2.2/26/18.YAKIMA5...180996-03

LOG OF EXPLORATORY BORING

PROJECT NAME	**Yakima Valley Dairies**	BORING NO.	**LD-SB-L6S**
LOCATION	**Outlook, Washington**	PAGE	**1 of 1**
DRILLED BY	**Cascade Drilling, Inc.**	GROUND SURFACE ELEVATION	
DRILLING METHOD	**Geoprobe Direct Push 7730 DT**	TOP OF CASING ELEVATION	
LOGGED BY	**James Melton**	TOTAL DEPTH	**16.5 ft.**
BOREHOLE DIAMETER	**2.25 inches**	DATE COMPLETED	**1/25/18**
SAMPLING METHOD	**1.875-in by 5-ft core barrel (CB)**	PERMIT/STARTCARD NO.	
		WA STATE DEPT OF ECOLOGY WELL ID	

SAMPLING METHOD	RECOVERY (FEET)	DEPTH SAMPLED (FEET)	BLOW COUNTS	SAMPLE ID	DEPTH (FEET)	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION	GRA %	SAND %	FINES %
SS	1.4/1.5	0-1.5	3 3 7	LD-SB-L6S 0-5-180125 @1050			0 to 12.3 feet: **SANDY SILT (ML)**, brown, soft, dry, no plasticity, sand is fine-grained, no odor. (FILL) Existing ground elevation = 918.84' (NAVD88)	0	25	75
CB	3.0/3.5	1.5-5.0					@ 1.2 feet: brownish tan silty sand, loose, small rounded gravels, trace gravels present past 1.2 feet.	<1	65	34
SS	1.5/1.5	5.0-6.5	7 7 8	LD-SB-L6S 5-12.3-180125 @1100	5		@ 4.8 feet: same as above until 5.0 feet, brownish tan silty sand. @ 5.0 feet: density firm.			
CB	2.9/3.5	6.5-10.0								
SS	1.5/1.5	10.0-11.5	7 12 19		10		@ 9.5 feet: much less sand, no gravel.	0	10	90
CB	3.2/3.5	11.5-15.0					@ 11.2 feet: gravelly sand lense to 11.4 feet with silt. @ 11.4 to 12.3 feet: more sand.	20 0	70 25	10 75
SS	1.5/1.5	15.0-16.5	14 18 20	LD-SB-L6S 12.3-16.5-180125 @1110	15		12.3 to 16.5 feet: **SILTY SAND (SM)** with trace gravels, beige colored, medium density, dry, no odor, fine and medium grains, well-sorted, small rounded gravels, no odor. (FILL) @ 13.3 feet: color change to rusty darker brown. @ 16.3 feet: more gravel.	<5	75	20
							Total Depth = 16.5 feet.			
					20					

REMARKS

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YAKIMA5.gds:2.2/26/18.YAKIMA5...180996-03

LOG OF EXPLORATORY BORING

PROJECT NAME	**Yakima Valley Dairies**	BORING NO.	**LD-SB-L6W**
LOCATION	**Outlook, Washington**	PAGE	**1 of 1**
DRILLED BY	**Cascade Drilling, Inc.**	GROUND SURFACE ELEVATION	
DRILLING METHOD	**Geoprobe Direct Push 7730 DT**	TOP OF CASING ELEVATION	
LOGGED BY	**James Melton**	TOTAL DEPTH	**16.5 ft.**
BOREHOLE DIAMETER	**2.25 inches**	DATE COMPLETED	**1/25/18**
SAMPLING METHOD	**1.875-in by 5-ft core barrel (CB)**	PERMIT/STARTCARD NO.	
		WA STATE DEPT OF ECOLOGY WELL ID	

SAMPLING METHOD	RECOVERY (FEET)	DEPTH SAMPLED (FEET)	BLOW COUNTS	SAMPLE ID	DEPTH (FEET)	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION	GRA %	SAND %	FINES %
SS	1.5/1.5	0-1.5	7 7 7	LD-SB-L6W 0-5.7-180125 @1200			0 to 5.7 feet: **SANDY SILT (ML)**, gray, fine-grained, soft, dry, no plasticity, no odor, very powdery. (FILL) Existing ground elevation = 922.89' (NAVD88)	0	25	75
CB	3.1/3.5	1.5-5.0					@ 3.9 feet: color switch to brown, density is firm.			
SS	1.5/1.5	5.0-6.5	9 23 39		5					
CB	3.5/3.5	6.5-10.0					5.7 to 6.7 feet: **GRAVELLY SAND (SP)**, light brown, loose, dry, large and small angular and rounded grains, fine and medium gravel, well sorted. (FILL)	20	70	10
							6.7 to 7.5 feet: **SANDY SILT (ML)** with trace gravels, brown/gray, firm, dry, no plasticity, no odor. (FILL)	<1	25	75
				LD-SB-L6W 7.5-10-180125 @1210			7.5 to 14.5 feet: **GRAVELLY SAND (SP)**, white/gray/rust colored, dry, loose, no odor, well sorted in grain size. (FILL)	20	70	10
SS	1.5/1.5	10.0-11.5	12 20 15	LD-SB-L6W 10-16.5-180125 @1215	10		@ 10.0 to 11.0 feet: fine-grain, light brown sand, trace gravels.	<1	99	0
CB	3.5/3.5	11.5-15.0					@ 12.5 to 12.8 feet: brown/gray sandy silt layer, same as above. @ 12.8 to 12.9 feet: trace gravels.	<5	20	70
SS	1.5/1.5	15.0-16.5	25 32 28		15		14.5 to 16.5 feet: **SILTY SAND (SM)**, rust brown, soft, dry, loose, no odor, well sorted sand grains, olive green stained sand in shoe, no odor.	0	75	25
					20		Total Depth = 16.5 feet.			

REMARKS

ANCHOR QEA

YAKIMA5.gds:2.2/26/18.YAKIMA5...180996-03

Budinger & Associates

Geotechnical Engineering
Environmental Engineering
Construction Materials Testing
Subsurface Exploration
Special Inspection

Proudly serving the Inland Northwest for 40 years

Kyle King
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101

March 16, 2018

Project Number L18041

PROJECT: **Yakima Valley Dairies**
Yakima Valley, WA

SUBJECT: **Results of Laboratory Testing**
Report #2

At your request, we provided laboratory testing services for the subject project. Services were limited to the performance of specific laboratory tests, selected at your discretion.

For this period our involvement was limited to laboratory testing of eighteen samples delivered to us in Yakima, and returned to our laboratory on January 26, 2018. Laboratory tests were performed in general accordance with methods listed on the attached *Laboratory Summary, Moisture-Density Relationship* and *Particle Size Distribution* sheets.

If you have questions regarding this report, please call.

Respectfully Submitted,
Budinger & Associates, Inc.

Terri Ballard

Terri Ballard
Laboratory Manager

TJB/kh/Addressee – 2
Kyle King – kking@anchorqea.com
Casey Janisch – cjanisch@anchorqea.com

Attachments:
Soil Mechanics Laboratory Summary – (2 pages)
Moisture-Density Relationship - (4 pages)
Particle Size Distribution Report - (3 pages)

1101 North Fancher Road
Spokane Valley, WA 99212
Tel: 509-535-8841

9997 Lyle Loop Suite A
Hayden, Idaho 83835
Tel: 208-719-9038

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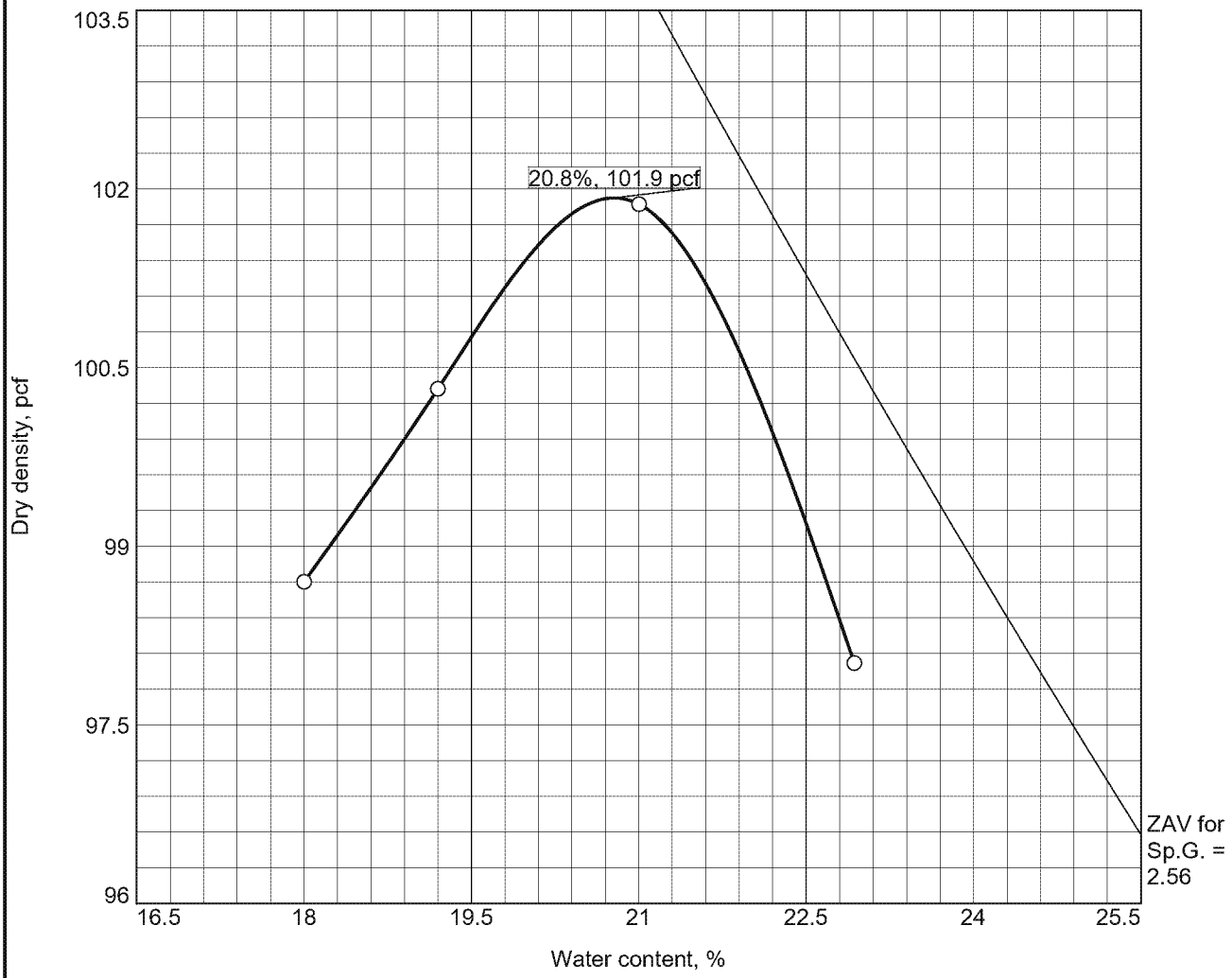
SOIL MECHANICS
LABORATORY SUMMARY

LABORATORY NUMBER				18-0086	18-0087	18-0088	18-0089	18-0090	18-0091	18-0094	18-0095	18-0096	18-0097
SAMPLED BY				Client	Client	Client	Client	Client	Client	Client	Client	Client	Client
SAMPLE TYPE				Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
DATE RECEIVED				1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18
FIELD SAMPLE IDENTIFICATION				LD-SB-L6S	LD-SB-L6S	LD-SB-L6W	LD-SB-L6W	LD-SB-L6W	LD-SB-L6W	LD-SB-L6N	LD-SB-L6N	LD-SB-L6E	LD-SB-L6E
DEPTH	TOP	feet		5	12.3	5	0	7.5	10	5	15	5	0
	BOTTOM	feet		12.3	16.5	10	5.7	10	16.5	15	21.2	10	10
				180125	180125	180125	180125	180125	180125	180125	180125	180125	180125
		Units	Test Method										
MOISTURE CONTENT		%	ASTM D2216	21.2	10.4			8.2	12.5	20.3	18.7		19.3
PROCTOR			ASTM D698										
Maximum Density		pcf				101.9						104.0	
Optimum Moisture		%				20.8						16.4	
LIQUID LIMIT		%	ASTM D4318	28			29				25		
PLASTIC LIMIT		%		23			24				20		
PLASTICITY INDEX		%		5			5				5		
USCS SOIL CLASSIFICATION			ASTM D2487	ML									
SIEVE ANALYSIS			ASTM D6913										
	3"												
S	1 1/2"	%											100
I	1"								100	100			99
E	3/4"	P		100					100-	99			99
V	1/2"	A		99					98	97			98
E	3/8"	S		99					96	96			97
	#4	S		98					92	95			96
S	#10	I		97					89	95			95
I	#16	N		96					87	94			93
Z	#30	G		94					85	93			91
E	#40			92					83	92			89
	#100			84					46	89			78
	#200		ASTM D1140	72	15			11	25	84	64		63
	0.05mm		ASTM D7928	63					19	77			58
	0.01mm			24					10	38			24
	0.005mm			15					6	22			16
	0.001mm			6					3	9			8

LABORATORY NUMBER				18-0098	18-0100	18-0101	18-0102	18-0105	18-0106	18-0107	18-0108
SAMPLED BY				Client	Client	Client	Client	Client	Client	Client	Client
SAMPLE TYPE				Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
DATE RECEIVED				1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18	1/26/18
FIELD SAMPLE IDENTIFICATION				LD-SB-L6E	LD-SB-L10S	LD-SB-L10S	LD-SB-L10S	LD-SB-L10E	LD-SB-L10E	LD-SB-L10E	LD-SB-L10E
DEPTH	TOP	feet		10	5	0	5	5	0	3.6	10.5
	BOTTOM	feet		15	10	5	10	10	3.6	10.5	15.2
				180125	180126	180125	180125	180126	180125	180125	180125
		Units	Test Method								
MOISTURE CONTENT		%	ASTM D2216	20.0		17.7	21.9		2.6	21.6	11.3
PROCTOR			ASTM D698								
Maximum Density		pcf			104.7			107.6			
Optimum Moisture		%			18.3			17.3			
LIQUID LIMIT		%	ASTM D4318	28		27				27	
PLASTIC LIMIT		%		23		22				21	
PLASTICITY INDEX		%		5		5				6	
USCS SOIL CLASSIFICATION			ASTM D2487			SC-SM				CL-ML	
SIEVE ANALYSIS			ASTM D6913								
	3"										
S	1 1/2"	%									
I	1"					100					100
E	3/4"	P				96				100	93
V	1/2"	A				90				100-	86
E	3/8"	S				87				99	82
	#4	S				82				98	52
S	#10	I				79				97	46
I	#16	N				77				96	44
Z	#30	G				74				94	41
E	#40					70				92	38
	#100					58				85	17
	#200		ASTM D1140	65		48	75		41	76	12
	0.05mm		ASTM D7928			40				71	11
	0.01mm					19				27	5
	0.005mm					13				16	4
	0.001mm					6				9	3

Moisture-Density Relationship



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
			23.5				4.9	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 101.9 pcf Optimum moisture = 20.8 %	Silty sand with gravel

Project No. L18041 **Client:** Anchor QEA

Project: Yakima Valley Dairies - Liberty

○ **Source of Sample:** On-site **Sample Number:** 18-0088

Remarks:

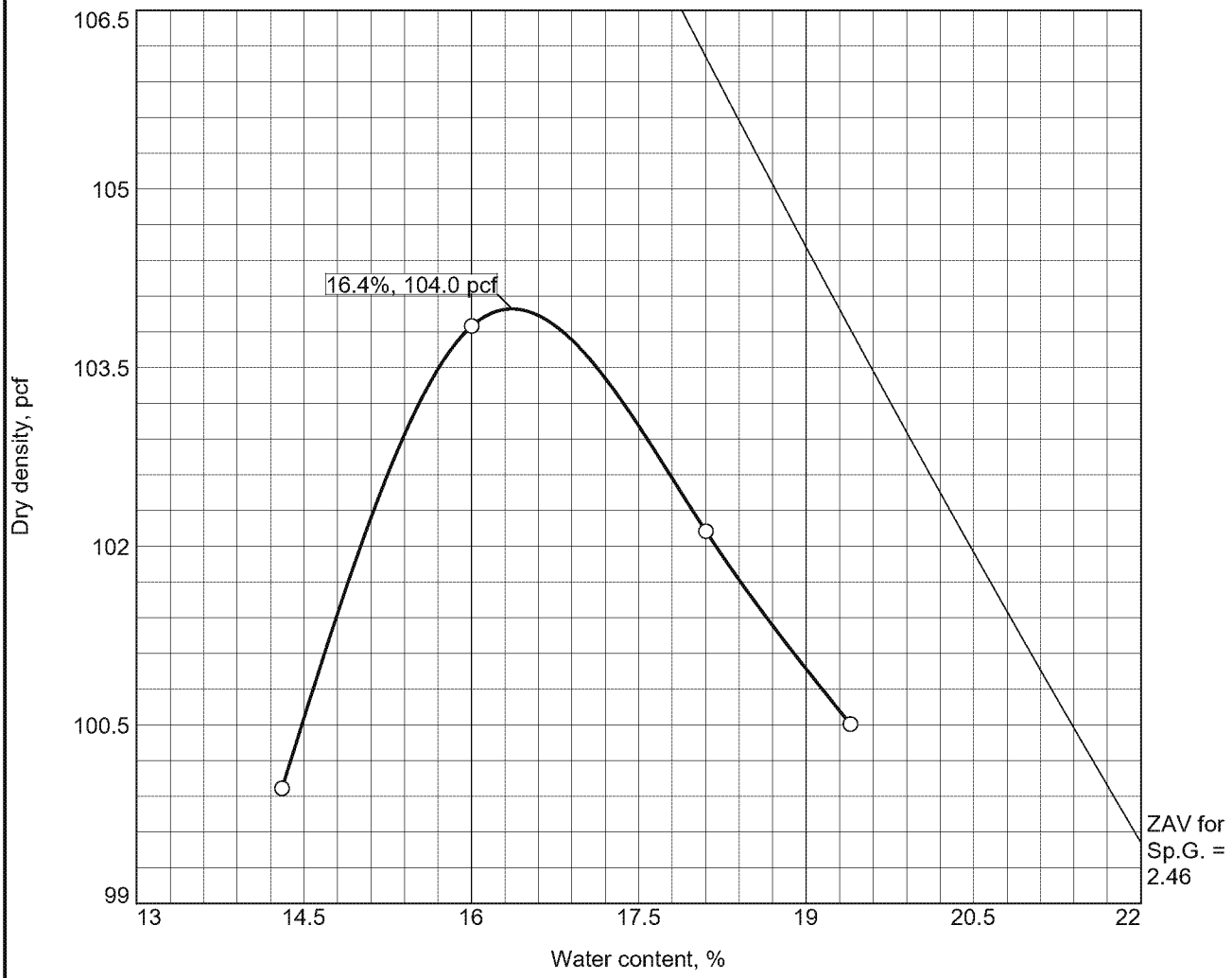
Sampled By Client Sampled at LD-SB-L6W-5-10-180125

BUDINGER & ASSOCIATES, INC.

Date: 2/22/18

Tested By: KC **Checked By:** TB

Moisture-Density Relationship



Test specification: ASTM D 698-07 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
			24.8				4.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 104.0 pcf Optimum moisture = 16.4 %	Silty sand with gravel

Project No. L18041 **Client:** Anchor QEA
Project: Yakima Valley Dairies - Liberty

○ **Source of Sample:** On-site **Sample Number:** 18-0096

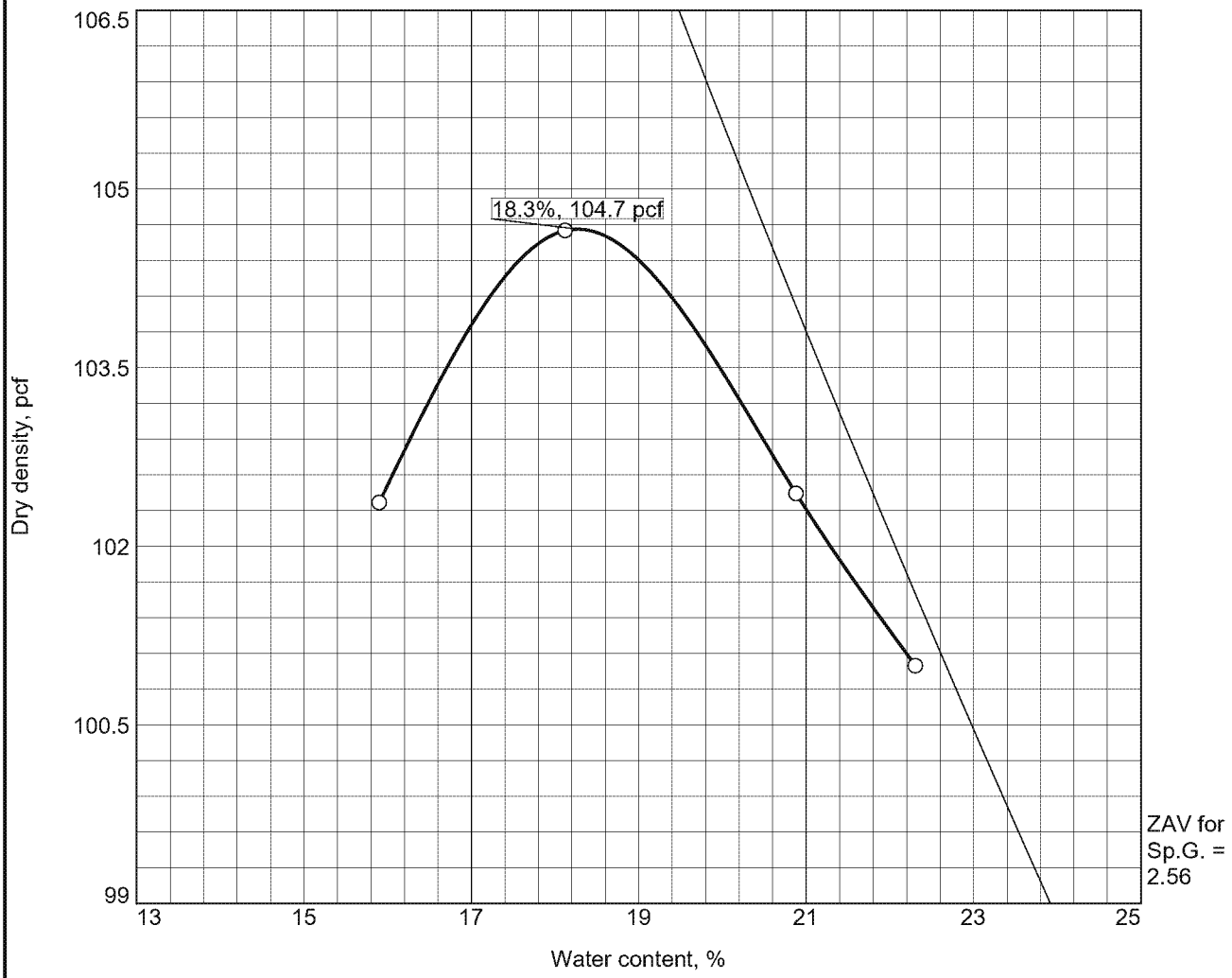
Remarks:
Samlped By Client
Sampled at LD-SB-L6E-5-10-180125

BUDINGER & ASSOCIATES, INC.

Date: 2/22/18

Tested By: KC **Checked By:** TB

Moisture-Density Relationship



Test specification: ASTM D 698-07 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
			25.3				4.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 104.7 pcf Optimum moisture = 18.3 %	Silty sand and gravel

Project No. L18041 **Client:** Anchor QEA

Project: Yakima Valley Dairies - Liberty

○ **Source of Sample:** On-site **Sample Number:** 18-0100

Remarks:

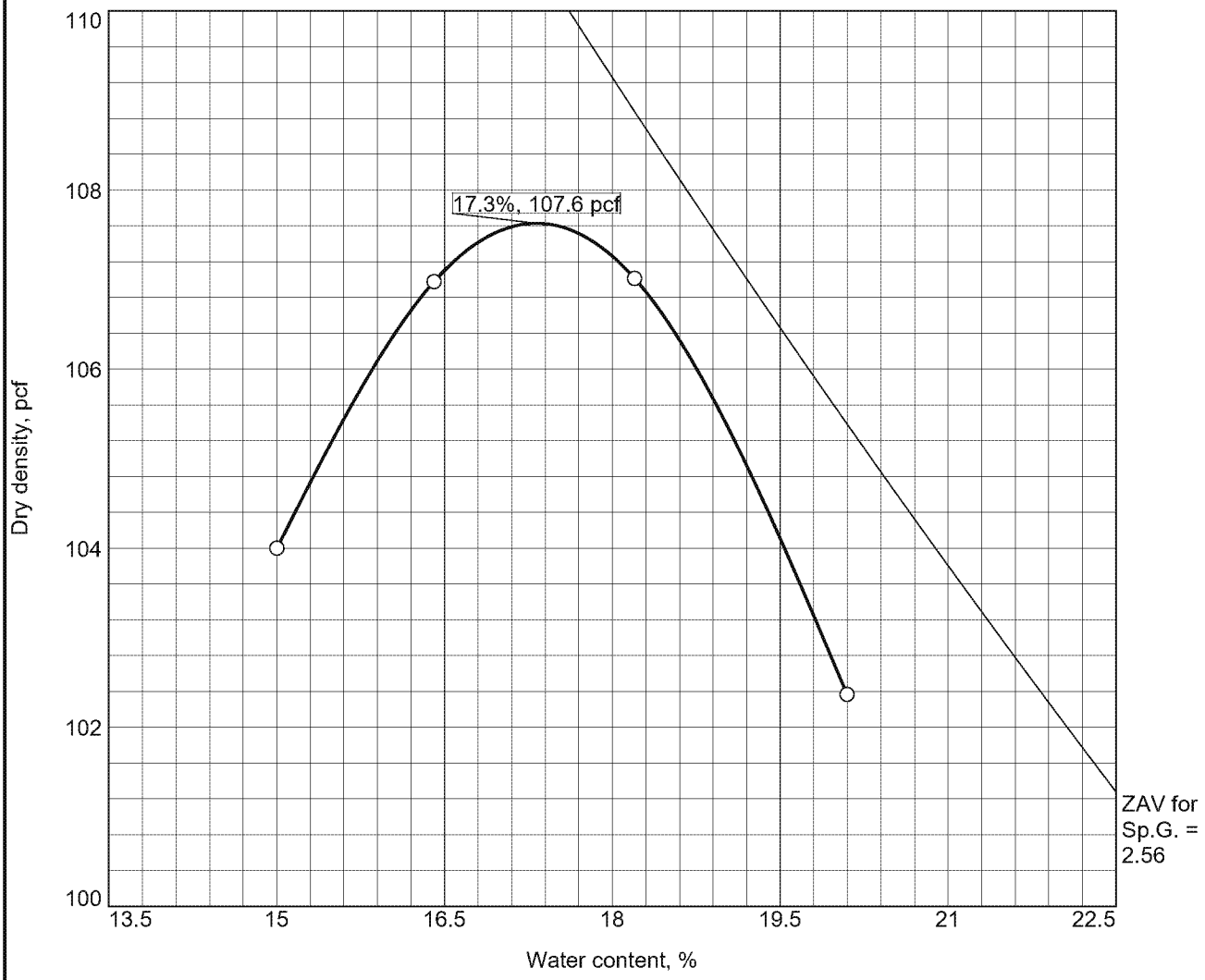
Sampled By Client Sampled at LD-SB-L10S-0-5-180126

BUDINGER & ASSOCIATES, INC.

Date: 2/22/18

Tested By: KC **Checked By:** TB

Moisture-Density Relationship



Test specification: ASTM D 698-07 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
			21.6				2.7	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 107.6 pcf Optimum moisture = 17.3 %	Silty sand with gravel

Project No. L18041 **Client:** Anchor QEA
Project: Yakima Valley Dairies - Liberty

○ **Source of Sample:** On-site **Sample Number:** 18-0105

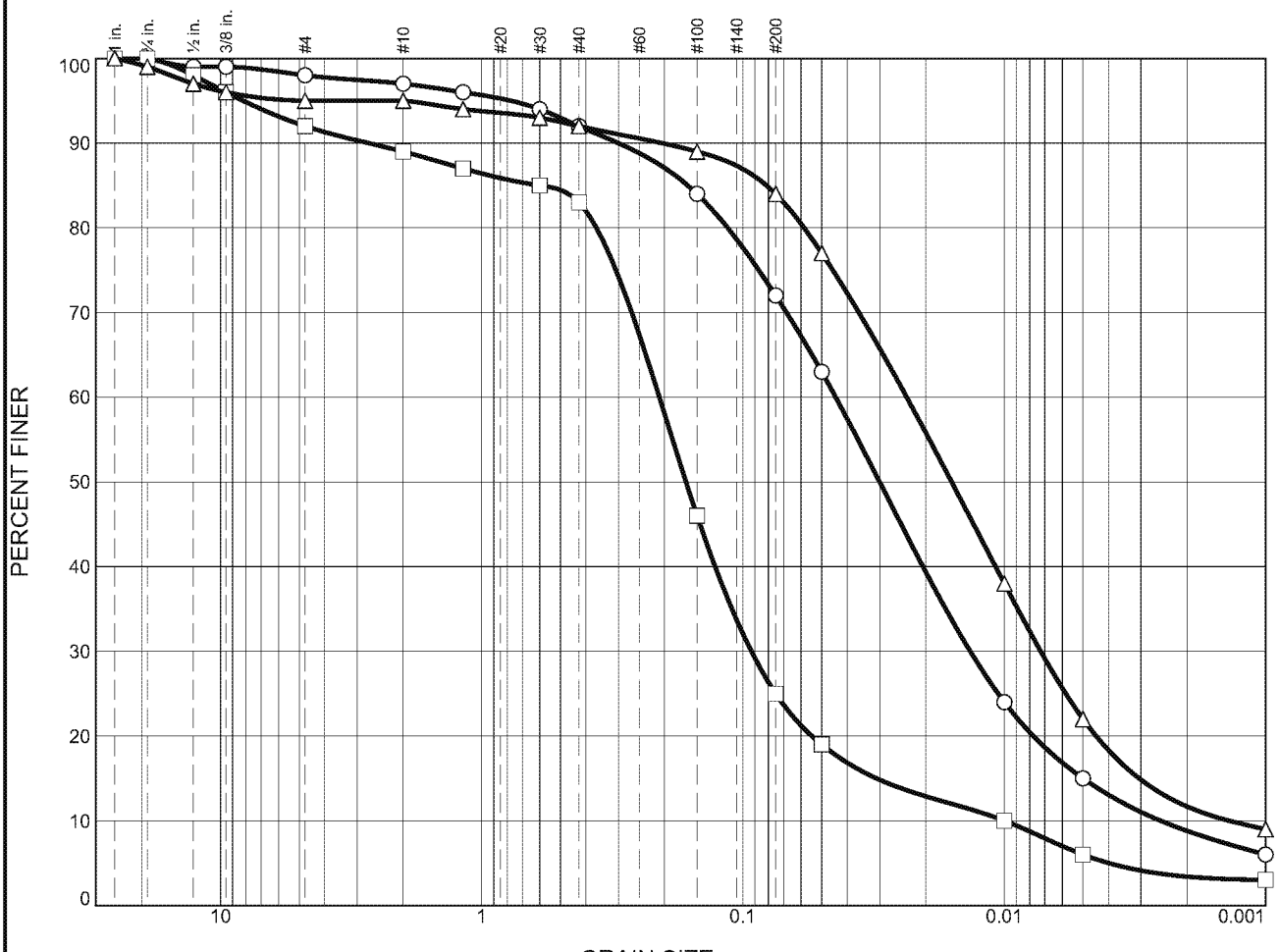
Remarks:
Sampled By Client Sampled at LD-SB-L10E-5-10-180126

BUDINGER & ASSOCIATES, INC.

Date: 2/22/18

Tested By: KC **Checked By:** TB

Particle Size Distribution Report



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	2	1	5	20	57	15
□	0	8	3	6	58	19	6
△	1	4	0	3	8	62	22

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	6	28	23	0.1629	0.0442	0.0300	0.0135	0.0050	0.0025	1.63	17.50
□	3			0.6000	0.2091	0.1654	0.0929	0.0309	0.0100	4.13	20.91
△	9			0.0813	0.0236	0.0159	0.0073	0.0030	0.0014	1.62	17.13

	Material Description	USCS	AASHTO
○	silt with sand	ML	A-4(2)
□			
△			

Project No. L18041 **Client:** Anchor QEA

Project: Yakima Valley Dairies - Liberty

○ **Source of Sample:** On-site **Depth:** 5'-12.3' **Sample Number:** 18-0086

□ **Source of Sample:** On-site **Depth:** 10'-16.5' **Sample Number:** 18-0091

△ **Source of Sample:** On-site **Depth:** 5'-15' **Sample Number:** 18-0094

Date: ○ □ △

Remarks:

○ Sampled by Client from LD-SB-L6S

□ Sampled by Client from LD-SB-L6W

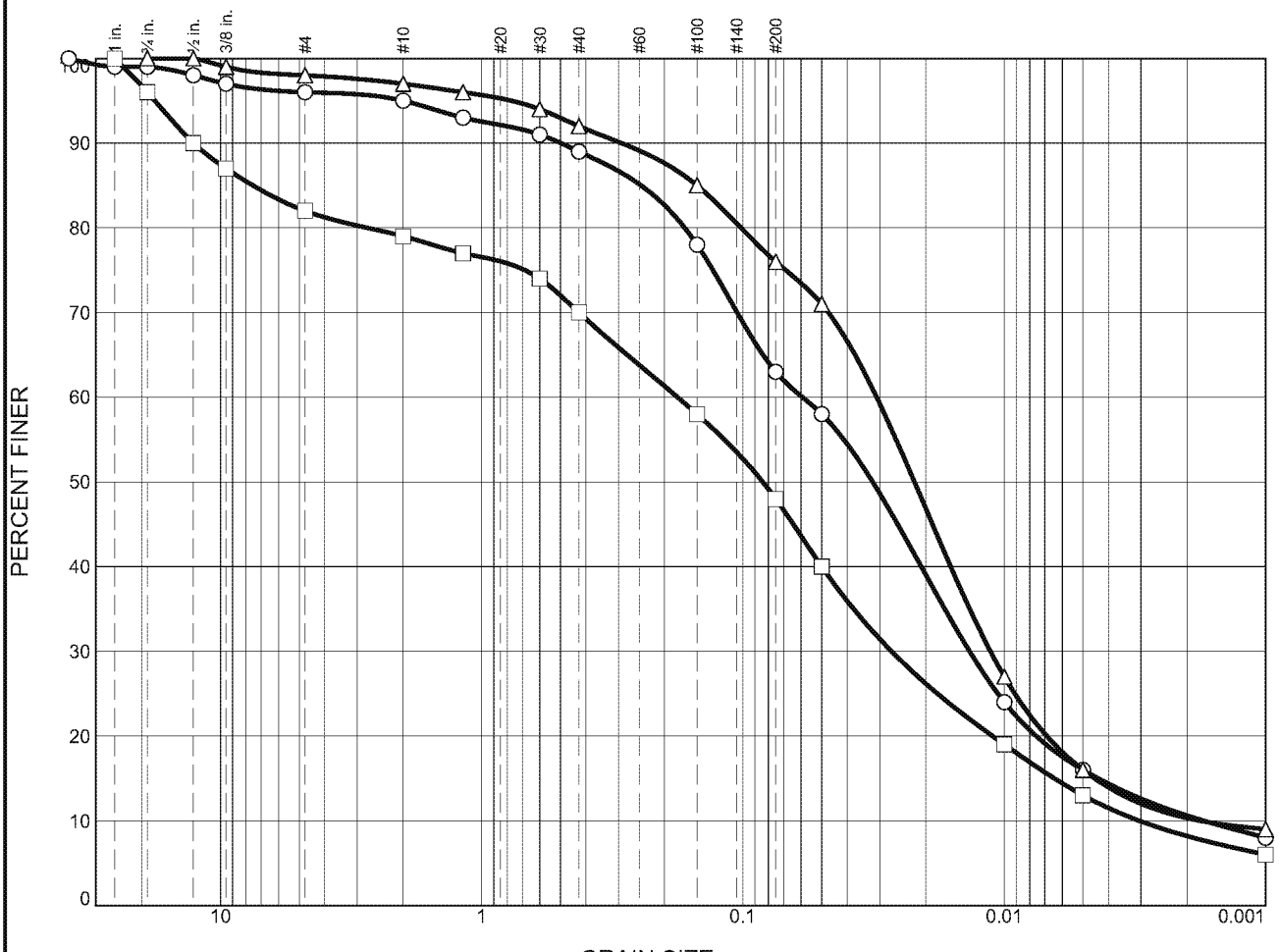
△ Sampled by Client from LD-SB-L6N

Date: 3/15/18

BUDINGER & ASSOCIATES, INC.

Tested By: DVK **Checked By:** TB

Particle Size Distribution Report



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	1	3	1	6	26	47	16
□	4	14	3	9	22	35	13
△	0	2	1	5	16	60	16

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	8			0.2456	0.0593	0.0319	0.0136	0.0044	0.0017	1.80	34.37
□	6	27	22	7.5233	0.1781	0.0841	0.0270	0.0064	0.0030	1.35	58.41
△	9	27	21	0.1500	0.0308	0.0221	0.0113	0.0045	0.0018	2.32	17.25

Material Description	USCS	AASHTO
○		
□ silty clayey sand	SC-SM	A-4(0)
△ silty clay with sand	CL-ML	A-4(3)

Project No. L18041 **Client:** Anchor QEA

Project: Yakima Valley Dairies - Liberty

○ **Source of Sample:** On-site **Depth:** 0'-10' **Sample Number:** 18-0097

□ **Source of Sample:** On-site **Depth:** 0'-5' **Sample Number:** 18-0101

△ **Source of Sample:** On-site **Depth:** 3.6-10.5 **Sample Number:** 18-0107

Date: ○ □ △

Remarks:

○ Sampled by Client from LD-SB-L6E

□ Sampled by Client from LD-SB-L10S

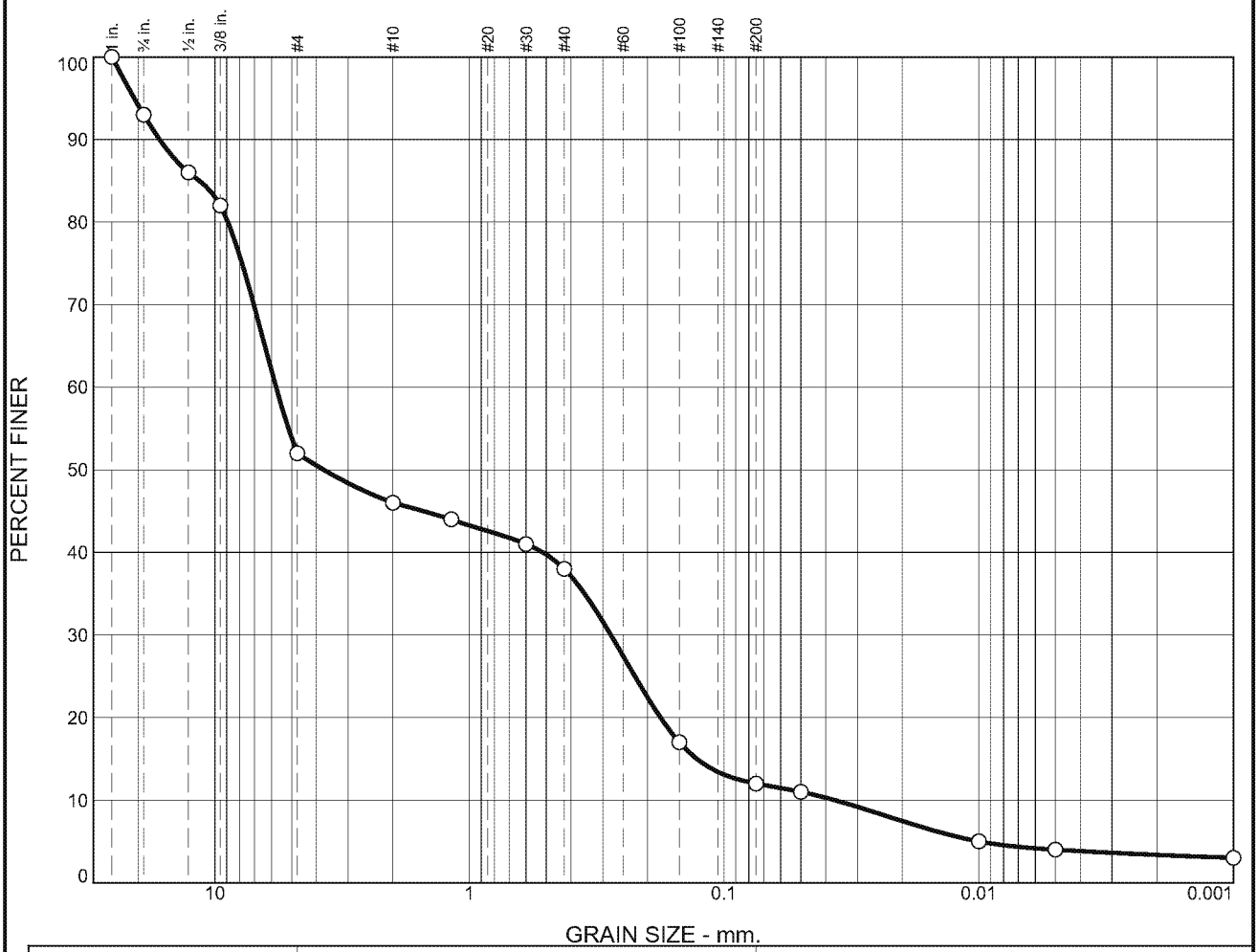
△ Sampled by Client from LD-SB-L10E

Date: 3/15/18

BUDINGER & ASSOCIATES, INC.

Tested By: DVK **Checked By:** TB

Particle Size Distribution Report



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	7	41	6	8	26	8	4

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	3			11.5138	5.7516	3.7382	0.2787	0.1282	0.0369	0.37	155.94

Material Description	USCS	AASHTO
○		

Project No. L18041 **Client:** Anchor QEA

Project: Yakima Valley Dairies - Liberty

○ **Source:** On-site **Depth:** 10.5'-15.2' **Sample No.:** 18-0108

Date: ○

Remarks:

○ Sampled by Client from LD-SB-L10E

BUDINGER & ASSOCIATES, INC.

Date: 3/15/18

Tested By: DVK **Checked By:** TB

Appendix B
H&S Bosma Dairy Lagoon No. 6
Construction Drawings

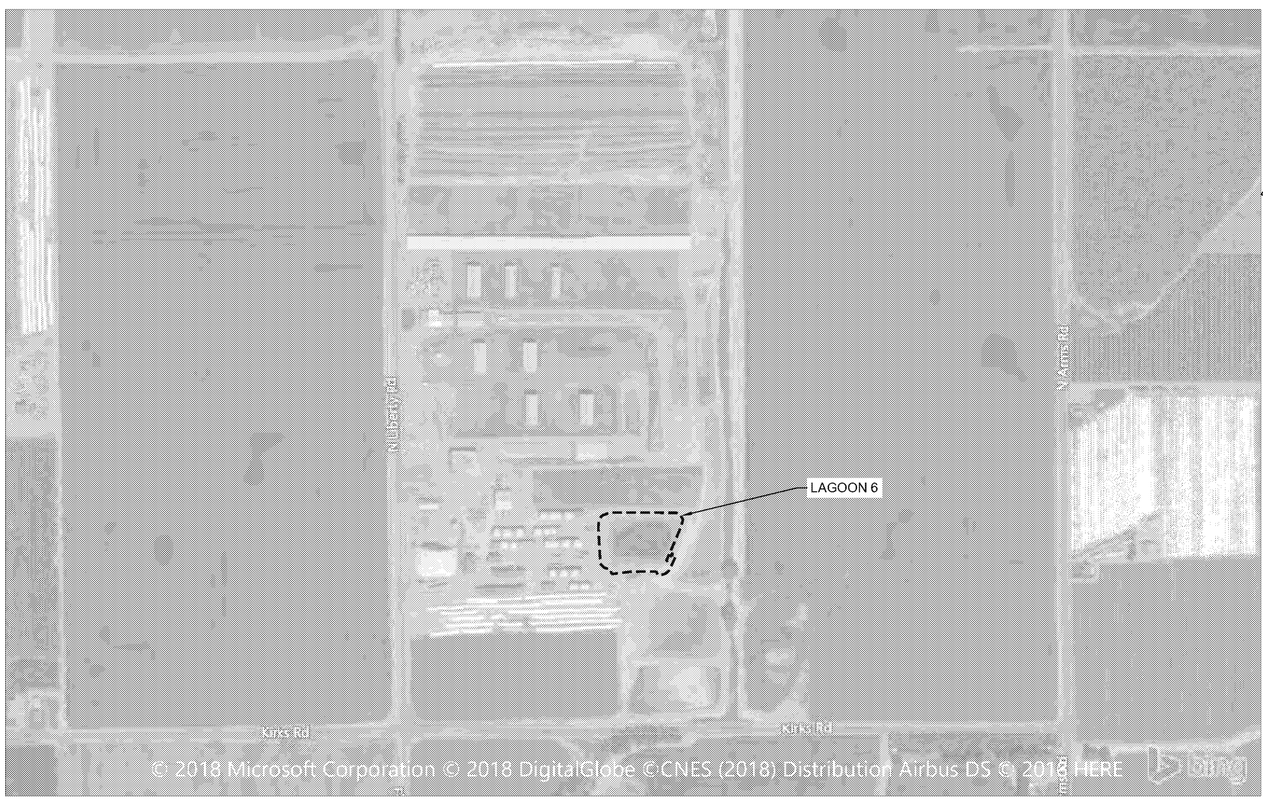
100% DESIGN SUBMITTAL

H&S BOSMA LAGOON NO. 6

H&S BOSMA DAIRY, LLC

Site Address:
823 North Liberty Road
Granger, Washington 98932

SDWA-10-2013-0080



SITE LOCATION MAP
SCALE: 1" = 300'

DRAWING INDEX		
SHEET NO.	DRAWING NO.	TITLE
01	G-01	COVER SHEET
02	G-02	GENERAL NOTES
03	C-01	SITE MAP
04	C-02	EXISTING CONDITIONS PLAN
05	C-03	SITE PLAN
06	C-04	FINAL GRADING PLAN
07	C-05	VENTING PLAN
08	C-06	LAGOON PROFILES
09	C-07	DETAILS (1 OF 2)
10	C-08	DETAILS (2 OF 2)

NORTH

0 300 600
SCALE IN FEET

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION
1	6/20/2019	RLP	JS	SEE SHEETS 4,5,6,7,8
2	8/9/2019	RLP	JS	SEE SHEETS C03, C04, C05

DESIGNED BY: N. KENNEDY/K. KING
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

COVER SHEET

G-01

SHEET NO. 1 OF 10

K:\Projects\0996-perkins cole\yakima dairies project\lagoons - 2019\construction plans\0996-CD-IVD 2019-NoLD-Bosma 6 (Cover Notes Site).dwg G-01
Aug 09, 2019 2:39pm rpetrie

ED_002369M_00000033-00042

PROJECT DESCRIPTION:

THE PROJECT SHOWN ON THESE CONSTRUCTION DRAWINGS AND DESCRIBED IN THE CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS CONSISTS OF WORK TO LINE A DAIRY LAGOON. THE WORK REQUIRES SITE PREPARATION, EARTHWORK, AND TEMPORARY EROSION AND SEDIMENT CONTROL MANAGEMENT; INSTALLATION OF A GEOSYNTHETIC CLAY LINER, HDPE GEOMEMBRANE, AND GEOCOMPOSITE VENT STRIPS; AND RESTORATION OF DISTURBED AREAS. IN ADDITION, HDPE GEOMEMBRANE LINER INSTALLATION WILL REQUIRE WELDING AND TESTING AS PART OF THE CONSTRUCTION QUALITY CONTROL PLAN EXECUTION. THE WORK IS SUBJECT TO THE OWNER, AGENCY, AND/OR PERMIT CONDITIONS.

PREPARED FOR:

LIBERTY AND H&S BOSMA DAIRIES
5860 E. ZILLAH DRIVE
GRANGER, WASHINGTON 98932

PREPARED BY:

ANCHOR QEA, LLC.
720 SW MACADAM AVENUE, SUITE 125
PORTLAND, OREGON 97219
PROJECT ENGINEER: KENDRA SKELLENGER, P.E.
PHONE: 503-924-6179
EMAIL: KSKELLENGER@ANCHORQEA.COM

SURVEY NOTES:

PROJECT VERTICAL DATUM IS NAVD 88, US FT.

PROJECT HORIZONTAL DATUM IS WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, US FT.

1. UTILITIES AND STRUCTURES ARE APPROXIMATE AND ARE LOCATED FROM ABOVE GROUND EVIDENCE ONLY. THERE MAY BE ADDITIONAL UTILITY LINES AND STRUCTURES WITHIN SURVEYED AREAS THAT ARE NOT SHOWN HEREIN.

PLSA ENGINEERING AND SURVEYING
521 N. 20TH AVE., SUITE 3
YAKIMA WASHINGTON, 98902
PHONE: 509-575-6990
EMAIL: JBAKER@PLSAOFYAKIMA.COM

THE ELEVATIONS FOR THIS PROJECT WERE DERIVED BY GPS OBSERVATION USING THE WASHINGTON STATE REFERENCE NETWORK. THE PROJECT BENCHMARK IS A PLSA CONTROL POINT WITH CAP NUMBER 999 AS SHOWN HEREON.

DETAIL REFERENCE NUMBER — 1
DRAWING ON WHICH DETAIL APPEARS ("-" INDICATES TYPICAL OR ON SAME DRAWING) — C-1

DETAIL REFERENCE NUMBER — 1 / - DETAIL SCALE: 1" = 10'

GENERAL NOTES:

1. A PRE-CONSTRUCTION SURVEY WILL BE COMPLETED BY THE OWNER OR ENGINEER TO ESTABLISH AND CONFIRM EXISTING CONDITIONS, INCLUDING PIPE INVERT ELEVATIONS AND TOPOGRAPHIC INFORMATION, PRIOR TO THE START OF THE WORK BY THE CONTRACTOR.
2. CONTRACTOR SHALL BECOME FULLY INFORMED OF ALL CONDITIONS AT THE WORK SITE THAT MAY OR COULD DELAY PROJECT COMPLETION, RESULT IN EXTRA WORK, OR COST AND SHALL ACCOUNT FOR THESE CONDITIONS IN THE PRICE BID. NO.ADDITIONAL COMPENSATION WILL BE ALLOWED FOR NEGATIVE CONDITIONS THAT COULD REASONABLY HAVE BEEN IDENTIFIED BY A DILIGENT EXAMINATION OF THE SITE AND EXISTING CONDITIONS.
3. CONTRACTOR SHALL PROTECT ALL MATERIALS BOTH PURCHASED AND SALVAGED, FOR THE DURATION OF THE WORK. MATERIALS LOST OR DAMAGED BY CONTRACTORS OPERATIONS OR THROUGH IMPROPER STORAGE SHALL BE REPAIRED OR REPLACED AS DIRECTED BY THE OWNER AT NO ADDITIONAL COST TO THE OWNER.
4. CONTRACTOR SHALL MAINTAIN AND PROVIDE AS-BUILT/RECORD DRAWINGS PER THE TECHNICAL SPECIFICATIONS.
5. CONTRACTOR SHALL COMPLY WITH ALL STATE, COUNTY, AND CITY LAWS, PERMITS AND ORDINANCES RELATED TO SAFETY AND CHARACTER OF WORK, EQUIPMENT AND LABOR PERSONNEL. THIS SHALL INCLUDE, BUT IS NOT LIMITED TO, THE SECURING OF THE WORK AREA AND PREVENTION OF DEBRIS DISCHARGE OUTSIDE THE LIMITS OF CONSTRUCTION.
6. CONTRACTOR SHALL CONTACT THE NORTHWEST UTILITY NOTIFICATION CENTER "CALL BEFORE YOU DIG" HOTLINE AT 1-800-424-5555 (OR 811) AND VERIFY THE EXACT LOCATION OF ANY EXISTING UTILITIES. ANY UTILITIES EXPOSED OR DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED AT CONTRACTORS EXPENSE.
7. ANY CONFLICTS WITH THE DESIGN OR CHANGES TO THE CONSTRUCTION DRAWINGS OR SHOP DRAWINGS SHALL BE AUTHORIZED AND APPROVED BY THE OWNER BEFORE CONTINUING WORK IN THAT AREA.

ABBREVIATIONS	
AC-FT	ACRE-FEET
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AT	ANCHOR TRENCH
BGS	BELOW GROUND SURFACE
CQA	CONSTRUCTION QUALITY ASSURANCE
DIA	DIAMETER
EA	EACH
EL, ELEV	ELEVATION
ESC	EROSION AND SEDIMENT CONTROL
EX	EXISTING
FT	FEET
GA	GAUGE
GCL	GEOSYNTHETIC CLAY LINER
H, HORIZ	HORIZONTAL
HDPE	HIGH DENSITY POLYETHYLENE
IE	INVERT ELEVATION
IPS	IRON PIPE SIZE
IRR	IRRIGATION
IV	IRRIGATION VALVE
LA	LAGOON ACCESS ROAD
LB	LINER BOTTOM

CONSTRUCTION NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR ADHERING TO THE STANDARDS SET FORTH IN THE CONTRACT DOCUMENTS AND AS PROVIDED BY THE MANUFACTURER.
2. CONTRACTOR SHALL PROTECT IN-PLACE ALL EXISTING SITE FEATURES, UNLESS OTHERWISE DIRECTED.
3. EXISTING LAGOONS SHALL BE RE-GRADED AS SHOWN IN THE CONSTRUCTION DRAWINGS TO THE DIMENSIONS, GRADES, AND ELEVATIONS SHOWN.
4. CONTRACTOR SHALL MAINTAIN SUBGRADE TO MEET REQUIREMENTS SET IN THE TECHNICAL SPECIFICATIONS PRIOR TO INSTALLATION OF GEOSYNTHETICS.
5. LINER SHALL BE INSTALLED BY AN EXPERIENCED AND CERTIFIED INSTALLER. LINER INSTALLATION SHALL BE EXECUTED TO THE GUIDELINES IN THE TECHNICAL TECHNICAL SPECIFICATIONS AND THE CONSTRUCTION QUALITY ASSURANCE AND CONSTRUCTION QUALITY CONTROL CONSTRUCTION DRAWINGS.
6. LINER INSTALLERS SHALL COMPLY WITH ALL MANUFACTURERS RECOMMENDATIONS AND SPECIFICATIONS FOR INSTALLING, WELDING, AND TESTING TECHNIQUES FOR THE LINER.
7. CONTRACTOR SHALL PROTECT THE LINER FROM VEHICLE OR OTHER CONSTRUCTION TRAFFIC DURING THE COURSE OF THE PROJECT. ANY DAMAGE TO THE LINER OR LINER COMPONENTS FROM THE CONTRACTOR SHALL BE REPLACED OR REPAIRED AT THE CONTRACTOR'S EXPENSE.

811 Know what's below. Call 811 before you dig.

ABBREVIATIONS	
LC	LINER CREST
LF	LINEAR FEET
MAX	MAXIMUM
MG	MILLION GALLONS
MIL	0.001 INCH
MIN	MINIMUM
NAD 83	NORTH AMERICAN DATUM, 1983
NAVD 88	NORTH AMERICAN VERTICAL DATUM, 1988
NW	NORTHWEST
O.C.	ON CENTER
PLSA	PLSA ENGINEERING AND SURVEYING
PP	POWER POLE
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
SF	SQUARE FEET
SY	SQUARE YARDS
TBD	TO BE DETERMINED
UG	UNDERGROUND
US	UNITED STATES
V, VERT	VERTICAL

EROSION AND SEDIMENT CONTROLS (ESC) NOTES:

1. IMPLEMENTATION OF ESC FACILITIES, MAINTENANCE, REPLACEMENT, AND UPGRADING OF ESC FACILITIES ARE THE RESPONSIBILITY OF THE CONTRACTOR'S ESC SUPERVISOR UNTIL FINAL STABILIZATION IS ESTABLISHED AND SUBSTANTIAL COMPLETION IS ACHIEVED,
2. ESC FACILITIES MUST BE CONSTRUCTED PRIOR TO OR IN CONJUNCTION WITH ALL SUBGRADE PREPARATION SO AS TO MINIMIZE THE TRANSPORT OF SEDIMENT TO SURFACE WATERS, DRAINAGE SYSTEMS, AND ADJACENT PROPERTIES.
3. DURING THE CONSTRUCTION PERIOD, ESC FACILITIES SHALL BE UPGRADED AS NEEDED OR REQUESTED BY CONSTRUCTION MANAGER FOR UNEXPECTED STORM EVENTS AND MODIFIED TO ACCOUNT FOR CHANGING SITE CONDITIONS (E.G., SUMP PUMPS, DITCHES AND SILT FENCES).
4. ESC FACILITIES SHALL BE INSPECTED BY THE CONTRACTOR'S ESC SUPERVISOR AND MAINTAINED TO ENSURE CONTINUED PROPER FUNCTIONING THROUGH PROJECT STABILIZATION.
5. ANY AREAS OF EXPOSED SOILS, INCLUDING ROADWAY EMBANKMENTS, THAT WILL NOT BE DISTURBED FOR TWO (2) DAYS DURING THE WET SEASON OR SEVEN (7) DAYS DURING THE DRY SEASON SHALL BE IMMEDIATELY STABILIZED WITH APPROVED ESC METHODS (E.G., SEEDING, MULCHING, PLASTIC COVERING).
6. THE ESC FACILITIES ON AREAS WITHIN THE CONSTRUCTION LIMITS THAT WILL REMAIN UNWORKED FOR SEVEN (7) OR MORE DAYS SHALL BE INSPECTED AND MAINTAINED BY THE CONTRACTOR A MINIMUM OF ONCE A MONTH OR WITHIN FORTY-EIGHT (48) HOURS FOLLOWING A STORM EVENT.
7. STABILIZED CONSTRUCTION ENTRANCES AND ROADS SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES, SUCH AS WASH PADS, MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.
8. MAINTAIN ALL EXISTING STORM DRAINS, CHANNELS, CULVERTS, AND STRUCTURES THAT RECEIVE FLOW UNTIL WORK IS COMPLETE. WHENEVER EXISTING STORM DRAINS, CHANNELS, CULVERTS, OR STRUCTURES ARE DISTURBED; PROVIDE SUITABLE MEANS FOR DIVERTING AND MAINTAINING ALL FLOWS AT CONTRACTOR'S EXPENSE.

LEGEND:

- 1021 — EXISTING ELEVATION CONTOUR
- EXISTING EMBANKMENT TOP/TOE
- IE=3.8 — EXISTING SURVEY SPOT ELEVATION
- EXISTING OVERHEAD POWER
- PP — EXISTING POWER POLE (PP)
- EXISTING 4X4 POST WITH POWER BOX
- IV — EXISTING IRRIGATION WATER VALVE
- IRRIGATION RISER (IRR)
- LD-SB-L6N — EXISTING BORING LOCATION

BEST MANAGEMENT PRACTICES (BMP) AND MONITORING NOTES:

1. DURING ALL PHASES OF THE WORK, CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT CONSTRUCTION TRASH AND DEBRIS FROM FOULING LOCAL WATERS AND COMPLY WITH YAKIMA COUNTY BEST MANAGEMENT PRACTICES (BMP) GUIDELINES. THE CONTRACTOR SHALL PROMPTLY CLEAN UP ALL MATERIALS DISCHARGED INTO LOCAL WATERS. IF CONTRACTOR FAILS TO CLEAN UP SPILLS, IT MAY CAUSE THE OFFENDING MATERIALS TO BE REMOVED BY THE OWNER, AND THE COST OF THAT REMOVAL WILL BE DEDUCTED FROM THE CONTRACT PRICE.
2. APPROPRIATE BMPS WILL BE IMPLEMENTED BY THE CONTRACTOR TO REDUCE CONSTRUCTION-RELATED IMPACTS TO NEARBY WATER BODIES.
3. NO CONSTRUCTION MATERIALS, EQUIPMENT, DEBRIS OR WASTE SHALL BE PLACED OR STORED OUTSIDE THE OWNER DESIGNATED STAGING/STOCKPILING AREA OR CONSTRUCTION BOUNDARIES NOTED IN THE DRAWINGS.
4. CONTRACTOR SHALL ENSURE NO UNWANTED DEBRIS, SOIL, SILT, SAND, SAWDUST, RUBBISH, CEMENT OR CONCRETE WASHINGS, OIL OR PETROLEUM PRODUCTS, FROM CONSTRUCTION, ENTERS INTO OR IS PLACED WHERE IT MAY BE INADVERTENTLY WASHED BY RAINFALL OR RUNOFF INTO LOCAL WATER BODIES.
5. REASONABLE AND PRUDENT MEASURES SHALL BE TAKEN BY THE CONTRACTOR TO PREVENT ANY DISCHARGE OF FUEL OR OILY WASTE FROM HEAVY MACHINERY, CONSTRUCTION EQUIPMENT OR POWER TOOLS INTO LOCAL WATER BODIES. CONTRACTOR SHALL HAVE ADEQUATE EQUIPMENT AVAILABLE TO CONTAIN ANY DISCHARGE IMMEDIATELY.

LEGEND:

- A A' — PROFILE SECTION LINE
- 1020 — PROPOSED 10&2 FT LINER ELEVATION CONTOURS
- PROPOSED INNER&OUTER EDGES OF ANCHOR TRENCH
- 1020 — PROPOSED 10&2 FT FINAL GRADING ELEVATION CONTOURS OUTSIDE LAGOON CREST
- LA-1 — PROPOSED LINER CONSTRUCTION POINT
- 3:1 — PROPOSED SURFACE GRADE, DIRECTION AND RUN:RISE
- PROPOSED GEOCOMPOSITE GAS VENTING STRIP
- ACCESS ROUTE

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: N. KENNEDY/K. KING
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

GENERAL NOTES

G-02

SHEET NO. 2 OF 10

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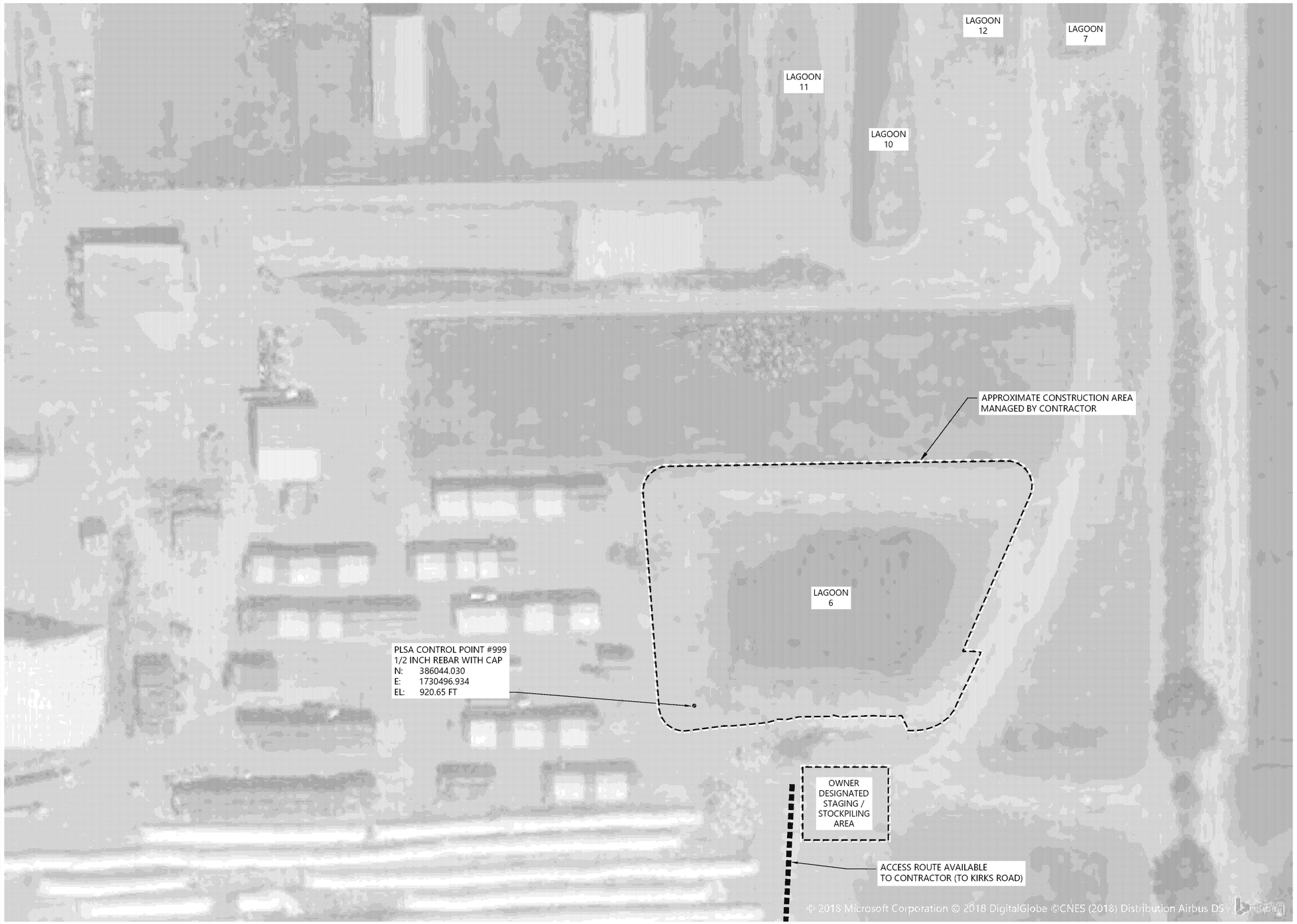

NOTES:

1. THE WORK WILL OCCUR WITHIN AN ACTIVE DAIRY FARM. THE CONTRACTOR SHALL MINIMIZE ITS IMPACTS TO THE OPERATIONS OF THE DAIRY.
2. THE OWNER DESIGNATED STAGING AND STOCKPILING AREA IS THE ONLY AREA ALLOWED FOR THE CONTRACTOR TO STAGE, STORE, AND PARK EQUIPMENT AND VEHICLES; STAGE AND STORE SUPPLIES, MATERIALS, AND TOOLS; AND STOCKPILE SOILS AND DEBRIS.
3. ACCESS ROUTES ARE PROVIDED TO THE CONTRACTOR BY THE OWNER FOR THE DURATION OF THE WORK AND ARE LIMITED TO VEHICLE AND EQUIPMENT ACCESS ONLY BETWEEN THE STAGING AND STOCKPILING AREA AND THE CONSTRUCTION AREA AS SHOWN, HEREON. MATERIALS, SUPPLIES, VEHICLES, AND EQUIPMENT SHALL NOT OCCUPY THE ACCESS ROUTES, OTHERWISE, WITHOUT PRIOR WRITTEN APPROVAL BY THE OWNER.

NORTH

0 50 100
SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, U.S FT.
2. VERTICAL DATUM: NAVD 88.

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: N. KENNEDY/K. KING
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

SITE MAP

C-01

SHEET NO. **3** OF **10**

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Aug 09, 2019 2:39pm rpetrie

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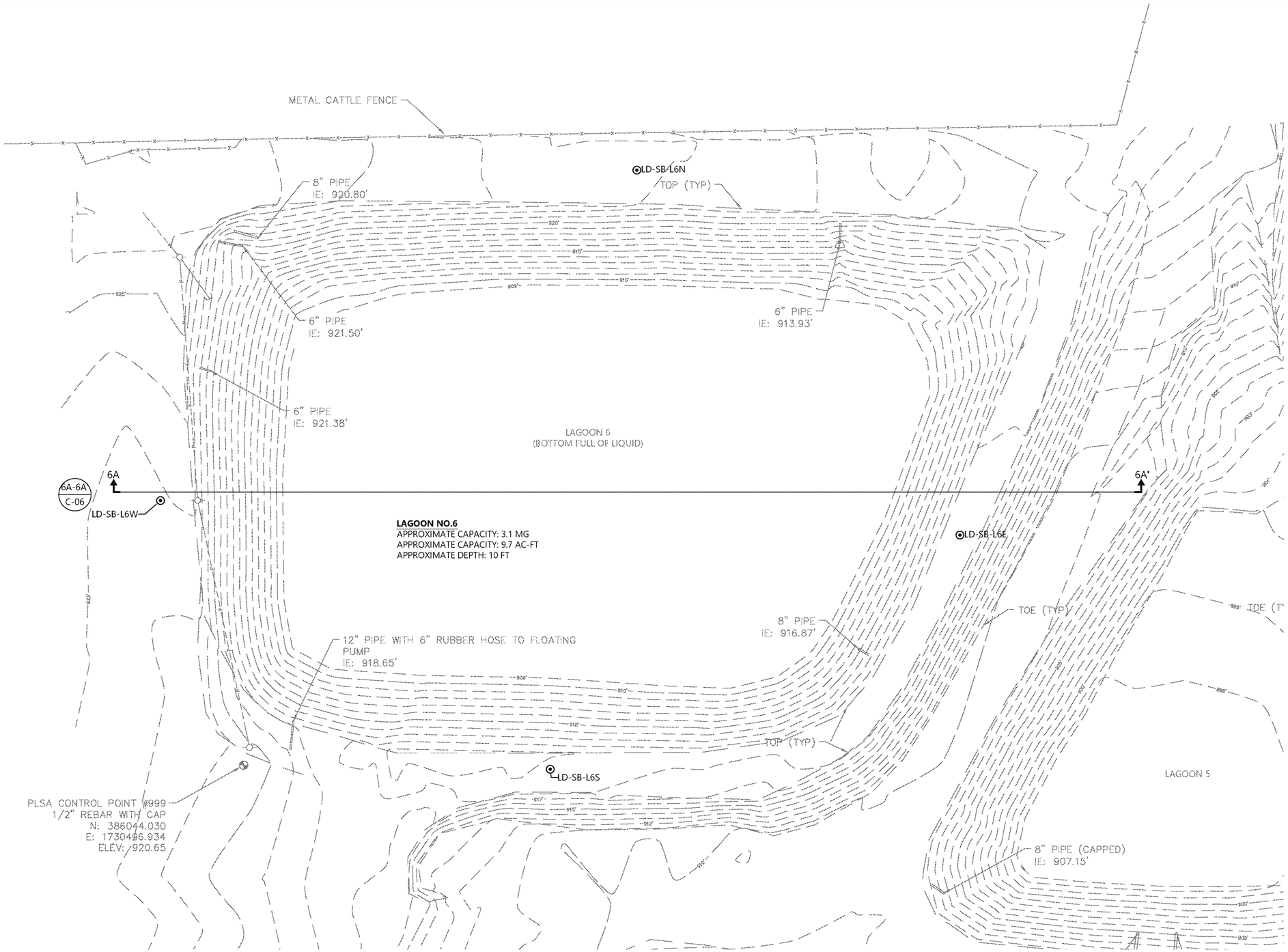

NOTES:

1. SURVEY SHOWN, HEREON, COMPLETED PRIOR TO EMPTYING OF THE LAGOONS.
2. OWNER WILL EMPTY LIQUID AND SOLID MANURE FROM LAGOON 6 PRIOR TO THE START OF THE WORK BY THE CONTRACTOR.
3. OWNER WILL ROUGH GRADE LAGOON 6 PRIOR TO THE START OF THE WORK BY THE CONTRACTOR.
4. PRIOR TO THE START OF THE WORK BY THE CONTRACTOR, THE OWNER OR ENGINEER SHALL COMPLETE A PRE-CONSTRUCTION SURVEY OF LAGOON TO BE USED FOR BASIS OF CONTRACT MEASUREMENT AND PAYMENT.

NORTH

0 20 40
SCALE IN FEET

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, U.S. FT.
2. VERTICAL DATUM: NAVD 88.
3. SURVEY BY PLSA, 1/8/2018.
4. SEE LEGEND ON DRAWING G-02.
5. EXISTING TOPOGRAPHY BELOW LIQUID LEVEL IS UNSURVEYED. ESTIMATE BY ANCHOR QEA..

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

EXISTING CONDITIONS PLAN

C-02

SHEET NO. **4** OF **10**

Aug 09, 2019 2:39pm rpetrie k:\Projects\0996-perkins coie\yakima dairies project\lagoons - 2019\construction plans\0996-CD-YVD 2019-NoLD-Bosma 6 (Plans and Profile).dwg C-02

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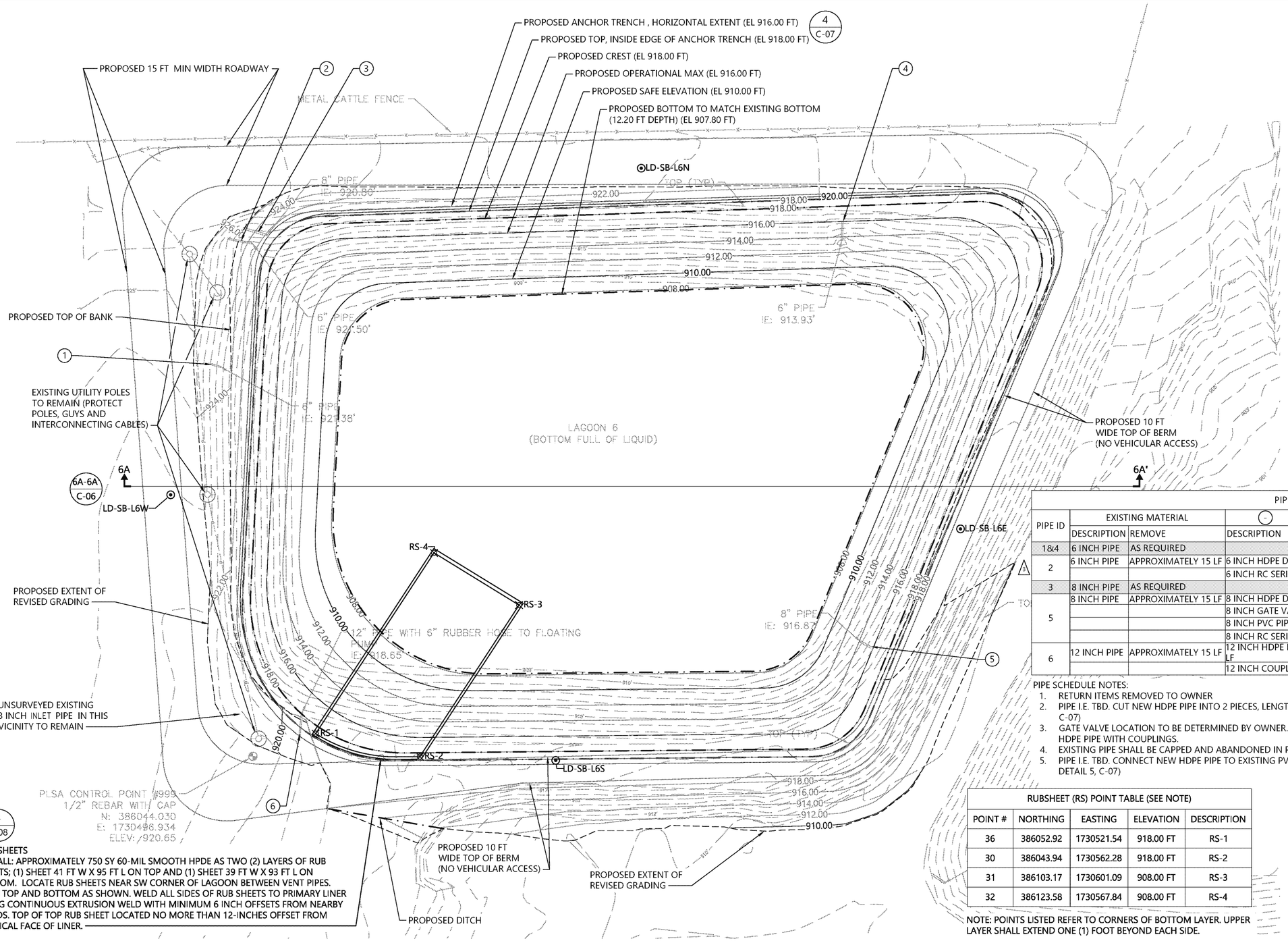


CONSOLIDATED LAGOON NO.6 - 10.2 FT DEPTH
3H:1V INTERIOR SIDE SLOPE
BOTTOM EL: 907.8 FT
MAX. OPERATIONAL EL: 916 FT, 8.2 FT DEEP
TOP EL: 918 FT, 10.2 FT DEEP
FREEBOARD DEPTH: 2 FT
EMBANKMENT LOW EL: 910 FT
MAX OPERATIONAL SURFACE AREA: 50700.53 SF
MAX OPERATIONAL VOLUME: 2.45 MG = 7.52 AC-FT
(AT 8.2 FT DEEP, MEASURED FROM EL 916 TO 907.8 FT)
EMERGENCY MAX VOLUME: 2.72 MG = 8.34 AC-FT
(AT 8 FT DEEP, MEASURED FROM EL 918 TO 910 FT)

PIPE SCHEDULE

PIPE ID	EXISTING MATERIAL		REPLACEMENT MATERIAL				PIPE SCHEDULE NOTES
	DESCRIPTION	REMOVE	DESCRIPTION	QTY	PART NO.	MANUFACTURER	
1&4	6 INCH PIPE	AS REQUIRED					4
2	6 INCH PIPE	APPROXIMATELY 15 LF	6 INCH HDPE DR17 IPS PIPE, 15 LF	1			1,2
			6 INCH RC SERIES COUPLING	1	1056-66RC	FERNCO	
3	8 INCH PIPE	AS REQUIRED					4
5	8 INCH PIPE	APPROXIMATELY 15 LF	8 INCH HDPE DR17 IPS PIPE, 15 LF	1			1,2,3
			8 INCH GATE VALVE	1	6801	VALTERRA	
			8 INCH PVC PIPE, SCH 80, 4 LF	2			
			8 INCH RC SERIES COUPLING	3	1056-88RC	FERNCO	
6	12 INCH PIPE	APPROXIMATELY 15 LF	12 INCH HDPE DR17 IPS PIPE, 15 LF	1			5
			12 INCH COUPLING	1	1001-1010	FERNCO	

PIPE SCHEDULE NOTES:
1. RETURN ITEMS REMOVED TO OWNER
2. PIPE I.E. TBD. CUT NEW HDPE PIPE INTO 2 PIECES, LENGTHS TBD. WELD HDPE PRIMARY LINER TO HDPE PIPE. (SEE DETAIL 5, C-07)
3. GATE VALVE LOCATION TO BE DETERMINED BY OWNER. CONNECT GATE VALVE TO PVC SPOOLS. CONNECT PVC SPOOLS TO HDPE PIPE WITH COUPLINGS.
4. EXISTING PIPE SHALL BE CAPPED AND ABANDONED IN PLACE.
5. PIPE I.E. TBD. CONNECT NEW HDPE PIPE TO EXISTING PVC WITH COUPLING, WELD HDPE PRIMARY LINER TO HDPE PIPE. (SEE DETAIL 5, C-07)

RUBSHEET (RS) POINT TABLE (SEE NOTE)

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
36	386052.92	1730521.54	918.00 FT	RS-1
30	386043.94	1730562.28	918.00 FT	RS-2
31	386103.17	1730601.09	908.00 FT	RS-3
32	386123.58	1730567.84	908.00 FT	RS-4

NOTE: POINTS LISTED REFER TO CORNERS OF BOTTOM LAYER. UPPER LAYER SHALL EXTEND ONE (1) FOOT BEYOND EACH SIDE.

RUB SHEETS
INSTALL: APPROXIMATELY 750 SY 60-MIL SMOOTH HPDE AS TWO (2) LAYERS OF RUB SHEETS; (1) SHEET 41 FT W X 95 FT L ON TOP AND (1) SHEET 39 FT W X 93 FT L ON BOTTOM. LOCATE RUB SHEETS NEAR SW CORNER OF LAGOON BETWEEN VENT PIPES. TRIM TOP AND BOTTOM AS SHOWN. WELD ALL SIDES OF RUB SHEETS TO PRIMARY LINER USING CONTINUOUS EXTRUSION WELD WITH MINIMUM 6 INCH OFFSETS FROM NEARBY WELDS. TOP OF TOP RUB SHEET LOCATED NO MORE THAN 12-INCHES OFFSET FROM VERTICAL FACE OF LINER.

NOTES:
1. HORIZONTAL DATUM: WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, U.S. FT.
2. VERTICAL DATUM: NAVD 88.
3. SURVEY BY PLSA, 1/8/2018.
4. SEE LEGEND ON DRAWING G-02.
5. EXISTING TOPOGRAPHY BELOW LIQUID LEVEL IS UNSURVEYED. ESTIMATE BY ANCHOR QEA.

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION
1	6/20/2019	RLP	JS	PROPOSED BOTTOM ELEVATION CHANGED TO 907.8
2	8/9/2019	RLP	JS	REGRADED SOUTH AND SOUTHEAST EXTERIOR
3	8/20/2019	JS	JS	PIPE NO. 2 TO REMAIN

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

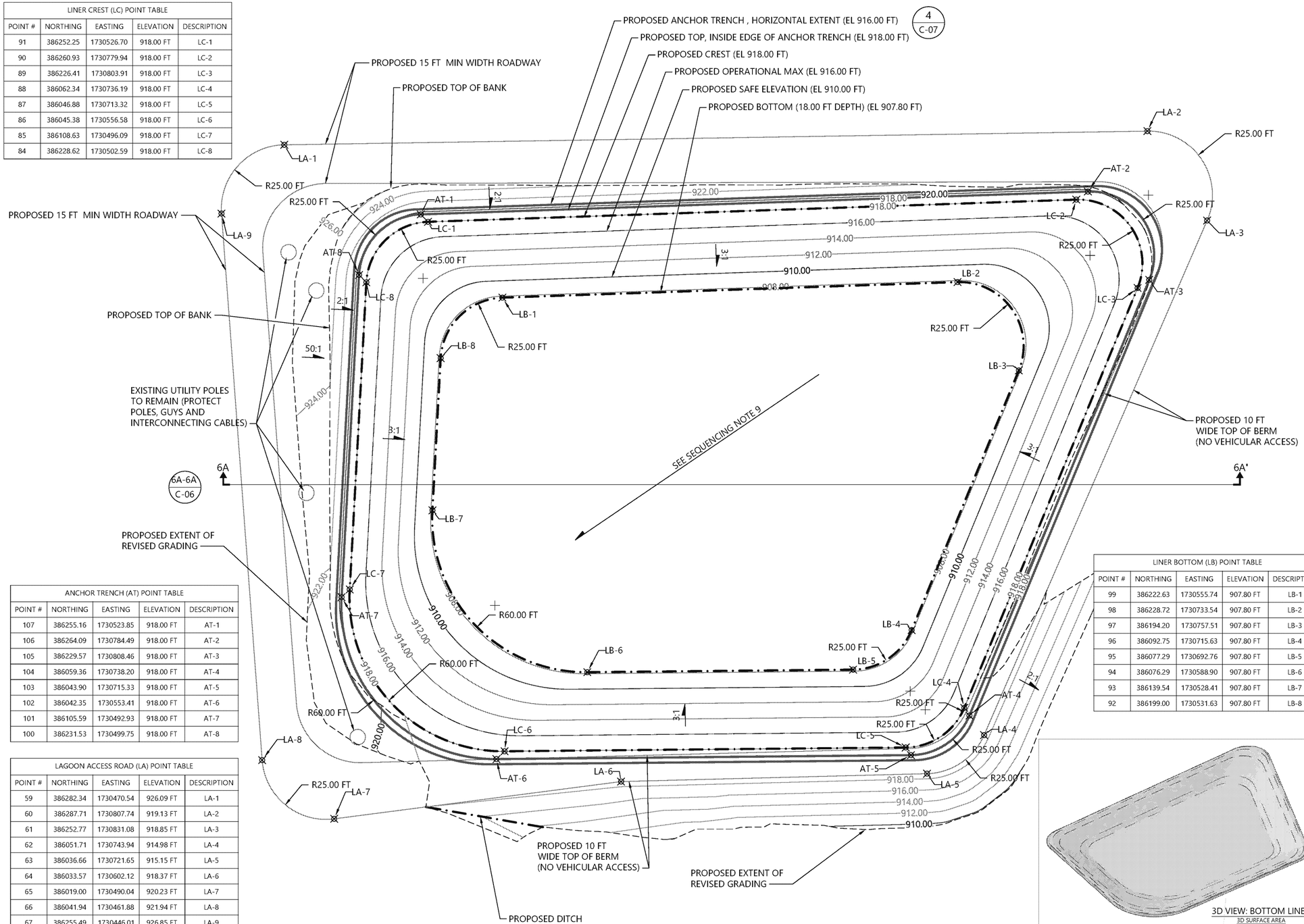
SITE PLAN

C-03

SHEET NO. 5 OF 10

K:\Projects\0996-Perkins Cole\Yakima Dairies Project\Lagoons - 2019\Construction Plans\0996-CD-YVD 2019-NoLD-Bosma 6 (Plans and Profile).dwg C-03
Aug 20, 2019 12:36pm jsexton

LINER CREST (LC) POINT TABLE				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
91	386252.25	1730526.70	918.00 FT	LC-1
90	386260.93	1730779.94	918.00 FT	LC-2
89	386226.41	1730803.91	918.00 FT	LC-3
88	386062.34	1730736.19	918.00 FT	LC-4
87	386046.88	1730713.32	918.00 FT	LC-5
86	386045.38	1730556.58	918.00 FT	LC-6
85	386108.63	1730496.09	918.00 FT	LC-7
84	386228.62	1730502.59	918.00 FT	LC-8



ANCHOR TRENCH (AT) POINT TABLE				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
107	386255.16	1730523.85	918.00 FT	AT-1
106	386264.09	1730784.49	918.00 FT	AT-2
105	386229.57	1730808.46	918.00 FT	AT-3
104	386059.36	1730738.20	918.00 FT	AT-4
103	386043.90	1730715.33	918.00 FT	AT-5
102	386042.35	1730553.41	918.00 FT	AT-6
101	386105.59	1730492.93	918.00 FT	AT-7
100	386231.53	1730499.75	918.00 FT	AT-8

LAGOON ACCESS ROAD (LA) POINT TABLE				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
59	386282.34	1730470.54	926.09 FT	LA-1
60	386287.71	1730807.74	919.13 FT	LA-2
61	386252.77	1730831.08	918.85 FT	LA-3
62	386051.71	1730743.94	914.98 FT	LA-4
63	386036.66	1730721.65	915.15 FT	LA-5
64	386033.57	1730602.12	918.37 FT	LA-6
65	386019.00	1730490.04	920.23 FT	LA-7
66	386041.94	1730461.88	921.94 FT	LA-8
67	386255.49	1730446.01	926.85 FT	LA-9

LINER BOTTOM (LB) POINT TABLE				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
99	386222.63	1730555.74	907.80 FT	LB-1
98	386228.72	1730733.54	907.80 FT	LB-2
97	386194.20	1730757.51	907.80 FT	LB-3
96	386092.75	1730715.63	907.80 FT	LB-4
95	386077.29	1730692.76	907.80 FT	LB-5
94	386076.29	1730588.90	907.80 FT	LB-6
93	386139.54	1730528.41	907.80 FT	LB-7
92	386199.00	1730531.63	907.80 FT	LB-8

SEQUENCING AND SELECT WORK REQUIREMENTS:

1. NOT ALL WORK IS DESCRIBED BELOW; REFER TO THESE DRAWINGS, TECHNICAL SPECIFICATIONS, AND OTHER CONTRACT DOCUMENTS.
2. PRIOR TO THE START OF THE WORK THE OWNER OR ENGINEER SHALL COMPLETE A PRECONSTRUCTION SURVEY OF LAGOON TO BE USED FOR BASIS OF CONTRACT MEASUREMENT AND PAYMENT.
3. CONTRACTOR SHALL PREPARE FINAL GRADE TO THE LINES, EXTENTS, AND ELEVATIONS SHOWN HEREON.
4. EXCESS IN-SITU SOILS FROM THE LAGOON, IF ANY, SHALL BE STOCKPILED IN THE DESIGNATED AREA (SHOWN ON DRAWING C-01) AND MANAGED IN ACCORDANCE WITH STORMWATER REQUIREMENTS; SEE TECHNICAL SPECIFICATIONS FOR FURTHER DETAILS.
5. THE FINISH GRADE SHALL BE A SMOOTH, UNYIELDING SURFACE FREE OF ORGANICS, DEBRIS, AND ANGULAR ROCK 3/8 INCH DIA OR LARGER.
6. UNLESS OTHERWISE REQUIRED IN THE TECHNICAL SPECIFICATIONS, PLACED FILL SHALL BE COMPACTED TO 92% OF THE MAX DRY DENSITY AS DETERMINED USING ASTM D1557 (MODIFIED PROCTOR).
7. UNLESS OTHERWISE REQUIRED IN THE TECHNICAL SPECIFICATIONS, SUBGRADES IN EXCAVATION AREA SHALL BE PROOF-ROLLED USING CONSTRUCTION EQUIPMENT TO VERIFY THE SUBGRADE IS IN A NONYIELDING CONDITION. THE ENGINEER SHALL DETERMINE WHAT EQUIPMENT IS SUITABLE FOR PROOF-ROLLING. THE ENGINEER SHALL MONITOR PROOF-ROLLING FOR YIELDING SUBGRADE SOILS. THE CONTRACTOR SHALL REMOVE SOFT SOILS TO A DEPTH RECOMMENDED BY THE ENGINEER AND REPLACE THE OVEREXCAVATION WITH ONSITE FILL MATERIAL OR IMPORT FILL MATERIAL TO BE COMPACTED AND TESTED IN ACCORDANCE WITH NOTE 6 AND THE TECHNICAL SPECIFICATIONS.
8. CONTRACTOR SHALL THEN COMMENCE INSTALLATION OF THE VENT SYSTEM GEOCOMPOSITE STRIPS, HDPE GEOMEMBRANE COVER STRIPS, GCL SECONDARY LINER, AND WELDED HDPE GEOMEMBRANE PRIMARY LINER IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS, THESE DRAWINGS, AND THE APPROVED CQA PLAN.
9. MINIMUM BOTTOM SLOPE OF LAGOON TO BE 1%. DIRECTION OF SLOPE TO BE DETERMINED IN THE FIELD BY THE CONTRACTOR.

NORTH

0 20 40
SCALE IN FEET

3D VIEW: BOTTOM LINER
3D SURFACE AREA
10.2 FT DEPTH = 64706 SF

NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, U.S. FT.
2. VERTICAL DATUM: NAVD 88.
3. SURVEY BY PLSA, 1/8/2018.
4. SEE LEGEND ON DRAWING G-02.

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION
1	6/20/2019	RLP	JS	PROPOSED BOTTOM ELEVATION CHANGED TO 907.8

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

FINAL GRADING PLAN

C-04

SHEET NO. **6** OF **10**

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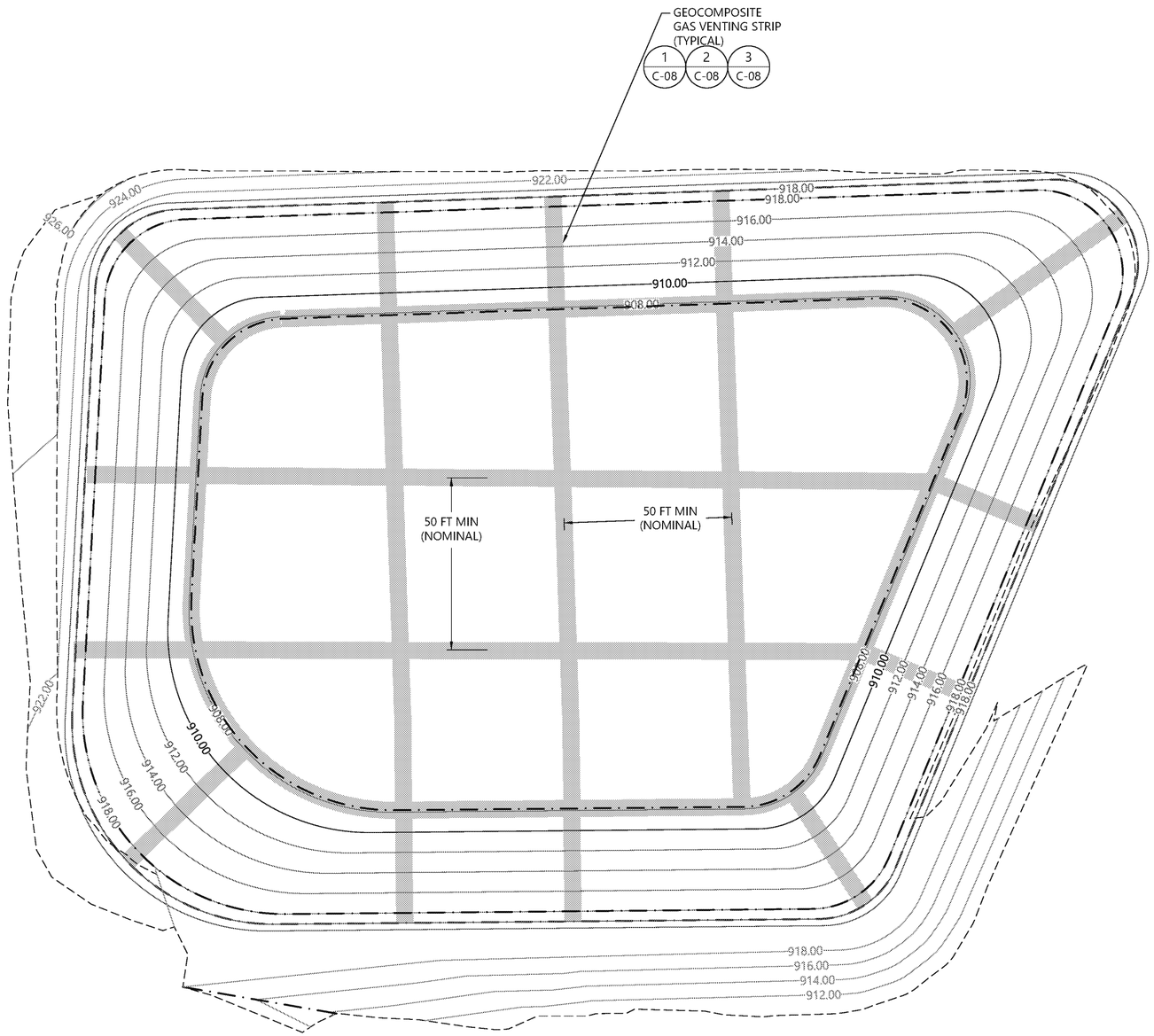
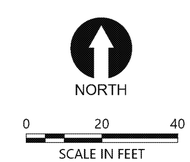
Aug 09, 2019 2:39pm rpetrie





NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, U.S. FT.
2. VERTICAL DATUM: NAVD 88.
3. SURVEY BY PLSA, 1/8/2018.
4. SEE LEGEND ON DRAWING G-02.

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION
1	6/20/2019	RLP	JS	PROPOSED BOTTOM ELEVATION CHANGED TO 907.8

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

VENTING PLAN

C-05

SHEET NO. **7** OF **10**

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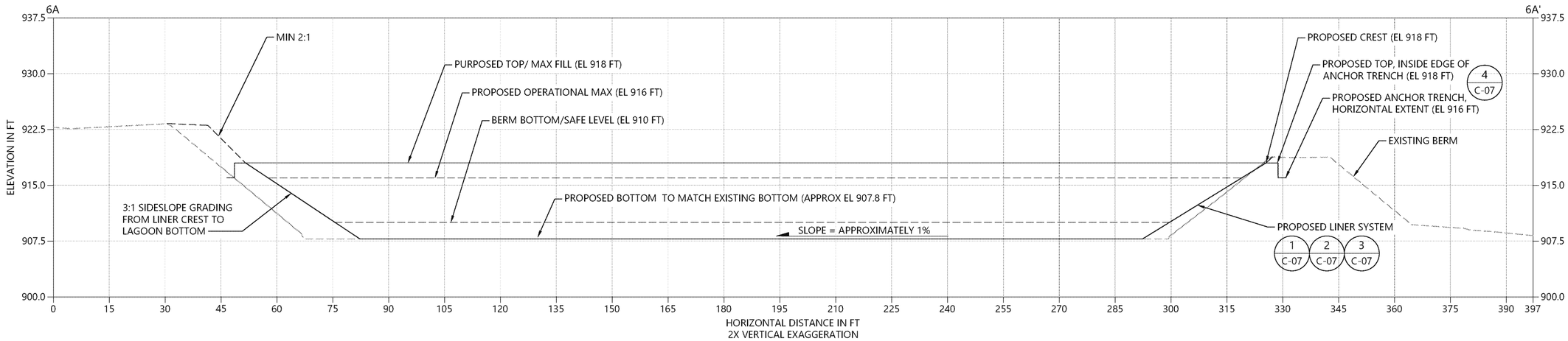
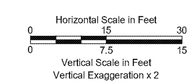
Aug 09, 2019 2:39pm rpetrie



NOTE:
EXISTING GRADE DATA AVAILABLE ONLY TO LIMITS SHOWN, HEREON. DATA COLLECTED PRIOR TO LAGOON CLEANOUT.



NOTES:

1. HORIZONTAL DATUM: WASHINGTON STATE PLANE SOUTH ZONE, NAD 83, U.S. FT.
2. VERTICAL DATUM: NAVD 88.
3. SURVEY BY PLSA, 1/16/2018.
4. SEE LEGEND ON DRAWING G-02.

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION
1	6/20/2019	RLP	JS	PROPOSED BOTTOM ELEVATION CHANGED TO 907.8

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

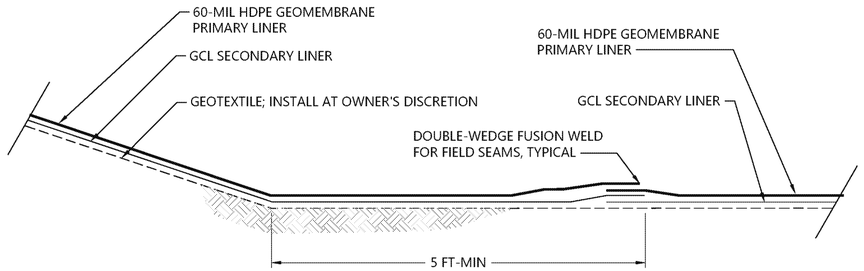
H&S BOSMA LAGOON NO. 6

LAGOON PROFILES

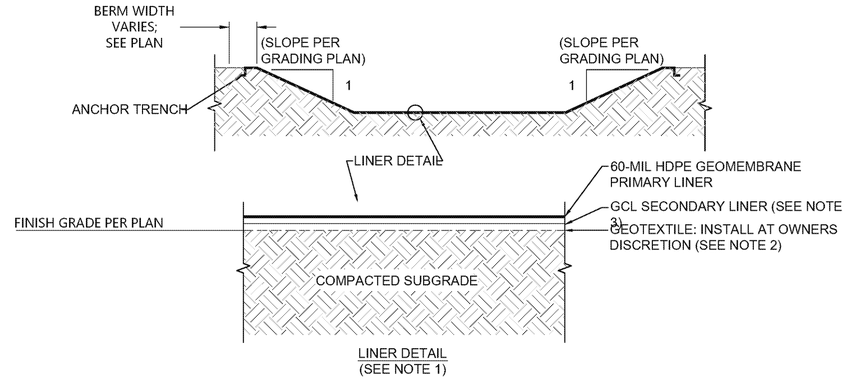
C-06

SHEET NO. **8** OF **10**

K:\Projects\0996-perkins cole\yakima dairies project\lagoons - 2019\construction plans\0996-CD-IVD 2019-NoLD-Bosma 6 (Plans and Profile).dwg C-06
Jun 20, 2019 5:25pm rpetrie

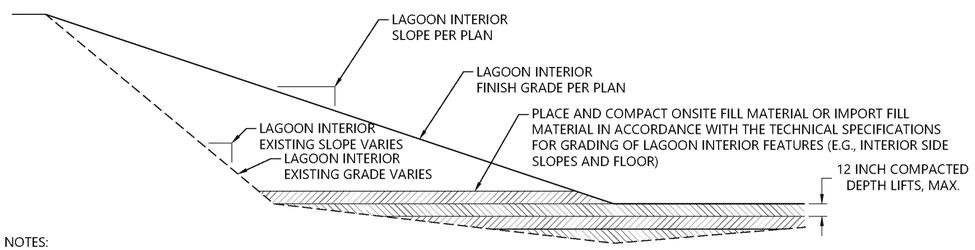


1 C-06 TYPICAL SLOPE TRANSITION WELDS
SCALE: NOT TO SCALE



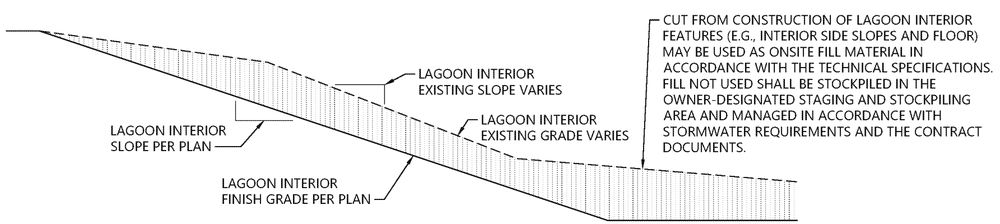
NOTES:
1. LINER DETAIL SIMILAR FOR INTERIOR SIDE SLOPES.
2. A CUSHION LAYER MAY BE NEEDED (AT THE DISCRETION OF THE OWNER) BENEATH THE SECONDARY LINER IF FINISH GRADE CONTAINS SHARP ANGULAR STONES OR PARTICLES GREATER THAN 3/8-INCH.
3. GAS VENTING GRID WILL BE INSTALLED UNDER SECONDARY LINER (SEE GAS VENTING PLAN).

3 C-06 GEOSYNTHETIC CLAY LINER
SCALE: NOT TO SCALE



NOTES:
1. THE FINISH GRADE SHALL BE A SMOOTH, UNYIELDING SURFACE FREE OF ORGANICS, DEBRIS, AND ANGULAR ROCK 3/8-INCH DIA OR LARGER. COBBLES ACCEPTABLE IN SUBGRADE (BELOW FINISH GRADE).
2. UNLESS OTHERWISE REQUIRED IN THE TECHNICAL SPECIFICATIONS, FILL SHALL BE COMPACTED TO 92% OF THE MAX. DRY DENSITY AND TO WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT, AS DETERMINED USING ASTM D1557 (MODIFIED PROCTOR).

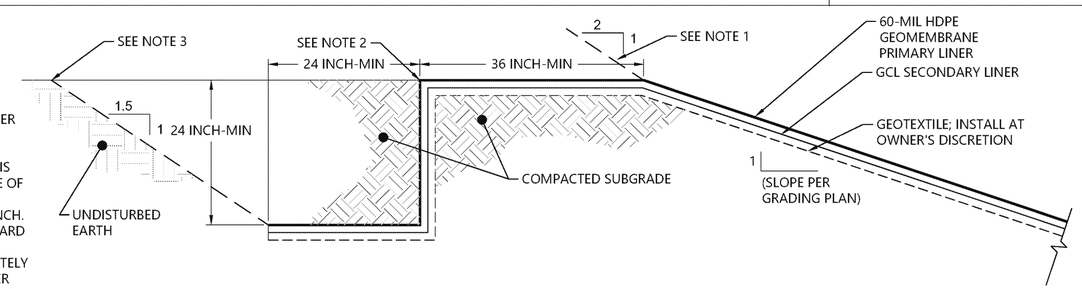
FILL PLACEMENT IN LAGOON INTERIOR



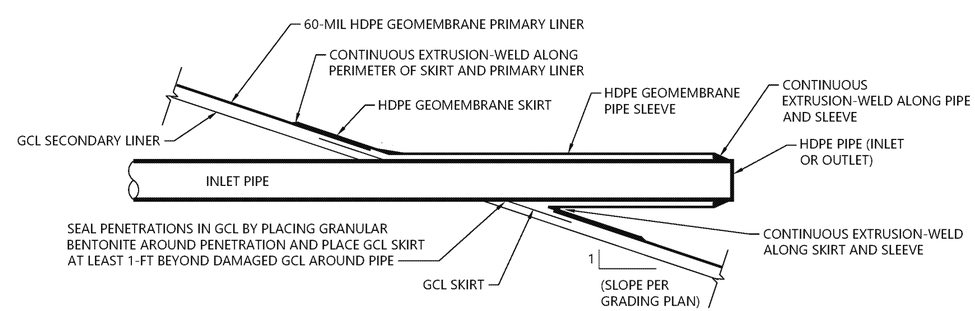
CUT IN LAGOON INTERIOR

2 C-06 INTERIOR GRADING DETAILS
SCALE: NOT TO SCALE

NOTES:
1. WHERE GRADING FROM CREST IS INDICATED ON PLAN, REPLACE EXCAVATED MATERIAL ABOVE LINER AT A SLOPE OF 2:1 TO EXISTING GRADE.
2. WHERE ABUTTING ACCESS ROAD IS INDICATED ON PLAN, INNER EDGE OF ACCESS ROAD SHALL BEGIN AT VERTICAL EDGE OF ANCHOR TRENCH. ACCESS ROAD SHALL SLOPE TOWARD LAGOON AT 1% GRADE.
3. WHERE GRADING TO APPROXIMATELY LEVEL EXISTING GRADE, THE OUTER EDGE OF TRENCH SHALL BE SLOPED AT APPROXIMATELY 1.5:1. THE TRENCH FILL SHALL BE SLOPED EVENLY FROM THE VERTICAL EDGE OF THE LINER TO THE EXISTING GRADE.



4 C-06 TYPICAL ANCHOR TRENCH DETAIL
SCALE: NOT TO SCALE



5 - PIPE PENETRATION SEAL
SCALE: NOT TO SCALE

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS

REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

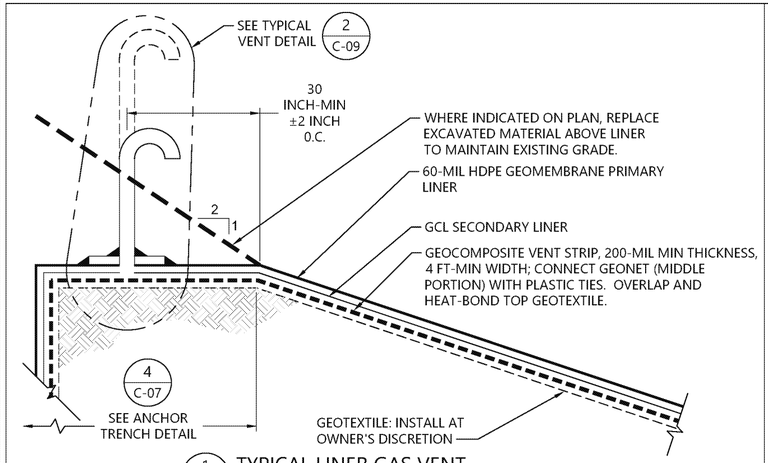
H&S BOSMA LAGOON NO. 6

DETAILS (1 OF 2)

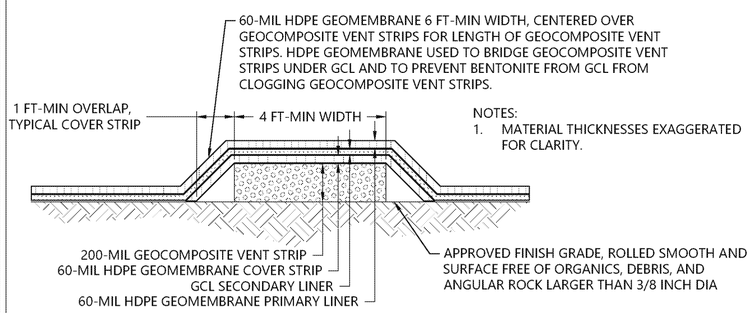
C-07

SHEET NO. **9** OF **10**

k:\Projects\0996-perkins coie\yakima dairies project\lagoons - 2019\construction plans\0996-CD-YVD 2019-NoLD-Bosma 6 (Plans and Profile).dwg C-07
Jun 20, 2019 5:25pm rpetrie

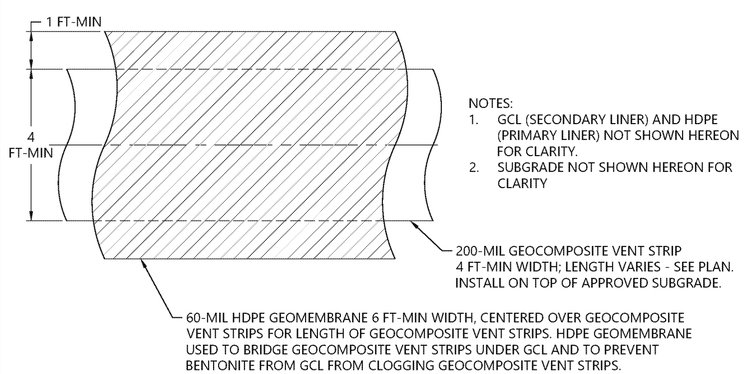


1 C-05 TYPICAL LINER GAS VENT
SCALE: NOT TO SCALE



NOTES:
1. MATERIAL THICKNESSES EXAGGERATED FOR CLARITY.

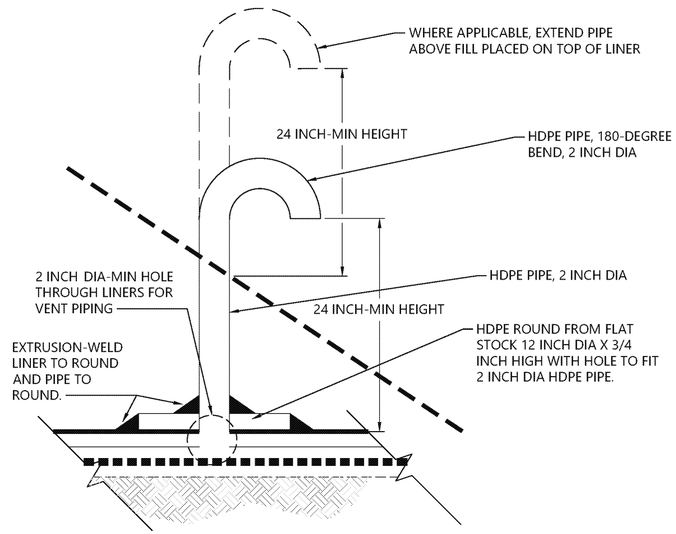
GEOCOMPOSITE VENT STRIP PROFILE



NOTES:
1. GCL (SECONDARY LINER) AND HDPE (PRIMARY LINER) NOT SHOWN HEREON FOR CLARITY.
2. SUBGRADE NOT SHOWN HEREON FOR CLARITY

GEOCOMPOSITE VENT STRIP PLAN

3 C-05 GEOCOMPOSITE VENT STRIP DETAIL
SCALE: NOT TO SCALE



2 C-05 TYPICAL VENT DETAIL
SCALE: NOT TO SCALE

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

ANCHOR QEA

REVISIONS				
REV	DATE	BY	APP'D	DESCRIPTION

DESIGNED BY: K SKELLENGER
DRAWN BY: R PETRIE
CHECKED BY: J. VERDUIN/K. SKELLINGER
APPROVED BY: J. VERDUIN/K. SKELLINGER
SCALE: AS NOTED
DATE: JUNE 22, 2018

H&S BOSMA LAGOON NO. 6

DETAILS (2 OF 2)

C-08

SHEET NO. **10** OF **10**

k:\Projects\0996-perkins coie\yakima dairies project\lagoons - 2019\construction plans\0996-CD-YVD 2019-NoLD-Bosma 6 (Plans and Profile).dwg C-08
Jun 20, 2019 5:25pm rpetrie

Appendix C
Technical Specifications

Liberty Dairy Lagoon Nos. 6 and 10
Technical Specifications

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SECTION 00 52 00
AGREEMENT FORM

This Contract, dated for reference purposes as of _____, is made by and between

Liberty Dairy, LLC ("Liberty")

a limited liability company, herein referred to as the "Owner",

and _____, ("Contractor"),

a _____ *(LLC, Corporation, or other entity)*

with respect to the Project known as the:

Liberty Dairy Consolidated Lagoon 10 and Liberty Lagoon 6 Project

(the "Project"), located at:

5860 E. Zillah Drive, Granger, Washington 98953

referred to as the "Site" or collectively referred to as the "Sites", as a result of Contractor's successful bid (the "Contractor's Bid"), which was accepted by the Owners under

the terms of the Bid Package with Contract Documents, dated _____, which was prepared for the Project (collectively, the "Bid Package").

The Owners and the Contractor hereby agree as follows:

A. Scope of Work: The Contractor shall, within the time stipulated in this Contract, carry out the Project and perform the work called for in the Bid Package and this Contract (collectively, the "Work"), furnishing all Work, labor, equipment, transportation, material, and services necessary to construct and complete the Project in a good, expeditious, workmanlike, and substantial manner. All the Work shall be completed in strict conformance with the Construction Drawings, Specifications, Technical Specifications, and working details contained or referenced in the Bid Package and to the satisfaction of the Owners.

B. Component parts of the Contract: In addition to this main body of the Contract, each of the following documents is incorporated into the Contract by this reference, as fully as if set out herein in full, and shall constitute a component part of the Contract, with the various parts of the Contract sometimes being referred to individually as a "Contract Document" and collectively as the "Contract Documents":

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1. The Contractor's Bid Package.

2. The Procurement and Contracting Requirements (Division 00 of the Specifications).

3. The Technical Specifications (Divisions 01 through Division 40 of the Specifications).

4. The Appendices to the Specifications.

5. The Construction Drawings (Plans).

6. All Addenda that were issued during Bidding.

In the case of certain of those exhibits, what is attached hereto as an exhibit is a list of the Specifications, Technical Specifications, Construction Drawings, schedules or other items in question, and those cases the items so listed are themselves incorporated into this Contract as well by this reference, as fully as if set out herein in full. The Contract Documents are intended to be complementary. Work required by any one of the Contract Documents and not by any one or more other Contract Documents shall be done as if required by all. In addition, each capitalized term used in one of the Contract Documents that is not otherwise defined therein shall have the meaning ascribed to that term in the other Contract Documents, wherever applicable and appropriate.

(continued on the next page)

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In witness whereof, the parties have executed this Contract, effective as of the date first above written.

Liberty Dairy:	**Contractor:**
Liberty Dairy, LLC,	_____,
a limited liability company	a _____. *(LLC, Corporation, or other entity)*
By: _____ *(Signature)*	By: _____ *(Signature)*
Print Name: _____	Print Name: _____
Title: _____	Title: _____

END OF SECTION 00 52 00

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SECTION 00 72 00
GENERAL CONDITIONS

Article 1. Definitions.

1.01 "As-built Drawings (Record Drawings)" shall mean the record documents and drawings that depict the final position, configuration, adjustments and installation of the constructed works.

1.02 "Construction Drawings" shall mean the drawings developed by Anchor QEA, LLC., a Washington limited liability company ("Anchor QEA"), whether itself or through its subcontractors, dated June 22, 2018 (or later as amended to the Contract), to be used as the basis of design for construction by the Contractor, as updated during the bidding process, such updates all having been provided to Contractor, to be used as the basis of design for construction by the Contractor, as updated during the bidding process, such updates all having been provided to Contractor.

1.03 "Construction Schedule" shall mean the Contractor-developed Project schedule, as approved by the Owners' Representative, including all revisions, as necessary, throughout the Project.

1.04 "Contract Document" shall mean any of the documents so defined in the Contract, which together make up the complete set of "Contract Documents".

1.05 "Contract Sum" is stated in the Contract and is the total amount payable by Owners to Contractor for the performance of the work under the Contract.

1.06 "Contractor Construction Manager" or "CCM" shall be employed by Contractor, with a minimum of 5 years construction experience on similar size and type of construction projects. The CCM shall be satisfactory to the Owners and Owners' Representative, and shall not be changed except with the consent of the Owners' Representative, unless the CCM proves to be unsatisfactory to Contractor and ceases to be in his/her employ.

1.07 "Contractor Engineer" shall mean the professional engineer, licensed in Washington State, which is to be hired by Contractor in order to complete Work for the Project in accordance with State law and regulations and as specified in the Contract Documents.

1.08 "Contractor" shall mean (jointly and severally, if more than one) the person(s) and/or organization(s) identified as such in the Contract, or their authorized representative(s) (as appropriate).

1.09 "Engineer" shall refer in each case to the person or entity acting in an engineering capacity for the design, plan, specification, or other activity in question, it being understood that the "Engineers of Record" for this Project include Kendra Skellenger, PE and Brian Keenan, PE. Engineer may be synonymous with "Owners' Representative".

1.10 "NTP" shall mean Notice to Proceed, a written notification from the Owners to the Contractor. No Work by the Contractor may commence prior to the Owners' issuance of NTP.

1.11 "Owner" shall refer to Liberty Dairy, LLC ("Liberty").

1.12 "Owners' Representative" shall mean the person or organization acting from time to time as the agent of Owners for the management of the construction of the Project, who may at times be an employee of Owners or the Engineer. Owners' Representative may, in certain roles, be synonymous with "Engineer".

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1.13 "Owners" shall refer to Liberty Dairy, LLC ("Liberty").

1.14 "Project" shall mean the total construction designed by the Engineer. The work performed under this Contract is directed towards completion of all or a part of the Project.

1.15 "Project Footprint" shall be as described in the Construction Drawings and Technical Specifications.

1.16 "Request for Information (RFI)" shall mean any request from Owners' Representative or Contractor seeking information before or during construction.

1.17 "Request for Proposal (RFP)" shall mean an Owners' initiated change from Owners' Representative to the Contractor. An RFP will contain descriptions and changes in drawings, as necessary, describing the proposed changes.

1.18 "Sample" shall mean a physical example furnished by Contractor to illustrate materials, equipment, or workmanship, and to establish standards by which the work will be judged.

1.19 "Shop Drawing" shall mean a drawing, diagram, illustration, schedule, performance chart, brochure, or other data prepared by Contractor or any Subcontractor, manufacturer, supplier, or distributor, which illustrates some portion of the Work.

1.20 "Site" shall mean the locations where the construction subject to this Contract is to take place.

1.21 "State" shall mean the state in which the Project is located.

1.22 "Subcontractor" shall mean a person or organization who has a direct contract with Contractor to perform any of the Work or to furnish material according to Construction Drawings and Technical Specifications for the Work. The term "Subcontractor" shall also include sub-subcontractors performing any part of the Work or furnishing special designed material for the Work, even if they have only an indirect relationship to Contractor.

1.23 "Visitors" shall mean individuals attending the Site during construction that are not an individual as otherwise defined. Visitors may include Liberty staff, agency representatives, general public or other individuals authorized to attend the Site by Owners.

1.24 "Work" shall mean all of the labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in such construction.

Article 2. Contract Interpretation.

2.01 Counting Time. When any provision in the Contract Documents calls for computation of time in terms of days, the period so counted shall include all calendar days within the period, including usual working days as well as weekends and holidays.

2.02 Gender and Number. References to one gender include the other; references to either singular or plural include the other.

2.03 Headings. Article, section, and paragraph headings are for convenience only, and shall not be used to interpret the provisions of this Contract.

2.04 Express and Implied Work Requirements. This Contract requires the performance of all elements of work expressly mentioned herein, together will all elements of work that are reasonably inferable from the express terms of this Contract as being necessary to the proper completion of the Work.

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2.05 Technical or Trade Meanings. Words which have well-known technical or trade meanings are used herein in accordance with such recognized meanings.

2.06 Interpretation and Execution of Contract Documents. The Contract Documents supersede all prior or contemporaneous communications and negotiations, both oral and written, concerning the subject matter of this Contract, and constitute the entire agreement between Owners and Contractor with respect to such matters. Any and all exhibits, schedules, and other addenda attached to or referred to in this Contract are hereby incorporated into this Contract as fully as if set out in their entirety herein. This Contract may be executed in several counterparts, and all counterparts so executed shall constitute one contract which shall be binding on all of the parties, notwithstanding that all of the parties are not signatory to the same counterpart.

2.07 Interpretations by Owners' Representative. Written interpretations necessary for the proper execution or progress of the Work, in the form of drawings or otherwise, will be issued with reasonable promptness by the Owners' Representative and in accordance with any schedule agreed upon. Either party to the Contract may make written request to the Owners' Representative for such interpretations. Such interpretations shall be consistent with, and reasonably inferable from the Contract Documents, and may be made by field orders issued pursuant to this Contract.

2.08 Conflicts Among Contract Documents – Priorities. If there is any conflict between or among any of the Contract Documents, the conflict shall be resolved by giving effect to the provisions in the Contract Documents having higher priority and by disregarding conflicting provisions in documents having lower priority, as follows: first priority, any modifications, with the most recent having priority over earlier modifications; second priority, the main body of the Contract; third priority, any addenda, with the most recent have priority over earlier addenda; fourth priority, the Supplementary Conditions; fifth priority, the General Conditions.

2.09 Conflicts and Interpretation Problems Involving Construction Drawings, Technical Specifications, or Working Details. If a conflict or other problem of interpretation involves Construction Drawings, Technical Specifications, or working details, the problem shall be resolved as follows: Dimensions take precedence over scale at all times. Figured dimensions on Construction Drawings shall govern, but work not dimensioned shall be as directed. Work not particularly shown or specified shall be the same as similar parts that are shown or specified. Large-scale details shall take precedence over smaller-scale details as to shape and details of construction. Technical Specifications shall govern as to materials, workmanship, and installation procedures. Construction Drawings, Technical Specifications, and working details are intended to be fully cooperative and to agree. However, if Contractor observes that Construction Drawings, Technical Specifications, and/or working details are in conflict, Contractor shall promptly notify the Owners' Representative in writing and any necessary changes shall be adjusted as provided elsewhere in the Contract Documents for changes in Work. The Owners' Representative shall resolve all conflicts involving Construction Drawings, Technical Specifications, or working details wherever the foregoing principles do not apply, or where, if applied, they lead to results that appear unreasonable.

Article 3. Contract Documents.

3.01 Contract Documents. The Contract Documents consist of all component parts of the Contract as specified in the Contract, including the Invitation to Bid and the information for Bidders contained in or referenced in the Bid package; Contractor's Bid as accepted, , as well as the Bid security; the main body of the Contract; the bonds and evidence of insurance submitted in connection with the Contract; these General Conditions; the Supplementary Conditions; and all of the Construction Drawings, Technical Specifications, working details, and other information prepared for and approved for the Work, including any and all Contractor Construction Drawings and Shop Drawings, as well addenda

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to the foregoing issued prior to execution of the Contract, and all modifications approved thereafter in accordance with the terms of the Contract.

3.02 Contract. The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral, including the bidding documents. The Contract may be amended or modified only by a modification which is prepared and approved as provided in the Contract.

3.03 Modifications. A modification is (1) a written amendment to the Contract signed by both parties, (2) a change order, (3) a written interpretation issued by the Owners' Representative, or (4) a written order for a minor change in the Work issued by the Owners' Representative pursuant to the Contract. A modification may be made only after execution of the Contract.

3.04 Execution. Unless otherwise specified in the Contract, the Contract Documents shall be signed in not less than duplicate by Owners and Contractor.

3.05 Familiarity with Site and Local Conditions. Prior to submitting a bid, and prior to executing this Contract, Contractor visited the Site, became familiar with the local conditions under which the Work is to be performed, and correlated Contractor's observations with the requirements of this Contract, and by executing the Contract, Contractor represents that Contractor has done so.

3.06 Contract Documents Furnished to Contractor. Except as otherwise provided in the Supplementary Conditions, Contractor will be furnished, free of charge, copies of all the Contract Documents, including a reasonably sufficient number of copies of the Construction Drawings, Technical Specifications, and working details to facilitate the execution of the Work. The number of copies to be furnished free of charge shall be as set forth in the Supplementary Conditions. Additional copies may be obtained at cost of reproduction.

3.07 Ownership of Documents. All Construction Drawings, Technical Specifications, working details, and copies thereof furnished by the Owners' Representative are and shall remain the property of Owners. Such documents shall not be used on any other project, and, with the exception of one set for each party to the Contract, shall be returned to the Owners' Representative at the completion of the Work.

3.08 Organization of Contract Documents not controlling. The organization of the Technical Specifications into divisions, sections, and articles, and the arrangement of the Construction Drawings or working details shall not control Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

3.09 Contract Documents on Site. Contractor will at all times maintain at least one complete, up-to-date set of the Contract Documents (including the original documents as well as all change orders and other supplemental and additional documents) on the Site, to be available to Owners and Owners' Representative, and their representatives.

Article 4. Subcontractors.

4.01 No Contractual Relationship Between Owners and Subcontractors. Nothing contained in the Contract Documents shall create any contractual relation between Owners or Owners' Representative and any Subcontractor.

4.02 Work Performed by Subcontractors; Substitutions. Subcontracted work shall be performed only by the Subcontractors identified in Contractor's bid documents or those later approved in writing by Owners.

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4.03 Contracts with Subcontractors. All work performed for Contractor by a Subcontractor shall be pursuant to a written agreement between Contractor and the Subcontractor (and where appropriate, between Subcontractors and sub-Subcontractors). All such agreements shall require performance by the Subcontractors in conformity with the terms of this Contract, and shall include all the terms of this Contract which are applicable to Subcontractors.

4.04 Payments to Subcontractors.

(a) Contractor shall promptly pay each Subcontractor any amount equal to the percentage of completion allowed to Contractor on account of such Subcontractor's work, less the percentage retained from payments to Contractor. Contractor shall also require each Subcontractor to make similar payments to its own sub-Subcontractors.

(b) If the Owners' Representative fails to issue a certificate for payment for any cause which is the fault of Contractor and not the fault of a particular Subcontractor, Contractor shall pay the Subcontractor on demand, made at any time after the certificate for payment should otherwise have been issued, for the work to the extent completed, less the retained percentage.

(c) Neither Owners nor the Owners' Representative shall have any obligation to pay or to see to the payment of any monies to any Subcontractor except as may otherwise be required by law.

4.05 Information Provided to Subcontractors. The Owners' Representative may, on request, and at the discretion of the Owners' Representative, furnish to any Subcontractor, if practicable, information regarding percentages of completion certified to Contractor on account of work done by such Subcontractors.

4.06 Contractor's Responsibility for Work of Subcontractors. Contractor shall be as fully responsible to Owners for the acts and omissions of any Subcontractor and of persons either directly or indirectly employed by the Subcontractors, as Contractor is for acts and omissions of persons directly employed by Contractor.

Article 5. Contract Administration by Owners' Representative

5.01 No Contractual Relationship Between Owners' Representative and Contractor. Nothing contained in the Contract Documents shall create any contractual relationship between the Owners' Representative and Contractor or any Subcontractor.

5.02 Owners' Representative. The Owners' Representative will be Owners' agent during construction and until final payment. The Owners' Representative will have authority to act on behalf of Owners to the extent provided in the Contract Documents, unless otherwise modified by written instrument which will be shown to Contractor. The Owners' Representative will advise and consult with Owners, and all of Owners' instructions to Contractor shall be issued through the Owners' Representative. As Owners' agent, the Owners' Representative will provide general administration of the Contract, including performance of the functions hereinafter described.

5.03 Instructions Issued Through Owners' Representative. Owners shall issue all instructions to Contractor through the Owners' Representative.

5.04 Owners' Representative's Access to Work. The Owners' Representative shall at all times have access to the Work wherever it is in preparation and progress. Contractor shall provide facilities for such access so the Owners' Representative may perform the Owners' Representative's functions under the Contract.

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5.05 Inspections. The Owners' Representative will make periodic visits to the Site in order to be familiar generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. These visits will include compliance observations and inspections as specified in the Construction Drawings and Technical Specifications for the Work. On the basis of on-site observations, the Owners' Representative will keep Owners informed of the progress of the Work, and will endeavor to guard Owners against defects and deficiencies in the Work. The Owners' Representative will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Owners' Representative will not be responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, and will not be responsible for Contractor's failure to carry out the Work in accordance with the Contract Documents.

5.06 Determination of Payments to Contractor. Based on such observations and Contractor's applications for payment, the Owners' Representative will determine the amounts owing to Contractor and will issue certificates for payment in such amounts, as provided in this Contract.

5.07 Decisions on Artistic Effect. The Owners' Representative's decisions in matters relating to artistic effect will be final if consistent with the intent of the Contract Documents.

5.08 Authority to Reject Work or to Require Special Inspection or Testing. The Owners' Representative may reject work which does not conform to the Contract Documents. Whenever, in the reasonable opinion of the Owners' Representative, it is necessary or advisable to insure the proper implementation of this Contract, the Owners' Representative may require special inspection or testing of the Work in accordance with this Contract, whether or not such work is then fabricated, installed, or completed. However, neither the Owners' Representative's authority to act under this paragraph, nor any decision made by the Owners' Representative in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Owners' Representative to Contractor, to any Subcontractor, to any of their agents or employees, or any other person performing any of the Work.

5.09 Review of Shop Drawings and Samples. The Owners' Representative will review Shop Drawings and Samples as provided in this Contract.

5.10 Change Orders Prepared by Owners' Representative. The Owners' Representative will prepare change orders and may order minor changes in the Work in accordance with the terms of this Contract. The change orders will be approved by the Owners' Representative and Owners.

5.11 Inspections and Document Review. The Owners' Representative will conduct inspections of the Work (including a final inspection), will receive and review written guarantees and related documents required by the Contract and assembled by Contractor and will issue a final certificate for payment.

5.12 Project Representatives. Owners may provide or arrange for one or more full-time Project representatives to assist the Owners' Representative in carrying out their responsibilities at the Site. The duties, responsibilities, and limitations of authority of any such Project representative shall be as set forth in the Supplementary Conditions.

5.13 Written Modification of Owners' Representative's Role. The duties, responsibilities, and limitations on the authority of the Owners' Representative as Owners' Representative during construction as set forth in these General Conditions will not be modified or extended without written consent of Owners and the Owners' Representative.

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5.14 Owners' Representative's Non--Responsibility for Contractor's Actions. The Owners' Representative will not be responsible for the acts or omissions of Contractor, any Subcontractors, or any of their agents or employees, or any other persons performing any of the Work.

5.15 Termination of Owners' Representative's Employment; Substitution of New Owners' Representative. In case of the termination of the employment of the Owners' Representative, Owners shall appoint a new Owners' Representative to replace the former Owners' Representative.

Article 6. Services Provided by Owners.

6.01 Easements obtained by Owners. Owners shall secure and pay for all easements, rights-of-way, and fee interests in land necessary to enable Contractor to complete the work.

6.02 Surveys provided by Owners. Owners shall furnish all surveys describing the physical characteristics, and legal limits for the site of the Project.

6.03 Information and Services Provided by Owners. Information or services under Owners' control shall be furnished by Owners with reasonable promptness to avoid delay in the orderly progress of the work.

Article 7. Contractor's Administrative Duties.

7.01 Review of Contract Documents for Errors. Contractor shall carefully study and compare the Contract documents and shall at once report to the Owners' Representative any error, inconsistency, or omission he/she may discover. Contractor shall not be liable to Owners or the Owners' Representative, for any damage resulting from any such errors, inconsistencies, or omissions in the Contract documents.

7.02 Taxes. Contractor shall pay all sales, consumer, use, and other similar taxes required by law.

7.03 Permits, Fees, and Licenses. Contractor shall secure and pay for all permits, governmental fees, and licenses necessary for the proper execution and completion of the work, which are applicable at the time the bids are received.

7.04 Transportation and Utility Service. Contractor shall pay for all transportation and utility service not later than the 20th day of the calendar month following that in which such services are rendered.

7.05 Materials and Equipment. Contractor shall pay for all materials, tools, and other expendable equipment to the extent of 90% of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at the Project site and the balance thereof not later than the 30th day following completion of that part of the work in or on which such materials, tools, and equipment are incorporated or used.

7.06 Contractor Construction Manager or CCM. See also Article 1. Definitions. Contractor shall employ a competent manager and necessary assistants who shall be in attendance at the Site during the progress of the Work. The CCM shall represent Contractor and all communications given to the CCM shall be as binding as if given to Contractor. Important communications will be confirmed in writing. Other communications will be so confirmed on written request in each case.

7.07 Contractor's Responsibility for Agents and Employees. Contractor shall be responsible to Owners for the acts and omissions of all his/her employees and all subcontractors, their agents and employees, and

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all other persons performing any of the work under a contract with Contractor. Agent, employees or those listed in the submitted shall be not be changed except with the written consent of the Owners' Representative.

7.08 Communication through Owners' Representative. Contractor shall forward all communications to Owners through the Owners' Representative.

Article 8. General Provisions Regarding Conduct of Work.

8.01 No Work Without Construction Drawings and Technical Specifications. Contractor shall do no work without current Construction Drawings, Technical Specifications, and working details.

8.02 Supervision and Construction Procedures. Contractor shall supervise and direct the Work, using Contractor's best skill and attention. Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract.

8.03 Contractor's Responsibility for Labor, Materials, and Equipment. Unless otherwise specifically noted, Contractor shall provide and promptly pay for all labor, materials, equipment, and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

8.04 Conduct and skill of Employees. Contractor shall at all times enforce strict discipline and good order among Contractor's employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned. Any person in the employ of Contractor whom Owners may deem incompetent or unfit shall be dismissed from the Work and shall not again be employed on it except with the written consent of Owners.

8.05 Construction Schedule. Contractor shall, by the deadline set in Specification Section 01 32 00 – Construction Progress Documentation, prepare and submit for the Owners' Representative's approval, a Draft Construction Schedule for the Work. The Construction Schedule shall be related to the entire Project. This Construction Schedule shall indicate in detail the dates for the starting and completion of the various stages of construction and shall be revised as required by the conditions of the Work, subject to the Owners' Representative's approval.

8.06 Construction Drawings and Technical Specifications at Site. Contractor shall maintain at the Site for Owners one copy of all Construction Drawings, Technical Specifications, working details, addenda, approved Contractor Construction Drawings and Shop Drawings, change orders, and other modifications, in good order and marked to record all changes made during construction. These shall be available to the Owners' Representative. The Construction Drawings, Contractor Construction Drawings, and working details, marked to record all changes made during construction remain the property of Owners and shall be delivered to the Owners' Representative for Owners upon completion of the Work.

8.07 Dimensions to be Checked. All dimensions shall be carefully checked by the various partisans. Each trade shall be held responsible for the accuracy of the dimensions of its own work. Dimensions shown on Construction Drawings shall be adhered to insofar as it is possible, and no deviation from such dimensions shall be made except with the consent of the Owners' Representative. Where the efforts of one trade come in contact with those of another trade, each trade shall carefully check all dimensions which affect its own work. Wherever possible, dimensions shall be taken at the building, but no work shall be delayed or held up waiting for building dimensions, when by the exercise of foresight and proper cooperation, the dimensions may be established in advance of construction.

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Contractor shall verify all dimensions at the Site and shall be solely responsible for same or deviations from same.

8.08 Cutting and Patching. Contractor shall be responsible for any cutting, fitting, and patching that may be required to complete Contractor's work, except as otherwise specifically provided in the Contract Documents. Contractor shall not endanger any work of any other contractors by cutting, excavating, or otherwise altering any work and shall not cut or alter the work of any other contractor except with the written consent of the Owners' Representative.

8.09 Revision of Operations. When, in the judgment of Owners, it becomes necessary to accelerate the Work, Contractor when so ordered, shall concentrate Contractor's forces at such points as directed, and execute such portions of the Work as may be required.

8.10 Damage to Work or Property on Site. All damage or loss to any property on or near the Site caused in whole or in part by Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, shall be remedied by Contractor, at Contractor's expense, except damage or loss attributable to faulty Construction Drawings, Technical Specifications, or working details, or to the acts or omissions of Owners or Owners' Representative or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault or negligence of Contractor.

Article 9. Shop Drawings and Samples.

9.01 Submittal of Shop Drawings and Samples. Contractor shall review, stamp with Contractor's approval, and submit to the Owners' Representative, with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the work of any other contractor, all Shop Drawings and Samples required by the Contract Documents or subsequently by the Owners' Representative as covered by modifications. Shop Drawings and Samples shall be properly identified as specified, or as the Owners' Representative may require. At the time of submission, Contractor shall inform the Owners' Representative in writing of any deviation in the Shop Drawings or Samples from the requirements of the Contract Documents.

9.02 Warranties Concerning Shop Drawings and Samples. By approving and submitting Shop Drawings and Samples, Contractor thereby represents that Contractor has determined and verified all field measurements, field construction criteria, materials, catalog numbers, and similar data, or will do so, and that Contractor has checked and coordinated each Shop Drawing and Sample with the requirements of the Contract Documents.

9.03 Owners' Representative's Review and Approval. The Owners' Representative will review and approve Shop Drawings and Samples with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Owners' Representative's approval of a separate item shall not indicate approval of an assembly in which the item functions.

9.04 Corrections. Contractor shall make any corrections required by the Owners' Representative and shall resubmit the required number of corrected copies of Shop Drawings or new Samples until approved. Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Owners' Representative on previous submissions.

9.05 Contractor's Responsibility. The Owners' Representative's approval of Shop Drawings or Samples shall not relieve Contractor of responsibility for any deviation at the time of submission, nor shall the Owners' Representative's approval relieve Contractor from responsibility for errors or omission in the Shop Drawings or Samples.

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9.06 Completion of Work in Accordance with Shop Drawings and Samples. No portion of the Work requiring a Shop Drawing or Sample submission shall be commenced until the submission has been approved by the Owners' Representative. All such portions of the Work shall be in accordance with approved Shop Drawings and Samples.

Article 10. Separate Contracts on Same Project.

10.01 Owners' Right to Award Separate Contracts. Owners reserve the right to award other contracts in connection with other portions of the Project.

10.02 Coordination Among Contractors. Contractor shall ascertain to Contractor's own satisfaction the scope of the Project and the nature of any other contracts that have been or may be awarded by Owners in prosecution of the Project, to the end that Contractor may perform this Contract in light of such other contracts, if any. Nothing herein shall be interpreted as granting to Contractor exclusive occupancy at the Site. Contractor shall not cause any unnecessary hindrance or delay to any other contractor working on the Project. If simultaneous execution of any contract for the Project is likely to cause interference with the performance of some other contract or contracts, Owners shall decide which contractor shall cease work temporarily and which contractor shall continue or whether work can be coordinated so that contractors may proceed simultaneously. Owners shall not be responsible for any damages suffered or extra costs incurred by Contractor resulting directly or indirectly from the award or performance or attempted performance of any other contract or contracts on the Project, or caused by any decision or omission of Owners respecting the order of precedence in performance of the contracts.

10.03 Responsibility to Other Contractors. Contractor shall afford other contractors on the Project reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall properly connect and coordinate Contractor's work with theirs.

10.04 Duty to Inspect the Work of Other Contractors. If any part of the Work depends for proper execution or results upon the work of any other separate contractor, Contractor shall inspect and promptly report to the Owners' Representative any apparent discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of Contractor so to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper to receive Contractor's work, except as to defects which may develop in the other separate contractor's work after the execution of Contractor's work.

10.05 Damage to the Work of Other Contractors. Should Contractor cause damage to the work or property of any separate contractor on the Project, Contractor shall, upon due notice, settle with such other contractor by agreement or arbitration, if the other contractor will so settle. If such separate contractor sues Owners or initiates an arbitration proceeding on account of any damage alleged to have been so sustained, Owners shall notify Contractor who shall defend such proceedings at Owners' expense, and if any judgment or award against Owners arises therefrom, Contractor shall pay or satisfy it and shall reimburse Owners for all attorneys' fees and court and arbitration costs which Owners has incurred.

10.06 Responsibility for Costs Caused by One Contractor to Another. Any costs to one contractor or its Subcontractors on the Project caused by defective or ill-timed work by another contractor or its Subcontractors on the Project shall be borne by the party responsible for such defective or ill-timed work.

10.07 Owners' Right to Settle Disputes Over Clean-Up. If a dispute arises between the separate contractors as to their responsibility for cleaning up under their respective contracts, Owners may clean up and charge the cost thereof to the several contractors as the Owners' Representative shall determine to be just.

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Article 11. Special Inspections and Testing.

11.01 Contractor's Responsibility for Required Tests. If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any work to be inspected, tested, or approved, Contractor shall give the Owners' Representative timely notice of its readiness and of the date arranged so the Owners' Representative may observe such inspection, testing, or approval. Except as otherwise provided in the Contract, Owners shall bear all costs of such inspections, tests, and approval.

11.02 Responsibility for Tests Not Anticipated in Contract. If after the commencement of the Work the Owners' Representative determines that any work requires special inspection, testing, or approval which Paragraph 11.01 does not cover, the Owners' Representative will, upon written authorization from Owner, instruct Contractor to order such special inspection, testing, or approval, and Contractor shall give notice as in Paragraph 11.01. If such special inspection or testing reveals a failure of the Work to comply (1) with the requirements of the Contract Documents or (2) with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, then Contractor shall bear all costs thereof, including the Owners' Representative's additional services made necessary by such failure; otherwise Owners shall bear such costs, and an appropriate change order shall be issued.

11.03 Certificates of Inspection. Required certificates of inspection, testing, or approval shall be secured by Contractor and promptly delivered by Contractor to the Owners' Representative.

11.04 Observation by Owners' Representative. If the Owners' Representative wishes to observe the inspections, tests, or approvals required by this Article 11, the Owners' Representative will do so promptly and, where practicable, at the source of supply.

11.05 No Waiver of Contractor's Responsibility. Neither the observations of the Owners' Representative in the Owners' Representative's administration of the construction contract, nor inspections, tests, or approvals by persons other than Contractor shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

Article 12. Time for Performance and Liquidated Damages.

12.01 Time is of the Essence. All time limits stated in the Contract Documents are of the essence of the Contract.

12.02 Commencement and Completion of Work. Contractor shall commence the Work on the starting date established in the Notice to Proceed (NTP) and shall complete the Work thereafter within the time limit established in the NTP. If there is no NTP, Contractor shall commence the Work on the starting date established in the Supplementary Conditions and shall complete the Work thereafter within the time limit established in the Supplementary Conditions. If there is no NTP and if the Supplementary Conditions do not establish a starting or completion date, Contractor shall commence the Work promptly after the Contract is executed by all parties and shall prosecute the Work regularly and diligently so as to complete the Work within a reasonable time thereafter.

12.03 Prosecution of Work. Contractor shall prosecute the Work diligently and expeditiously with adequate forces and shall complete it within the time specified in the Contract Documents.

12.04 Date of Final Completion. When Contractor believes that Contractor's work is completed, Contractor shall request that the Owners' Representative inspect the Work and certify its completion. The Owners' Representative will respond promptly to such a request. The date of final completion of the Work or any designated portion thereof is the date on which, after the Owners' Representative

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certifies that construction has been completed in accordance with the Contract Documents, Owners accepts the Work.

12.05 Grounds for Extension of Time. The time for completion of the Work shall be extended by change order for such reasonable time as the Owners' Representative may determine, if an extension of time is reasonably necessary due to a delay caused to Contractor by any of the following circumstances:

(a) any act or neglect of Owners or Owners' Representative, any employee of either, or any separate contractor employed by Owner;

(b) any approved change ordered in the Work;

(c) any labor disputes, fire, unusual delay in transportation, unavoidable casualties, or causes beyond Contractor's control; or

(d) any other cause which the Owners' Representative determines may justify the delay.

12.06 Extensions of Time Due to Failure to Furnish Interpretation. No extension of time shall be allowed for delay caused by the Owners' Representative's failure promptly to provide an interpretation of the Contract, except in the following circumstances:

(a) The Owners' Representative failed to provide the interpretation for over fifteen days after demand was made for such interpretation, and it would be reasonable to extend time due to such failure; or

(b) The parties have agreed upon a schedule for the provision of interpretations, the Owners' Representative failed to comply with that schedule, and it would be reasonable to extend time due to such failure.

12.07 Procedure for Requesting Extension of Time. If Contractor requests an extension of the Contract completion or Work dates for in-water Work windows or construction Work periods, Contractor shall furnish the following information:

(a) Proposed revisions to the Construction Schedule showing delays or extensions by Work item. List all Work items affected by the delay or extension.

(b) A brief explanation of the cause of the change, and justification or supporting evidence that delay or extension is necessary, and is a result of extenuating circumstances beyond the control of Contractor.

(c) For time extensions due to unusually severe weather, the following conditions must be satisfied:

(1) The weather experienced at the Site during the Contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated (greater than the 75th Percent Quantile of the days per month exceeding 0.01 and 0.1 inches of precipitation) for the Project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the Project. The delay must be beyond the control and without the fault or negligence of Contractor.

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(3) A schedule of monthly anticipated adverse weather delays will be included, based on National Oceanic and Atmospheric Administration (NOAA) and will constitute the base line for monthly weather time evaluations. Contractor's Construction Schedule must identify and reflect these anticipated adverse weather delays in all weather dependent activities.

(4) Upon acknowledgment of the NTP and continuing throughout the Contract, Contractor will record on the weekly or monthly progress reports the occurrence of adverse weather and resultant impact to normally scheduled Work. Actual adverse weather delays must prevent Work on critical activities for 50 percent or more of Contractor's scheduled work day.

(5) The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated according to paragraph above, the Owners' Representative will convert any qualifying delays to calendar days, giving full consideration for equivalent fair-weather Work days, and issue a change order for a Contract time of performance extension, pending approvals of Regulatory Agencies when necessary.

12.08 Claims for Extension of Time. All claims for extension of time shall be made in writing to the Owners' Representative.

Article 13. Use of Site.

13.01 Limit of Operations. Contractor shall confine Contractor's apparatus, the storage of materials, and the operations of Contractor's workers to limits indicated on the Construction Drawings, or by law, ordinances, permits, or directions of the Owners' Representative and shall not occupy the premises with Contractor's personnel or materials. Insofar as possible, Contractor shall arrange Contractor's work and its progress to prevent any interference with the operations of the existing facilities. All utilities must be protected, and connections made to utilities so as not to interrupt service.

13.02 Utilities. All utilities, including but not limited to, electricity, water, gas, and telephone, used on the Work shall be furnished and paid for by Contractor. Contractor shall furnish and install temporary distribution systems, including meters, if necessary, from distribution points to points on the Site where utility is necessary to carry on the Work. Upon completion of the Work, Contractor shall remove all temporary distribution systems. If this Contract is for an addition to an existing facility, Contractor may, with the written permission of Owner, use Owners existing utilities by making prearranged payments to Owners for utilities used by Contractor.

13.03 Metering Devices. For the purpose of providing utility service to the Project, Contractor may install or cause to be installed metering devices or other equipment of utility companies or of political subdivisions, title to which is commonly retained by the utility company or political subdivision. If any such metering device or equipment is installed, Contractor shall advise Owners as to the Owners of such device or equipment.

13.04 Sanitary Facilities. Contractor shall provide temporary sanitation facilities in accordance with OSHA and other applicable laws and regulations and as directed by the Owners' Representative for the use of all workers. The facilities shall be maintained in a sanitary condition at all times and shall be left at the Site until removal is directed by the Owners' Representative. Sanitation facilities shall include,

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but are not limited to: portable toilet(s), portable washing facilities with hand soap or similar cleaning agents, and garbage/refuse receptacle(s).

13.05 Cleaning up During and After Work. Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by Contractor's operations. At the completion of the Work, Contractor shall remove all of Contractor's waste materials and rubbish from and about the Project as well as all Contractor's tools, construction equipment, machinery, and surplus materials, and shall clean all glass surfaces and leave the Project "broom-clean" or its equivalent, except as otherwise specified. If Contractor fails to clean up, Owners may do so and the cost thereof shall be charged to Contractor.

Article 14. Materials.

14.01 Materials Provided by Contractor. Except as otherwise expressly stated in this Contract, Contractor shall provide and pay for all materials, labor, tools, equipment, water, lights, power, transportation, superintendence, temporary constructions of every nature, and all other services and facilities of every nature whatsoever necessary to execute and complete this Contract within the specified time.

14.02 Quality of Materials. Unless otherwise specified, all materials shall be new and both workmanship and materials shall be of good quality.

14.03 Provision and Storage of Materials. Materials shall be furnished in ample quantities and at such times as to insure uninterrupted progress of work and shall be stored properly and protected as required. Contractor shall be entirely responsible for damage or loss by weather or other causes to materials or work under this Contract.

14.04 Substitution of Materials. Whenever in the Technical Specifications, any materials, process, or article is indicated or specified by grade, patent, or proprietary name or by the name of the manufacturer, such specification shall be deemed to be used for the purpose of facilitating the description of the material, process, or article desired and shall be deemed to be followed by the words "or equal," and Contractor may, unless otherwise stated, offer any material, process, or article which shall in every respect be substantially equal to or better than that specified. The burden of proof as to equality of any material, process, or article shall rest with Contractor. Contractor shall submit any request for substitution, together with any substantiating data, within thirty-five days after the award of this Contract. These provisions authorizing submission of "or equal" justification data shall not in any way authorize an extension of time for performance of this Contract. In the event Contractor furnished material, processes, or articles that are more expensive than those specified, the difference in cost so furnished shall be borne by Contractor.

Article 15. Changes in the Work.

15.01 Change Orders. Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, including major design revisions as determined by the Owners' Representative. The Contract Sum and the time for performance of the Work shall be adjusted accordingly. All such changes in the Work shall be authorized by change order and shall be executed under the applicable conditions of the Contract Documents. The Contract Sum and the time for performance of the Work may be changed only by change order.

15.02 Change Order Log. Contractor shall maintain a Change Order Log and update the Log as necessary during construction. The Change Order Log shall be regularly submitted with weekly and monthly progress reports. The Change Order Log shall keep track of the sequential list of change proposals and

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list if the change order is Owners Initiated or Contractor Initiated, submittal date, and the status of the request (pending or approved).

15.03 Owners Initiated Changes. Owners initiated changes are changes issued by the Owner, through the Owners' Representative, that may require changes in the Work, Contract Sum, or Contract time for performance. Owners' initiated changes will be issued through the Owners' Representative to Contractor as a Request for Proposal (RFP). An RFP will contain descriptions and changes in drawings, as necessary, describing the proposed changes. RFPs shall use the following procedures:

(a) Owners' Representative will issue RFP via email to Contractor. RFP will be numbered sequentially and dated (i.e. RFP-01-15JUL10).

(b) Contractor will respond to RFP with a proposal submittal within 7 days of RFP issue date. Contractor's proposal shall include a summary of estimated quantities, unit prices, Shop Drawing and revised Construction Schedule necessary to complete the Work as described in the RFP. Unit costs shall use the costs as shown on the Bid Schedule for similar Work items.

15.04 Contractor Initiated Changes. Contractor initiated changes are changes requested by Contractor due to changes in conditions not identified or correctly represented in the Construction Drawings or Technical Specifications. Contractor initiated changes shall be requested by Contractor as first a notification and then follow up proposal from Contractor to the Owners' Representative. Contractor change requests shall use the following procedures:

(a) Contractor shall notify Owners' Representative within 48 hours of observed changes in conditions via email. Change order item shall be added to the change order log.

(b) Contractor shall develop a proposal and submit to the Owners' Representative for approval. Change proposal shall be submitted within 7 days of the original change order notification. The following items shall be included in all change proposals:

(1) Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Schedule.

(2) Include a set of drawings or Shop Drawing showing the change proposal Work elements.

(3) Include a list of unit prices or lump sum price to complete the Work. Unit prices shall use the costs as shown on the Contract Documents for similar Work items (where appropriate).

(4) Contractor will allow 7 days for review and response to change proposal from the Owners' Representative.

15.05 Signatures on Change Orders. A change order shall be in writing and shall be signed by Owners and the Owners' Representative. Except as otherwise provided herein, the change order shall also be signed by Contractor in order to be effective, indicating Contractor's consent to the changes made.

15.06 Determining Cost or Credit for Change Orders.

(a) The cost or credit to Owners resulting from a Change in the Work shall be determined in one or more of the following ways:

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(1) by mutual acceptance of a lump sum for work and materials properly itemized;

(2) by unit prices stated in the Contract Documents or subsequently agreed upon; or

(3) by cost and a mutually acceptable fixed or percentage fee.

(b) All parties to the Contract shall observe the following procedures for all change proposals and shall require all sub-contractors to follow the same procedures:

(1) Each change proposal shall carry a unique chronological identifying number to be assigned by the Owners' Representative, shall be documented in a change order log, and shall be contained in the appropriate progress report. All correspondence referring to that change order, no matter who originates the correspondence, shall refer to the same identifying number. Any change proposal without such number shall be returned to the originator without review.

(2) The items of work involved in the change proposal (Changed Work) shall be identified by specific reference to drawing and detail number and Technical Specification section if applicable.

(3) The quantities of material or other work involved will be identified along with the costs thereof. The items of Changed Work shall be arrayed in a manner which is consistent with the Construction Technical Specifications Institute (CSI) forty-eight division uniform system for classifying construction activities used for the schedule of values for each Project component.

(4) The total cost of a change proposal shall be limited to the following elements of the Cost of the Changed Work plus overhead and profit as delineated below, with the term "Cost of the Changed Work" meaning costs reasonably and necessarily incurred by Contractor in the proper performance of the Changed Work and any savings attributable to the change, at rates not higher than the construction industry standard paid in the State; it being understood that the Cost of the Changed Work shall include only the items set forth in this section:

(A) for labor:

(i) wages of construction workers directly employed by Contractor to perform the construction of the Changed Work at the Site or, with the Owners' Representative's prior written approval, at off-Site workshops;

(ii) wages or salaries of Contractor's supervisory and administrative personnel when stationed at the Site, with the Owners' Representative's prior written approval, for that time required for and directly attributable to the Changed Work;

(iii) wages and salaries of Contractor's supervisory and administrative personnel engaged at factories, workshops, or on the road, in expediting the production of or transportation of materials or equipment required for and directly attributable to the Changed Work, but only for that portion of their time required for the Changed Work; and

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(iv) costs paid or incurred by Contractor for taxes, insurance, contributions, assessments, and benefits required by law or collective bargaining agreements and, for personnel not covered by such agreements, customary benefits such as sick leave, medical and health benefits, holidays, vacations and pensions, provided such costs are based on wages and salaries included in the Cost of the Changed Work;

(B) for subcontracts: payments made by Contractor to Subcontractors in accordance with the requirements of the subcontracts;

(C) for materials and equipment incorporated in the Changed Work: costs, including taxes and transportation, of materials and equipment incorporated or to be incorporated in the Changed Work;

(D) for other materials and equipment, temporary facilities and related items:

(i) costs, including transportation, installation, maintenance, dismantling and removal of materials, supplies, temporary facilities, machinery, equipment, and hand tools not customarily owned by the construction workers which are provided by Contractor at the Site and fully consumed in the performance of the changed work; and cost less salvage value on such items not fully consumed whether sold to others or retained by Contractor; it being understood that the "cost "for items previously used by Contractor shall mean "fair market value";

(ii) rental charges for temporary facilities, machinery, equipment and hand tools not customarily owned by construction workers which are provided by Contractor at the Site whether rented from Contractor or others, and costs of transportation, installation, and dismantling and removal thereof, the rates and quantities of which shall be subject to prior written approval of the Owners' Representative; and

(iii) costs of removal of debris from the Site;

(E) for miscellaneous costs:

(i) that portion of premiums for insurance and bonds directly attributable to the Changed Work;

(ii) sales or similar use taxes imposed by a governmental authority which are directly attributable to the Changed Work and for which Contractor is liable

(iii) fees for permits, licenses and inspections directly attributable to the Changed Work for which Contractor is required to pay;

(iv) the costs of blueprints or other drawings directly associated with the Changed Work; and

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(v) other costs incurred by Contractor in the performance of the Changed Work if approved in writing in advance by the Owners' Representative;

(F) for markup, the maximum markup allowed by Owners for overhead and profit shall be as specified in the Supplementary Conditions, subject to the following:

(i) markup shall not include any of the following items of expense:
- salaries or other compensation of Contractor's personnel stationed at Contractor's principal office or offices other than the Site office;
- expenses of Contractor's principal office and offices other than the Site office; or
- other overhead and general expenses, except as may be expressly included above;
- Contractor's capital expenses, including any interest on Contractor's capital or other borrowed capital;

(ii) no change order which extends the contract time shall result in increased payments to Contractor for overhead, extended overhead, or amounts of a similar nature, except those directly generated by Owners caused delays; or

(iii) when both additions and credits covering the Changed Work are involved in any one change, the allowance for overhead and profit shall be figured on the net increase, if any, with respect to that change.

(5) Change proposals shall be accompanied by invoices or quotes from vendors. Change proposals shall be sent to the Owners' Representative in duplicate. The Owners' Representative shall maintain a data base of all proposals which can readily determine the location and status of the change request.

(6) All change proposals shall be checked by the Owners' Representative for accuracy and fairness. Quantities, material costs, and labor time will be compared to takeoffs and estimates prepared by the Owners' Representative.

(7) When the final costs are agreed upon by Owner, Contractor, and the Owners' Representative, a change order will be prepared by the Owners' Representative for signature by Owner, Contractor and Owners' Representative. The change order shall be the record document defining the costs and time extensions, if any, of the required and agreed-to change in the Work.

(8) If the methods set forth above cannot be agreed upon in a specific instance, Contractor, provided it receives a written order signed by the Owners' Representative, shall promptly proceed with the work involved. The cost of such work shall then be determined on the basis of the reasonable expenditures and savings of those performing the Changed Work, including, in the case of an increase in the Contract Sum, with an allowance for overhead and profit at the rate set in the Supplementary Conditions. In such case, Contractor shall keep and present, in such form as the Owners' Representative may prescribe, an itemized accounting, together

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with appropriate supporting data for inclusion in a change order. Costs shall be limited to those costs enumerated in subparagraphs (b)(4) above.

(9) In any case, Contractor shall keep and present, in such form as the Owners' Representative may prescribe, an itemized accounting together with appropriate supporting data. Pending final determination of cost to Owner, payments on account shall be made on the Owners' Representative's certificate for payment.

(10) The amount of credit to be allowed by Contractor to Owners for any deletion or change which results in a net decrease in cost will be the amount of the actual net decrease as confirmed by the Owners' Representative. When both additions and credits are involved in any one change, the allowance for overhead and profit shall be figured on the basis of net increase, if any.

15.07 Adjustment of Unit Prices. Estimated quantities, if any, set forth on the Form of Bid are estimates only, being given only as a basis for the comparison of bids, and the Owners do not warrant, expressly or by implication, that the actual amount of Work will correspond to the estimated quantities. The Owners reserves the right to increase or decrease the amount of any class of portion of the Work and to make changes in the Work as the Owners may deem necessary or appropriate. The basis of payment for unit price bid items for which estimated quantities were set forth on the Form of Bid shall be the actual number of unit items provided or performed under this Contract.

15.08 Concealed Conditions. If concealed conditions encountered in the performance of the Work below the surface of the ground are at variance with the conditions indicated by the Contract Documents, or if previously unknown physical conditions encountered below the surface of the ground are of an unusual nature, differing materially from those generally recognized as inherent in work of the character and in the location provided for in this Contract, then the Contract Sum shall be equitably adjusted by change order upon claim by either party made within 10 days after first observing the conditions.

15.09 Claims for Additional Costs. All claims for additional compensation or for an increase in the Contract Sum shall be made as provided in. Any change in the Contract Sum resulting from such claim shall be authorized by change order.

15.10 Minor Changes in the Work. Subject to approval by Owner, the Owners' Representative may order minor changes in the Work that fall within the agreed Scope of Work, unit prices, quantities and agreed Work elements and Construction Schedule, and do not require a change in Contract Sum or an extension of the Contract Time. Minor field changes may result in minor adjustments in alignments, material applications, field adjustments not represented or shown in the Construction Drawings or Contractor Construction Drawings. Such changes may be made by field order or by other written order. Such changes shall be binding on Owners and Contractor.

15.11 Field Orders. Subject to approval by Owner, the Owners' Representative may issue written field orders which interpret the Contract Documents or order minor changes in the Work without change in Contract Sum or Contract time. Contractor shall carry out such field orders promptly.

Article 16. Uncovering and Correction of Work.

16.01 Uncovering of Work.

(a) If any of the Work is covered contrary to the request of the Owners' Representative, it must, at the request of the Owners' Representative, be uncovered for the Owners' Representative's observation and replaced, at Contractor's expense.

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(b) The Owners' Representative may ask to see any other work that has been covered prior to its inspection by the Owners' Representative, and Contractor shall uncover such work. If such work is found to be in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate change order, be charged to Owner. If such work is found not to be in accordance with the Contract Documents, Contractor shall pay such costs unless it is found that this condition was caused by a separate contractor, and in that event Owners shall be responsible for the payment of such costs.

16.02 Correction of Work.

(a) Contractor shall promptly correct all work rejected by the Owners' Representative as defective or as failing to conform to the Contract Documents, whether observed before or after substantial completion and whether or not fabricated, installed, or completed. Contractor shall bear all cost of correcting such rejected work, including the cost of the Owners' Representative's additional services made necessary thereby.

(b) All such defective or non-conforming work shall be removed from the Site if necessary, and the work shall be corrected to comply with the Contract Documents without cost to Owner.

(c) Contractor shall bear the cost of making good all work of separate contractors destroyed or damaged by such removal or correction.

16.03 Failure to Remove Defective Work. If Contractor does not remove such defective or non-conforming work within a reasonable time fixed by written notice from the Owners' Representative, Owners may remove it and may store the materials or equipment at the expense of Contractor. If Contractor does not pay the cost of such removal and storage within ten days thereafter, Owners may upon ten additional days' written notice sell such work at auction or a private sale and shall account for the net proceeds thereof, after deducting all the costs that should have been borne by Contractor including compensation for additional Owners' Representative services. If such proceeds of sale do not cover all costs that Contractor should have borne, the difference shall be charged to Contractor and an appropriate change order shall be issued. Such change order shall not require Contractor's consent to be effective. Said amount may be deducted from any payment thereafter due to Contractor under this or any other contract with Owner. If the payments then or thereafter due Contractor are not sufficient to cover such amount, Contractor shall pay the difference to Owner.

16.04 Failure to Correct Defective Work. If Contractor fails to correct such defective or non-conforming work, Owners may correct it in accordance with the terms of this Contract.

16.05 Acceptance of Defective or Non-Conforming work. If Owners prefers to accept defective or non-conforming work, it may do so instead of requiring its removal and correction, in which case a change order will be issued to reflect an appropriate reduction in the Contract Sum, or, if the amount is determined after final payment, it shall be paid by Contractor.

16.06 Emergency Corrective Action by Owner. If, in the opinion of Owner, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to Owners or third parties or to prevent interruption of operations of Owners or third parties, Owners will attempt to give notice to Contractor. If Contractor cannot be contacted promptly or does not comply with Owners' request for correction within a reasonable time as determined by Owner, Owners may, notwithstanding the provisions of this Contract, proceed to make such correction or provide such attention and the costs of such correction or attention shall be charged against Contractor. Such action by Owners shall not relieve Contractor of any warranty obligations provided in this contract.

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Article 17. Protection of Persons and Property.

17.01 Contractor's Responsibility for Safety. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury, or loss to:

(a) all employees on the Site and all other persons who may be affected thereby;

(b) all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the Site, under the care, custody, or control of Contractor or any Subcontractor; and

(c) other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

17.02 Compliance with Safety Requirements. Contractor shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss. Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying the Owners' Representative, Owner, and users of adjacent utilities.

17.03 Trench and Pit Safety. For all trenches or pits deeper than 4 feet to be made in connection with the Work, Contractor shall submit a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches or pits. If such plan varies from the shoring system standards, the plan shall be prepared by a registered (licensed) civil or structural engineer. The plan shall be reviewed, and must receive approval as adequate to protect worker safety, by Owners or by a registered civil or structural engineer employed by Owner, in advance of excavation.

17.04 Embankment Stability. For all excavation and sloping of embankments, it shall be the responsibility of Contractor to continually monitor the work to maintain the integrity of all embankments and slopes. Contractor shall adjust operations as to maintain such excavations.

17.05 Hazardous Materials. The term "hazardous materials" includes, but is not limited to, asbestos, toxic chemicals, contaminants, and/or other pollutants. No cutting, handling, removal, or other disposition of hazardous materials shall be performed by Contractor or any Subcontractor under this Contract, except as otherwise explicitly provided in the Contract Documents. Unless otherwise so specified, all such work shall be performed by a special contractor licensed for the work under separate contract directly with Owner. If during the performance of any work, the presence of hazardous materials is discovered or suspected, Contractor shall cease work involving such materials and shall immediately notify the Owners' Representative and Owner, and arrangements shall be made for the complete, legal removal and disposition of the hazardous materials, as provided above.

17.06 Contractor's Safety Monitor. Contractor shall designate a responsible member of Contractor's organization at the Site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to Owners and the Owners' Representative.

17.07 Unsafe Loading. Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.

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17.08 Emergencies. In any emergency affecting the safety of persons or property, Contractor shall act, at Contractor's discretion, to prevent threatened damage, injury, or loss. Any additional compensation or extension of time claimed by Contractor on account of emergency work shall be determined as provided in these General Conditions for Changes in the Work.

Article 18. Progress Payments.

18.01 Periodic Progress Payments. Periodic progress payments shall be made to Contractor, at the periods specified in the Section 01 20 00 – Price and Payment Procedures (in each case, a "Payment Period").

18.02 Schedule of Values. Before Contractor submits any application for payment, Contractor shall submit to the Owners' Representative a schedule of values of the various portions of the Work, to be used to enable Owners to estimate the timing and amounts of the successive progress payments. If required by the Owners' Representative, the schedule shall include quantities aggregating the total Contract Sum, divided so as to show Contractor's anticipated payments to Subcontractors. The schedule shall be prepared in such form as may be specified in the Contract Documents or by the Owners' Representative, or as may be agreed upon by the Owners' Representative and Contractor. The schedule shall include such data as the Owners' Representative may require to substantiate its correctness. Each item in the schedule shall include its proper share of overhead and profit. This schedule, when approved by the Owners' Representative, shall be used for preparing and reviewing Contractor's applications for payment, but may also be considered as a basis for additions to or deductions from the Contract Sum via the change order process. Once the schedule of values is approved by the Owners' Representative, each Project component shall be updated monthly indicating the value of the Work completed during the month and the value of the Work completed to date.

18.03 Application for Payment. At the end of each Payment Period, Contractor shall submit to the Owners' Representative an application for payment, requesting payment for the portion of the Work completed since the prior application for payment, using a form prescribed by the Owners' Representative, and as described in the Technical Specifications, for requesting progress payments. The application shall be itemized and shall be supported by such data substantiating Contractor's right to payment as Owners or the Owners' Representative may require. Where appropriate under the scheme for mechanics or materials liens in the State, Contractor's application shall be accompanied by such interim or provisional lien waivers or similar documentation, as Owners may reasonably require.

18.04 Payment for Stored Materials and Equipment (Materials on Hand). If payments are to be made on account of materials or equipment not yet incorporated in the Project but delivered and suitably stored at the Site, or at some other location agreed upon in writing, such payments shall be conditioned upon submission by Contractor of bills of sale or such other procedures satisfactory to Owners to establish Owners' title to such materials or equipment or otherwise protect Owners' interest including applicable insurance and transportation to the Site.

18.05 Certificates for Payment. If Contractor has made application for payment as above, the Owners' Representative shall with reasonable promptness after the receipt of the application issue a certificate for payment to Owner, with a copy to Contractor, for such amount as the Owners' Representative determines to be properly due, or state in writing the reasons for withholding a certificate as provided in this Contract.

18.06 Findings to Issue Certificate. In determining to issue a certificate of payment, the Owners' Representative must make the following findings, based on the Owners' Representative's observations at the Site, the schedule of values, and the data included in the application for payment:

(a) that the Work has progressed to the point indicated;

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(b) that, to the best of the Owners' Representative's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon substantial completion, to the results of any subsequent tests required by the contract documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in the Owners' Representative's certificate); and

(c) that Contractor is entitled to payment in the amount certified.

18.07 Amount of Progress Payment. The amount of each progress payment shall equal ninety percent of the estimated value of work performed to date, less the aggregate of all previous payments. The amount of the progress payment may be further reduced by any withholdings or deductions that may be taken from the payment pursuant to the Contract Documents. For the purpose of determining the amount of any particular progress payment, the value of work completed is only an estimate; such value or estimate shall be used for no other purpose in connection with this Contract and shall not be binding on Owners or Owners' Representative for any other purpose or any other payment, and Owners and Owners' Representative shall have the right to correct any error in such value or estimate for later payments.

18.08 Payment by Owner. Within 30 days after the Owners' Representative has issued a certificate for payment, Owners shall make payment to Contractor.

18.09 Limited Effect of Issuance of Certificate or Progress Payment. By issuing a certificate for payment, the Owners' Representative shall not thereby be deemed to represent that the Owners' Representative has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that the Owners' Representative has reviewed the construction means, methods, techniques, sequences, or procedures, or that the Owners' Representative has made any examination to ascertain how or for what purpose Contractor has used the monies previously paid on account of the Contract Sum. Further, no certificate for a progress payment, nor any progress payment, nor any partial or entire use or occupancy of the Site by Owner, shall constitute an acceptance of any work not in accordance with the Contract Documents.

18.10 Contractor's Right to Stop Work for Failure to Pay. If the Owners' Representative should fail to issue any certificate for payment through no fault of Contractor, within the time period specified in the Supplementary Conditions after receipt of Contractor's application for payment, or if Owners should fail to pay Contractor within 30 days after the Owners' Representative has issued a certificate of payment, any amount certified by the Owners' Representative, then Contractor may, upon 7 additional days' written notice to Owners and Owners' Representative, stop the Work until payment of the amount owing has been received.

Article 19. Withholding Payment.

19.01 Grounds for Withholding Payment. The Owners' Representative may decline to approve an application for payment and may withhold the Owners' Representative's certificate as to all or part of the payment amount requested, to the extent reasonably necessary to protect Owners if, in the opinion of the Owners' Representative, the Owners' Representative is not able to make the findings set forth in these General Conditions for issuance of a certificate for payment. The Owners' Representative may also decline to approve payment, in whole or in part, and, based on subsequently discovered evidence or subsequent inspections, may nullify the whole or any part of any certificate for payment previously issued, to such extent as may be necessary in the Owners' Representative's opinion to protect Owner. Such withholding of the certificate or of any amounts requested by Contractor in connection with the certificate, may be based on any of the following grounds:

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(a) defective work not remedied;

(b) third party claims filed or reasonable evidence indicating probable filing of such claim;

(c) failure of Contractor to make payments properly to Subcontractors or for labor, materials, or equipment;

(d) reasonable doubt that the Work can be completed for the unpaid balance of the Contract Sum;

(e) damage to another contractor;

(f) reasonable indication that the Work will not be completed within the Contract time, or

(g) unsatisfactory prosecution of the Work by Contractor.

19.02 Application of Withheld Amounts. Owners may apply any such withheld amounts to payment of such claims or obligations, in Owners' sole discretion. In so doing, Owners shall be deemed the agent of Contractor and any payment so made by Owners shall be considered as a payment made under Contract by Owners to Contractor. Owners shall not be liable to Contractor for any such payments made in good faith. Such payments may be made without prior judicial determination of such claim or obligation. Owners will render to Contractor a proper accounting of any funds so disbursed on behalf of Contractor.

19.03 Payment when Grounds Removed. When the above grounds for withholding payment are removed by Contractor or by Owner, payment of the withheld amounts or the remaining balance thereof shall be made to Contractor.

Article 20. Completion and Final Payment.

20.01 Application for Final Payment. When the Work is complete, Contractor shall submit to the Owners' Representative the following documents:

(a) a written notice that the Work is ready for final inspection;

(b) an application for final payment;

(c) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which Owners or Owners' property might in any way be responsible, have been paid or otherwise satisfied;

(d) the consent of the sureties, if any, to final payment; and

(e) if required by Owner, other proof such as receipts, releases, and waivers of liens establishing payment or satisfaction of all obligations arising out of the Contract, to the extent and in such form as may be designated by Owner.

20.02 Bond for Outstanding Claims or Liens. If any person refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owners to indemnify Owners against any claim that might be made against Owners or any lien that might be placed against the Site or the Project on account of such person. If any such claim or lien remains unsatisfied after all payments are made, Contractor or the surety shall pay to Owners all monies that Owners may be compelled to pay in discharging such claim or lien, including all costs and reasonable attorneys' fees.

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20.03 Inspection and Final Certificate. Upon receipt of the above documents, the Owners' Representative will promptly inspect the Work. The Owners' Representative shall issue a certificate for final payment, with copies to both Owners and Contractor, in which the Owners' Representative makes the following findings:

(a) that the Work is acceptable under the Contract Documents;

(b) that the Contract has been fully performed,

(c) that to the best of the Owners' Representative's knowledge, information, and belief, and on the basis of the Owners' Representative's observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents;

(d) that all potential liens or claims for Subcontractors' services and for labor, equipment and materials used in the Work have been satisfied or adequately secured; and

(e) that the balance noted in the final certificate is due and payable.

20.04 Determination Not to Issue Certificate for Final Payment. If the Owners' Representative determines that the Owners' Representative cannot make the necessary findings to issue a final certificate, the Owners' Representative shall promptly notify Contractor in writing of the reasons for such determination. Contractor shall promptly thereafter take appropriate steps to remove the grounds for denial of the final certificate.

20.05 Time for Final Payment. The final payment will be withheld for 35 days after Owners record the notice of completion (Section 01 77 00 – Closeout Procedures). If, at any time within that 35-day period or thereafter prior to delivery of the final payment to Contractor, it appears that the decision of the Owners' Representative to issue a certificate for final payment was in error, the certificate shall be revoked until such time as the grounds for revocation are removed. Owners will give Contractor prompt notice of any such revocation and the reasons for it. If the certificate is not revoked within the 35-day waiting period, final payment shall be made to Contractor after the expiration of the period.

Article 21. Compliance with Laws.

21.01 Compliance with Laws. Contractor shall give all notices and comply with all laws, ordinances, rules, regulations, and orders of any public authority bearing on the performance of the work. If Contractor observes that any of the Contract documents are at variance therewith in any respect, he/she shall promptly notify the Owners' Representative in writing, and any necessary changes shall be adjusted by appropriate modification. If Contractor performs any work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without such notice to the Owners' Representative, he/she shall assume full responsibility therefore and shall bear all costs attributable thereto.

21.02 Rules of Governing Agencies. All work and materials shall be in full accordance with the Rules and Regulations of the State Fire Marshall, the Safety Orders of the Division of Industrial Safety, and all other applicable codes and regulations.

21.03 Compliance with Codes. All work and materials shall comply with the Uniform Building Code, the National Electric Code, the Uniform Plumbing Code, the Uniform Mechanical Code, and the Uniform Administrative Code, as adopted and amended by the local jurisdiction in which the construction project takes place.

21.04 Compliance with Clean Air and Clean Water Acts. Contractor and all subcontractors shall comply with the federal Clean Air Act (42 U.S.C.A. §§ 1857 et seq. and §§ 7401 et seq.) and with the federal

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Clean Water Act (33 U.S.C.A. §§ 1251 et seq.) and all other applicable federal air and water pollution control rules and regulations.

21.05 Provisions Required by Law. Each and every provision required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein. If through mistake or otherwise any such provision is not set forth word for word in the Contract documents, or is not correctly set forth, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion or correction.

Article 22. Performance and Payment Bonds.

22.01 Required Bonds and Amounts. Contractor shall furnish a surety bond in an amount equal to one hundred percent of the Contract sum as security for faithful performance of this Contract, and shall furnish a separate bond in an amount at least equal to one hundred percent of the Contract sum as security for the payment of all laborers, mechanics, and subcontractors and materialmen, and all persons who supply such person or persons, or subcontractors, which provisions and supplies for the carrying on on such work of this Contract. The form of these bonds shall be as set forth in these Contract documents. Upon request of Contractor, Owners will consider and accept multiple sureties on such bonds.

Article 23. Indemnification and Insurance.

23.01 Indemnification. Contractor hereby agrees to indemnify and defend Owner; the members and managers of the Owners board; each of the Owners officers, agents, and employees, and invitees; and any and all governmental officers or employees who may at any time be at the Site to inspect or review the Work (in each case, an "Indemnified Party") against, and to save each of the Indemnified Parties harmless of and from, any and all claims, demands, liabilities, expenses, and/or losses of any kind whatsoever, which any of the Indemnified Parties may incur or suffer, or to which any of the Indemnified Parties may be subjected: (a) accruing or resulting to any person or entity furnishing or supplying work, services, materials, or supplies in connection with the performance of this Contract; (b) arising to any extent out of or in any way related to Contractor's performance (or failure to perform) under this Contract; or (c) otherwise caused to any extent by the negligence, misconduct, or failure to act (where there is a duty to act) of Contractor or any Subcontractor, or by any of the employees, agents, or invitees of Contractor or any Subcontractor; including (but not limited to) claims, demands, liabilities, expenses, and/or losses related to mechanics or material person's or supplier's liens, as well as those for property damage, personal injury, death, injuries to reputation, economic loss, or emotional distress, and any and all legal expenses (such as attorneys' fees, court costs, investigation costs, and experts' fees, whether incurred at the trial, appellate, or administrative level). The foregoing obligations to indemnify shall be effective and shall extend to all such claims and losses, in their entirety, even when such claims or losses are brought about in part by the comparative passive negligence of an Indemnified Party, but shall not extend, with respect to a given Indemnified Party, to the extent caused by the sole negligence or willful misconduct of that Indemnified Party.

23.02 General Insurance Requirements. Without limiting Contractor's duty to indemnify, Contractor shall maintain in effect throughout the term of this agreement a policy or policies of insurance meeting the requirements hereinafter set forth. All such insurance shall meet the following requirements:

(a) Each policy shall be with a company authorized by law to transact insurance business in the State of Washington, and shall be written on an occurrence form.

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(b) Each policy shall provide that Owners shall be given notice in writing at least thirty days in advance of any change, cancellation or non-renewal thereof.

(c) Except with respect to workers compensation insurance, each policy shall provide an endorsement naming Owner, its officers, agents and employees, and the Owners Representative as additional insured's, and shall further provide that such insurance is primary to any other insurance maintained by Owner.

23.03 Comprehensive General Liability Insurance. Contractor shall maintain comprehensive general liability insurance, covering all of Contractor's operations with a combined single limit of not less than $5,000,000.00.

23.04 Motor Vehicle Insurance. Contractor shall maintain insurance covering all motor vehicles (including owned and non-owned) used in providing services under this Contract, with a combined single limit of not less than $1,000,000.00.

23.05 Workers Compensation Insurance. Contractor shall maintain a workers' compensation plan covering all of its employees as required by state law, either (a) through workers' compensation insurance issued by an insurance company, with coverage meeting the statutory limits and with a minimum of $100,000.00 per occurrence for employer's liability, or (b) through a plan of self-insurance certified by the State, with equivalent coverage. If Contractor elects to be self-insured, the certificate of insurance otherwise required by this agreement shall be replaced with a consent to self-insure issued by the State.

23.06 Certificate of Insurance. Prior to the execution of this agreement by Owner, Contractor shall file certificates of insurance with Owners' Contract Administrator, showing that Contractor has in effect the insurance required by this Contract. Contractor shall file a new or amended certificate promptly after any change is made in any insurance policy which would alter the information on the certificate then on file.

23.07 Acknowledgment of Workers' Compensation Requirements. As required by state law, Contractor and each subcontractor shall, before commencing work on the Project, sign and file with Owner, the following certificate:

"I am aware of the provisions of state law which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of state law, and I will comply with such provisions before commencing the performance of the work of this contract."

Article 24. Negotiation, Mediation, And Arbitration of Disputes.

24.01 Negotiation. In the event of any controversy or claim arising out of or relating to this Agreement, or the breach thereof, the parties hereto shall promptly use their best efforts to settle such controversy or claim. To this effect, the parties shall, within thirty (30) days from the date the controversy or claim arises, consult and negotiate with each other in good faith and, recognizing their mutual interests, attempt to reach a just and equitable solution satisfactory to both parties.

24.02 Mediation. If the controversy or claim cannot be settled through negotiation as provided above, then upon written notice by either party given to the other within ten (10) days after the parties determine that the controversy or claim cannot be settled through negotiation, the parties shall use their best efforts in good faith to settle the controversy or claim by mediation administered by the American Arbitration Association under its Construction Industry Mediation Rules, before resorting to arbitration, litigation, or some other dispute resolution procedure.

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24.03 Arbitration. If said controversy or claim cannot be settled through mediation, as provided in Paragraph 24.02 above, within a period of sixty (60) days from the date of submission to mediation, then upon written notice by either party given to the other within ten (10) days after the parties determine that the controversy or claim cannot be settled through mediation, the controversy or claim shall be finally settled by arbitration administered by the American Arbitration Association in accordance with the provisions of its Construction Industry Arbitration Rules, and judgment upon the award rendered by the arbitrator may be entered in any court having jurisdiction thereof.

(a) Any provisional remedy which would be available from a court of law shall be available, upon application of a party, from the arbitrator pending the arbitrator's determination of the merits of the controversy. In addition, either party may, without inconsistency with this Agreement, seek from a court any interim or provisional relief that may be necessary to protect the rights or property of that party pending the arbitrator's determination of the merits of the controversy.

(b) The award rendered by the arbitrator shall not add to, subtract from, nor otherwise modify the terms and conditions of this Agreement. The arbitrator shall act in conformity with principles of law and the award shall be supported by law and substantial evidence.

(c) Unless otherwise agreed by the parties in writing, Contractor shall continue to carry out his/her responsibilities under this Agreement and maintain the contract completion date during any negotiation, mediation, or arbitration proceedings, and Owners shall continue to make payments as otherwise provided for in this Agreement.

24.04 Consolidation or Joinder. Any mediation or arbitration undertaken pursuant to this Article shall include, by consolidation or joinder or in any other manner, all parties substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in mediation or arbitration, unless such interest or responsibility is insubstantial. Consent to mediation or arbitration involving an additional person or entity shall not constitute consent to mediation or arbitration of a dispute not described therein or with a person or entity not named or described therein. All controversies and claims which are related to or dependent upon each other shall be heard by the same mediator and by the same arbitrator.

24.05 Timely Assertion of Claims. A party who files a notice of demand for mediation or arbitration must assert in the demand all controversies and claims known to that party on which mediation or arbitration is permitted to be demanded. When a party fails to include a controversy, or claim through oversight, inadvertence, or excusable neglect, or when a controversy or claim has matured or been acquired subsequently, the arbitrator may permit amendment.

24.06 Locale and Governing Law. All mediation and arbitration proceedings conducted pursuant to this Article shall be conducted in the city of Portland, Oregon, or at such other place as may be selected by the parties by mutual written agreement. This Agreement shall be governed by the laws of the State of Oregon.

Article 25. Default and Termination of the Contract.

25.01 Owners' Right to Stop Work. If Contractor fails to correct defective work or persistently fails to supply materials or equipment in accordance with the Contract documents, Owners may order Contractor to stop the work, or any portion thereof, until the cause for such order has been eliminated.

25.02 Owners' Rights upon Contractor's Default. If Contractor fails to prosecute the work diligently or fails to perform any provision of the Contract, Owners may, after seven days' written notice to Contractor

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and without prejudice to any other remedy he may have, make good such deficiencies. In such case any appropriate change order shall be issued deducting from the payments then or thereafter due Contractor, the cost of correcting such deficiencies, including the cost of the Owners' Representative's additional services made necessary by such default. Such change order shall not require the consent of Contractor to be effective. The Owners' Representative must approve both such action and the amount charged to Contractor. If the payments then or thereafter due Contractor are not sufficient to cover such amount, Contractor shall pay the difference to Owner.

25.03 Termination by Owner.

(a) Owners may terminate the employment of Contractor under this Contract, without prejudice to any other right or remedy Owners may have, in the manner hereinafter provided, upon certification by the Owners' Representative that the following circumstances have arisen:

(1) Contractor is adjudged bankrupt, or makes a general assignment for the benefit of Contractor's creditors, or a receiver is appointed on account of his/her insolvency (except as provided in (e), below);

(2) Contractor persistently or repeatedly refuses or fails, except in cases for which an extension of time is provided, to supply enough properly skilled workers or proper materials;

(3) Contractor fails to make prompt payment to subcontractors, to suppliers of materials or equipment, or to employees;

(4) Contractor persistently disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction; or

(5) Contractor otherwise is guilty of a substantial violation of the Contract.

(b) To terminate the Contract, Owners shall first give ten days' written notice to Contractor and Contractor's surety, if any, stating Owners' intent to terminate the Contract unless within ten days the grounds for such termination have been removed, and giving reasons therefor.

(c) If within ten days the grounds for termination are not removed, Owners may immediately terminate the Contract and shall promptly serve notice of termination on Contractor and the surety. The surety shall have the right to take over and perform the Contract, provided that, within fifteen days after service upon it of said notice of termination, the surety must first give written notice to Owners that it intends to take over and perform the Contract, and within thirty days after service upon it of said notice of termination, the surety must commence performance of the Contract. If surety fails to take either of these steps in a timely manner, Owners may immediately take possession of the site and of all materials, equipment, tools, construction equipment, and machinery thereon owned by Contractor and may finish the work by whatever method Owners may deem expedient.

(d) If within ten days of Owners' notice of intent to terminate, the grounds for termination are not removed, Contractor shall not be entitled to receive any further payment until the work is finished. If, upon completion of the work by Owner, the unpaid balance of the Contract sum exceeds the costs of finishing the work (including compensation for additional Owners' Representative, managerial, and administrative services), such excess shall be paid to Contractor. If such costs exceed such unpaid balance, Contractor or his/her surety shall pay the difference to Owner. The costs incurred by Owners as herein provided shall be certified by the Owners' Representative.

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(e) Notwithstanding the foregoing, this Contract may not be terminated or modified where a trustee in bankruptcy has assumed the Contract pursuant to 11 U.S.C. Sec. 365.

25.04 Termination by Contractor.

(a) Contractor may, upon seven days' written notice to Owners and the Owners' Representative, terminate the Contract if the following circumstances arise:

(1) the work is stopped for a period of thirty days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of Contractor or a subcontractor or their agents or employees or any other person performing any of the work under a contract with Contractor; or

(2) the work is stopped for a period of thirty days by Contractor for the Owners' Representative's failure to issue a certificate for payment or for Owners' failure to make payment thereon as provided in Article 18.

(b) To terminate the Contract, Contractor must give written notice to Owners of such termination, stating the reasons therefor.

(c) Contractor may then recover from Owners payment for all work executed, for any proven loss sustained upon any materials, equipment, tools, construction equipment and machinery, for lost profits, and for all other damages suffered by Contractor on account of such default by Owners subject to set-off for any damages owed by Contractor to Owner.

Article 26. Warranties.

26.01 Warranty as to Work. Contractor shall guarantee all work performed under this Contract against defective materials or workmanship for a period of one year from the date of final acceptance by Owner, or for such longer time period as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract. Contractor shall remedy any defects appearing within that time period and pay for any damage resulting therefrom.

26.02 Repair of Defective Work. If, within the time period specified above, any of the work is found to be defective or not in accordance with the Contract documents, Contractor shall correct it promptly after receipt of a written notice from Owners to do so and shall pay for the damage resulting therefrom, unless Owners has previously given Contractor a written acceptance of such condition pursuant to the terms of this Contract. Owners shall give such notice promptly after discovery of the condition. The provisions set forth in Article 16 shall apply to the work done under this paragraph.

26.03 Liens at Time of Progress Payment. Contractor warrants and guarantees that title to all work, materials, and equipment covered by an application for payment, whether incorporated in the project or not, will pass to Owners upon the receipt of such payment by Contractor, free and clear of all liens, claims, security interests, or encumbrances.

26.04 Warranty as to Liens. No materials, supplies, or equipment for work under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in the work and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by Contractor, to Owners free from claims, liens, or charges. Contractor further agrees

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that neither he/she nor any person, firm, or corporation furnishing any materials or labor for any work covered by this Contract shall have any right to any lien upon the premises or any improvement or appurtenance thereon. Nothing contained in this article, however, shall defeat or impair the right of persons furnishing material or labor under any bond given Contractor for their protection or any rights under any law permitting such persons to look to funds due Contractor in the hands of Owner, and this provision shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing material for work when no formal contract is entered into for such material.

Article 27. Miscellaneous Provisions.

27.01 Governing Law. The Contract shall be governed by the law of the State.

27.02 No Assignment. Neither party to the Contract shall assign the Contract without the written consent of the other, nor shall Contractor assign any monies due or to become due to Contractor hereunder, without the previous written consent of Owner. Should any money due or to become due under this Contract be assigned, it shall be subject to a prior lien for services rendered or material supplied for performance of work under this Contract in favor of all persons, firms, or corporations rendering such services or supplying such materials to the extent that claims are filed pursuant to State law.

27.03 Binding on Successors and Assigns. Owners and Contractor each binds themselves, their partners, successors, heirs, assigns, and legal representatives to the other party hereto and to the partners, successors, assigns, and legal representatives of such other part in respect to all covenants, agreements, and obligations contained in the Contract Documents.

27.04 Notices. All notices and requests required or permitted to be given under this Contract shall be in writing and shall be deemed to have been given: (a) upon delivery (or refusal of delivery) to the individual addressed, or, in the case of an entity, to the contact person for that entity, whether by courier or otherwise, in either case either personally or at the address for such purposes specified in this Contract ; or (b) three calendar days after being placed in the U.S. mail, properly addressed to such individual or such contact person, with postage thereon fully prepaid. The proper address shall be that most recently specified for such purposes in writing by the proposed recipient, by a notice given in such manner.

27.05 Contractual Rights and Remedies Not Exclusive. The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies, otherwise imposed or available by law, except as otherwise specified herein.

27.06 Royalties and Patents. Contractor shall pay all royalties and license fees. Contractor shall defend all suits or claims for infringement of any patent rights and shall save Owners harmless from loss on account thereof, except that Owners shall be responsible for all such loss when a particular design, process, or the product of a particular manufacturer or manufacturers is specified, but if Contractor has reason to believe that the design, process, or product specified is an infringement of a patent, Contractor shall be responsible for such loss unless Contractor promptly gives such information to the Owners' Representative.

27.07 Prohibited Interests. No official of Owners who is authorized in such capacity and on behalf of Owners to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting or approving any construction management, inspection, construction or material supply contract or any subcontract in connection with the Project, shall become directly or indirectly interested financially in this Contract or in any part thereof. No officer, employee, designer, attorney, engineer or inspector of or for Owners who is authorized in such capacity and on behalf of Owners to exercise any executive

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supervisory or other similar functions in connection with construction of the Project shall become directly or indirectly interested financially in this Contract or in any part thereof.

27.08 No Continuing Waiver. No failure of a party to this Contract to insist upon the timely performance of any obligation by another party shall constitute a waiver of the right to require performance of that or any subsequent occurrence of the obligation, or act as a waiver of the right to require the performance of any other obligation of such party (or any other party).

27.09 Survival of Representations, Warranties, Covenants, Agreements, and Obligations. The representations, warranties, covenants, agreements, and obligations of the parties which are set out in this Contract (including, but not limited to, any indemnification obligations) shall remain in full force and effect after the expiration or termination of this Contract, with respect to all matters occurring or accruing before such expiration or termination, in each case until and unless there is a waiver or release of such representation, warranty, covenant, agreement, or obligation by the beneficiary thereof.

END OF SECTION 00 72 00

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SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

1. Notice to Proceed. See the following Sections for more information:
   a. Section 00 21 10 - Instructions to Bidders; Article 1.02 Project Dates.
   b. Section 01 11 00 – Summary of Work; Article 1.06 Notices to Proceed, Work, and Milestones.

2. Time for Completion of Project. Contractor shall commence the Project no later than five (5) business days after the execution of this Contract by all parties and shall diligently pursue the Project to Final Completion (the "Final Completion Deadline") as stated in Section 00 21 10 – Instructions to Bidders, subject to such delays as may be permitted explicitly under this Contract, it being understood that time is of the essence in the performance of each of the obligations of Contractor under this Contract.

3. Liquidated Damages. The parties acknowledge and agree that the Liberty Dairy, LLC ("Liberty") and D&A Dairy, LLC ("D&A") (hereby referred to as "Owners") will suffer financial damage if the identified project work is not complete by the above identified Project Deadline, but that the exact amount of such damage would be difficult to determine in advance, and they therefore agree that Contractor shall pay the Owners the sum of one thousand five hundred dollars ($1,500.00) for each calendar day beyond the Deadlines that the project work remains uncompleted, to the extent not excused by such permissible delay, which daily sum shall constitute fixed damages. Impacts to Owners include but are not limited to:

   a. Additional engineering support (actual costs) to support the project due to extended duration.

   b. Operational impacts and potential for weather delays. This could result in both actual costs to maintain lagoons through the wet weather season and/or pumping, covering the site with plastic, etc.

   c. Penalties incurred by the Owners as stipulated in the Administrative Order on Consent SDWA-10-2013-0080.

   d. Other non-direct costs include dairy operation impacts to the operators and possible impacts due to staging operation on the site where dairy operations would take place.

   The parties agree that the daily amount set forth above constitutes a reasonable estimate of such damage and shall constitute liquidated damages and not a penalty.

4. Delays. See General Conditions.

5. Independent Contractor. The parties to this Contract intend that an independent contractor-client relationship shall be created by this Contract. The conduct and control of the work to be done under this Contract shall lie solely within the purview of Contractor. Contractor is not to be considered an agent or employee of the Owners for any purpose, and no joint venture or Owner-agent relationship exists. Neither Contractor nor any employee(s) of Contractor shall be entitled to any of the benefits that the Owners provides for its employees. Neither the Owners nor Contractor shall have any right, power, or authority to create any obligation, expressed or implied, on behalf of the other.

6. Use of Owners Name/Logo. Contractor may not use Owners name and/or logo in any way in conjunction with the services or products called for in this Contract.

7. Taxes. Contractor agrees to be responsible for any and all filing and payment of taxes and for compliance with any and all provisions and requirements arising under any applicable federal, state, or local tax laws,

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including (but not limited to) those for any jurisdiction(s) in which Contractor is organized or authorized to do business. No federal, state, or local income tax, nor any payroll tax of any kind, shall be withheld or paid by the Owners on behalf of Contractor, or employees of Contractor. If appropriate, the Owners shall report all fees paid to Contractor to the IRS on Form 1099.

8. Certification Regarding Material Support and Resources to Terrorists.

(a) Contractor hereby certifies as follows:
   (1) Contractor does not commit, attempt to commit, advocate, facilitate, or participate in terrorist acts, nor has it committed, attempted to commit, facilitated, or participated in terrorist acts;
   (2) Contractor will take all reasonable steps to ensure that Contractor does not and will not knowingly provide, material support or resources to any individual or entity that commits, attempts to commit, advocates, facilitates, or participates in terrorist acts, or has committed, attempted to commit, facilitated, or participated in terrorist acts;
   (3) Before providing any material support or resources to an individual or entity, Contractor will consider all information about that individual or entity of which it is aware or that is available to the public; and (4) Contractor will implement reasonable monitoring and oversight procedures to safeguard against assistance being diverted to support terrorist activity.

(b) For purposes of this Certification:
   (1) "material support and resources" means currency or monetary instruments or financial securities, financial services, lodging, training, expert advice or assistance, safe houses, false documentation or identification, communications equipment, facilities, weapons, lethal substances, explosives, personnel, transportation, and other physical assets, except medicine or religious materials;
   (2) "terrorist act" means:
      (i) an act prohibited pursuant to one of the 12 United Nations Conventions and Protocols related to terrorism (see UN terrorism conventions Internet site: http://untreaty.un.org/English/Terrorism.asp); or
      (ii) an act of premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents; or
      (iii) any other act intended to cause death or serious bodily injury to a civilian, or to any other person not taking an active part in hostilities in a situation of armed conflict, when the purpose of such act, by its nature or context, is to intimidate a population, or to compel a government or an international organization to do or to abstain from doing any act; and
   (3) "entity" means a partnership, association, corporation, or other organization, group or subgroup.

(c) In the event that any material misrepresentation in this Certification is discovered during the term of this Contract, the Owners may elect to declare this Contract null and void and immediately terminate it. In the case of an intentional material misrepresentation, the Owners may, at its option, recover damages resulting from the termination.

9. Certification For Conflict Of Interest Determination. Contractor certifies that the information it has provided on the "Disclosure Form" which was completed by Contractor and delivered to the Owners as part of the Bid (the "Disclosure Form") was and remains true and correct to the best of Contractor's knowledge. In the event that any material misrepresentation by Contractor in such Disclosure Form is discovered during the term of this Contract, the Owners may elect to declare this Contract null and void and immediately terminate it. In the case of an intentional material representation, the Owners may, at its option, recover damages resulting from the termination and shall be entitled to offset any amounts payable to Contractor for work satisfactorily completed against such damages. The balance of amounts payable to Contractor for work satisfactorily completed, if any, shall be paid to Contractor.

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10. Inconsistencies. In the event that inconsistencies are discovered, they shall be resolved in the following order of precedence (e.g., 1 presiding over 2, 3, and 4; 2 presiding over 3, 4, and 5; and so forth):
    1 The signed Agreement
    2 Supplementary Conditions
    3 General Conditions
    4 Division 00 Procurement and Contracting Requirements
    5 Division 01 General Requirements
    6 Divisions 02 through 40
    7 Construction Drawings

END OF SECTION 00 73 00

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section summarizes the Work required for the consolidation of and improvements to the existing liquid manure storage lagoons for:

1. H&S Bosma Dairy Lagoon No. 6 and Consolidated Lagoon No. 10

B. This Work is required by the U.S. Environmental Protection Agency (EPA) Administrative Order on Consent (AOC) SDWA-10-2013-0080, specifically for Liberty Dairy, LLC (and its associated Dairy Facility H&S Bosma Dairy) (hereby referred to as "Owner"). The AOC is included as an attachment to the Technical Specifications. The AOC is part of this Contract, and the Contractor shall abide by its conditions and requirements.

C. The two lagoon Projects shall be completed under one Contract. Each Project shall be managed under a separate Bid Form; see Section 01 40 00 – Bid Forms and Section 01 20 00 – Price and Payment Procedures for further details.

D. Major Work elements include, but are not limited to:

1. Work to be completed by the Owner:

a) Removal of liquids and solids from the base and side slopes of the existing lagoons prior to any earthwork. The solids will be removed from the Project area.

b) Excavation of the required common earthen berm(s) and sides, bottom, and top of the existing lagoons. Excavated soils will be stockpiled on site in an area that is compacted and drains to the lagoon system.

c) Demolition, removal, and disposal or recycling of select features shown on the Construction Drawings and described in the Technical Specifications.

d) Planting of vegetation following the completion of lagoon abandonment.

2. Work to be completed by the Contractor:

a) Mobilization of equipment, materials, supplies, labor, and other Work-required elements necessary to execute the Contract. Other

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Work-required elements may include, but are not limited to: utility locates, developing pre-construction submittals and construction submittals, and securing necessary construction permits and bond(s).

b) Site preparation Work including, but not limited to: procuring and installing temporary erosion and sediment controls, conducting topographical survey control, and establishing temporary staging and stockpiling area(s) and temporary facilities, as needed.

c) Progress surveys.

d) Final grading of the lagoon subgrade. Grading may involve placement of suitable On-site Fill Material and Import Fill Material. Compaction and compaction testing is required.

e) Modification to the existing lagoon pipe(s) to maintain proper function and operation of the lagoon. Modification may include earthwork and other related Work ranging from minor changes to pipe replacement and appurtenance installation.

f) Construction of a lagoon double liner system (with a perimeter anchor trench) by qualified and certified installers in accordance with the Construction Drawings, Technical Specifications, and Construction Quality Assurance (CQA) and Construction Quality Control (CQC) requirements. In general, the liner system includes, but is not limited to, the following major elements:

1) Geotextile(s): To be installed under the secondary liner by the Contractor at the option of and under the direction of the Owner. See Section 31 05 19.13 – Geotextiles for Earthwork.

2) Under-liner Vent System: To be installed under the secondary liner by the Contractor. See Section 31 05 19.23 – Geosynthetic Clay Liners.

3) Geosynthetic Clay Liner (GCL): To be installed as the secondary liner by the Contractor. See Section 31 05 19.23 – Geosynthetic Clay Liners.

4) HDPE Geomembrane: To be installed as the primary liner on top of the secondary liner by the Contractor; seams are to be welded and tested. See Section 31 05 19.16 – Geomembranes for Earthwork.

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g) Demobilization of equipment, excess materials, supplies, labor, and other Work-required elements necessary to close out the Contract. Other Work-required elements include, but are not limited to: cleanup of Work areas, developing final submittals, and developing As-Built Drawings.

3. Work by Others:

a) Leak detection testing by Others occurs:

1) After the Contractor installs the primary geomembrane liner.

1.02 RELATED SECTIONS

A. Section 00 72 00 – General Conditions

B. Section 00 73 00 – Supplementary Conditions

C. NOT USED

D. Section 31 05 19.13– Geotextiles for Earthwork

E. Section 31 05 19.16 – Geomembranes for Earthwork

F. Section 31 05 19.23 – Geosynthetic Clay Liners

G. Section 31 05 19.26 – Geocomposites

H. Section 31 00 00 – Earthwork

I. Section 01 50 00 – Construction Facilities and Temporary Controls

1.03 CONTRACT DOCUMENTS

A. Contract Documents include, but are not limited to:

1. Technical Specifications

2. Contract(s)

3. Construction Drawings

4. Permit(s) may be required and may include:

a) Yakima County Grading Permit

5. EPA AOC SDWA-10-2013-008

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1.04 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

1.05 TECHNICAL REPRESENTATIVES

A. In accordance with Section 00 72 00 – General Conditions, Article 1, the following Representatives are designated for the Project:

1. Engineer: Owner's Technical Representative responsible for development of the Technical Specifications and Construction Drawings of the Project, interpretation of design intent during Construction, and for responding to all Requests for Information (RFIs), responding to all substitution requests, and reviewing all submittals except the Health and Safety Plan, schedule of values, and schedules, which are the responsibility of the Owner's Representative. The Engineer, who may also be referred to as "Owner's Representative" throughout these Technical Specifications, is:

   a) Anchor QEA, LLC, 1119 Pacific Avenue, Suite 1600, Tacoma, Washington 98402 (Project Manager, Josh Sexton, P.E.).

2. Owner's Representative: Owner's Technical Representative responsible for monitoring and observing the Work (including, but not limited to, quality assurance) to verify that the Contractor's Work conforms to the requirements of the Contract Documents, monitoring and documenting Work progress, measuring bid items for payment, reviewing progress payments and Change Orders, project management, review and processing of progress payments, Contract management and Contract closeout will be performed by Anchor QEA.

1.06 NOTICES TO PROCEED

A. The Contractor shall complete the Work as described by the Contract Documents within the Contract Time. See the following Sections for additional information:

1. Section 00 72 00 – General Conditions

2. Section 00 73 00 – Supplementary Conditions

B. The Owner will provide the Contractor a written Notice to Proceed (NTP) before commencement of Work. Contract Time shall start on the date established in the NTP.

1. NTP:

   a) NTP should be issued within 15 calendar days after Contract Execution.

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b) Pre-construction submittals must be developed by the Contractor and submitted to the Owner's Representative for approval prior to issuance of NTP. See Section 01 33 00 for more detail.

c) The Contractor shall not conduct physical Work at the sites prior to obtaining the NTP.

1.07 LIQUIDATED DAMAGES

A. Time is of the essence of the Contract and Liquidated Damages apply. Refer to the following Sections:

1. Section 00 72 00 – General Conditions

2. Section 00 73 00 – Supplementary Conditions

B. Accordingly, the Contractor agrees:

1. The Liquidated Damages reduction to the Contract Price for failure to meet the approved Construction Schedule (detailed in Section 01 32 00 – Construction Progress Documentation) is $1,500 per calendar day. Liquidated damages may be waived at the Owner's discretion based on a written request from the Contractor detailing the rationale for delays.

1.08 CODES AND REGULATIONS

A. Work shall meet the requirements of applicable laws, statutes, regulations, ordinances, and safety regulations of federal, state, and county jurisdictions and may be further referenced in the Contract Documents.

B. Contractor shall comply with provisions of federal, state, and local statutes, ordinances, and regulations dealing with the prevention of environmental pollution of natural resources that affect the Project.

1.09 WORK BY OWNER AND OTHERS

A. Permits:

1. The Contractor shall secure and pay for all other temporary and permanent permits, certifications, tests, inspections, connection or "hookup" charges, and other legal or usual charges or fees required by government agencies and private utilities having jurisdiction over the Work, either directly or under contract. The Contractor shall determine prior to bidding what these charges, if any, will be.

B. Owner's testing and inspection services:

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1. The Owner's contract with testing and inspection agencies and/or use in-house testing services to determine whether the Contractor is in compliance with the Contract Documents.

2. The Owner's testing and inspection agencies provide services for the Owner exclusively, except as indicated in this Section and in Section 01 43 00 – Quality Assurance and Control.

3. If the law or ordinance of any public authority requires any Work to be tested, approved, or inspected, in addition to the testing required by Section 01 43 00 – Quality Assurance and Control, the Contractor shall arrange for and pay all costs related to such testing, inspections, and/or approvals.

4. Contractor responsibilities:

   a) The Contractor is required to perform, at no additional cost to the Owner, its own quality control program (including testing, inspection, and special inspections) as necessary to verify compliance with the Contract Documents.

      1) The Contractor is prohibited from employing the same testing and inspection agency or agencies employed by the Owner.

   b) The Contractor shall pay for testing of Work that is subject to corrective action or that was otherwise untested, not observed, or showing some other problem attributable to the Contractor's performance of the Work.

   c) The Contractor shall pay for additional testing above and beyond that required by the Contract Documents to facilitate the performance of its means and methods.

C. Removal of hazardous materials and dangerous waste:

1. Hazardous materials and dangerous wastes are not anticipated to be encountered during the Work.

2. In the event that hazardous materials and/or dangerous wastes are encountered during the Work or the Contractor utilizes or generates such materials and/or wastes, the Contractor's responsibilities may include, but are not limited to:

   a) At Owner's Representative's direction, the Contractor shall collect, handle, provide for possible temporary storage, and dispose of potential hazardous materials and dangerous waste.

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b) Provide and pay for the cleanup and mitigation of spills caused by the Contractor or its subcontractors, with no additional cost to the Owner.

D. Leak detection testing by Others:

1. Leak detection testing shall be conducted by Others following the Owner-approved construction of the lagoon improvements by the Contractor.

2. The Contractor shall coordinate its Work with the Owner's Representative and Others to accomplish the overall Work of the Project.

E. Work completed by Owner:

1. The Owner will conduct initial lagoon decommissioning Work, depending on Owner operations and scheduling. Work by the Owner may include, but is not limited to:

a) Removal of liquids and solids prior to any earthwork

b) Demolition and removal of site utilities and appurtenances.

c) Removal of earthen berm(s).

d) Rough grading of lagoons.

2. The Contractor may be required to complete any, all, or none of the items listed above. In the event that these items are completed by the Contractor, the Work will be managed in accordance with the applicable additive bid items.

1.10 QUALITY ASSURANCE AND CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control.

B. The Contractor shall be responsible for CQC. The Contractor shall engage and pay for the services of qualified staff or a qualified subcontractor to perform CQC for monitoring and documenting the quality of the Work in accordance with the Contract Documents.

C. The Owner's Representative will provide CQA. The Owner's Representative will be responsible for observing and documenting periodic verification, checking, or testing for confirmation that the quality of the Work is in accordance with the Contract Documents.

D. Unless otherwise specified, the Contractor shall complete CQC inspection, sampling, testing, or any other action as considered necessary by the Contractor to

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ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, compliance of the Work with the Contract Documents shall be defined by the results of the Owner's Representative's CQA program.

E. Any Work that does not satisfy the requirements of the Contract Documents shall be made good in accordance with the requirements of the Contract Documents or as directed by the Owner's Representative, Owner, or Owner's approved representative, at the sole expense of the Contractor.

1.11 SITE CONDITIONS

A. Contractor's staging area: Area(s) will be set aside on the Project property for the Contractor's use as a staging area for workers, equipment, and materials. The Contractor shall restore the staging area to its original condition at the conclusion of Work.

B. Disposal of waste material, including all materials generated during the Work that are not to be reused as part of the Work or returned to the Owner.

1. All waste materials shall be disposed of in accordance with local, state, and federal law and regulation.

2. Materials suitable for recycling are encouraged to be recycled.

3. Burning of waste material is not allowed.

4. Burying of waste material is not allowed.

C. Fire prevention and protection:

1. The Contractor shall perform all Work in a fire-safe manner and comply with applicable local and state fire prevention regulations.

2. The Contractor shall implement adequate fire prevention measures and ensure that these measures are observed by all employees, agents, and subcontractors.

3. The Contractor shall coordinate hours of Work with fire prevention measures.

1.12 WARRANTY

A. In addition to the 1-year warranty applicable to all the Work, as specified in Section 00 72 00 – General Conditions, certain elements of the Project are to be warranted for an extended period following the completion of the initial 1-year warranty.

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B. Refer to Section 31 05 19.16 – Geomembranes for Earthwork for warranty requirements for the geomembrane primary liner.

C. See Section 01 77 00 – Closeout Procedures for documentation requirements.

1.13 PROJECT UTILITY SOURCES

A. Refer to the Construction Drawings.

1.14 CHANGES IN THE WORK

A. Refer to Section 00 72 00 – General Conditions, Article 15.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 11 00

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SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Plans and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 – General Requirements Specification Sections, apply to this Section.

1.02 PAYMENT PROCEDURES

A. Monthly Applications for Payment shall be addressed to and emailed to the Project Engineer at Anchor QEA, LLC as described in Section 00 21 10 – Instructions to Bidders. Applications for Payment shall be developed electronically, using Adobe PDF file format.

B. Monthly Applications for Payment shall clearly identify the Work performed for the given time period based on a percentage of Work completed for lump-sum Bid Items as in the approved Schedule of Values and Progress Payment Quantities for unit price Bid Items.

C. Draft monthly Applications for Payment shall be submitted for review on or before the 5th of each month. Finalized Applications for Payment (including all backup information, signed cover letter) shall be submitted on or before the 10th of each month to be eligible for payment before the 15th of the month.

D. Finalized Applications for Payment submitted after the 10th of each month will be paid on the 15th of the following month.

E. Forward pricing on Work included in a monthly pay estimate shall not be considered for payment.

1.03 PAYMENT PRICING

A. Payment items for the Work of this contract for which contract unit price and lump sum payments will be made are listed in the Bid Form (Section 01 41 00 – Bid Forms) and described in the following Subsections.

B. All costs for items of Work, which are not specifically mentioned to be included in a particular lump-sum or unit price payment item, shall be included in the unit most closely associated with the Work involved.

C. Unit price and lump-sum price and payment made for each item listed shall constitute full compensation for furnishing all labor, materials, supplies, and equipment and performing associated Contractor quality control, environmental

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protection, meeting safety requirements, tests and reports, and performing all Work required to provide a complete installation for which separate payment is not otherwise provided.

D. Payment for Work under one item will not be paid for under any other item.

E. The Owner reserves the right to make changes should unforeseen conditions necessitate such changes. Where Work is on a unit price basis, the actual quantities occasioned by such changes shall govern the compensation.

1.04 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

B. Temporary Erosion and Sediment Control (TESC)

C. Washington State Department of Ecology (Ecology)

1.05 MEASUREMENT AND PAYMENT

A. Base Bid Items: Measurement for Base Bid Items will be at the lump sum or unit price as indicated in the Bid Form for the items listed below. Payment shall be considered full compensation for furnishing all labor, materials, and equipment to complete the work specified.

1. Bid Item Number 1.0: Mobilization and Demobilization.

a) Measurement shall be lump sum and include the following components:

1) Contractor work plans and submittals: Contractor Health and Safety Plan and Construction Work Plan.

2) Weekly and monthly project management reports: The weekly reports shall include, but not be limited to, progress reports, copies of inspections and approvals, construction survey reports, environmental monitoring reports, and health and safety incident reports.

3) Health and Safety Program: The Site Health and Safety Program shall include the costs for preparing the programs, submitting the programs for review, and revising the programs until they are accepted by the Owner's Representative.

4) As-built plans for each lagoon: Item includes copies of hand-written redlines on master plans, as well as survey

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files reflecting design and construction changes. A total of three 11-inch by 17-inch (half-size) copies and three 22-inch by 34-inch (full-size) copies, one electronic (PDF) copy, and all CAD drawing files shall be provided.

5) Mobilization and demobilization: 40% after the completion of mobilization to the site; 40% after the completion of demobilization to the site; and 20% after completion of all work on the Project has been completed, including cleanup, submittal of final As-Built Drawings, and Final Acceptance of the Project by the Owner.

b) Payment: Contractor will be paid per lump sum for the completion of Mobilization and Demobilization activities listed in the Bid Item.

2. Bid Item Number 2.0: Site Preparation.

a) Measurement: Perform all work, including labor, materials, equipment, sanitation facilities, utility connections, and construction operations as necessary for site preparation and providing construction facilities, as discussed in Section 01 50 00 – Temporary Facilities and Controls. Miscellaneous items not identified in the Bid Sheet shall be included with the closest item matching the work.

b) Payment: Lump-sum payment for the completion of site preparation and construction facilities (lump sum) based on percent complete on overall progress of site preparation and construction facilities, with reference to costs presented in the Schedule of Values.

3. Bid Item Number 3.0: Construction Surveys.

a) Measurement: Survey construction elements for measurement and payment and as-built purposes as necessary to complete and validate the work. Construction surveys are limited to progress surveys, that include, but may not be limited to: finish grade of the lagoon interior, installing lagoon piping and appurtenances, locating repairs of the geosynthetics, and locating the anchor trench. As-builts may be developed using progress surveys, provided all necessary information is included.

b) Payment: Payment for surveys will be in a lump sum based on percent complete on accomplishing surveys for the preceding referenced stages of construction and overall progress of construction.

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4. Bid Item Number 4.0 (Schedule A and B): Construction Quality Control.

   a) Construction Quality Control shall be measured by lump sum.

   b) Payment: Payment for Construction Quality Control will be in a lump sum. The contract lump sum price for Construction Quality Control shall include all costs for quality control inspections, testing, and reporting to be conducted by the Contractor as described in Section 01 43 00 – Quality Assurance and Control.

5. Bid Item Number 5.0: Grading and Testing.

   a) Measurement: Measurement of final grading and testing is in volume (cubic yards), as measured by comparisons of the pre-construction survey and progress surveys after finish grading. No allowance will be made for over-excavation or for the removal of any material outside the required lines unless authorized by the Engineer and/or Owner's Representative.

   b) Payment: Payment for final grading is based on volume cubic yards (cubic yards). Payment includes all materials, labor, and equipment to complete grading, excavations, placement of on-site fill material, compaction, testing, coordinated and scheduled hauling, regrading, and support work to complete the Work. No payment shall be made for construction, maintenance, or obliteration of temporary access and haul roads.

   c) Final grading and related earthwork for anchor trench construction is not included under Bid Item Number 5.0; see Bid Item Number 9.0.

   d) NOT USED

   e) Overexcavation, backfill, compaction, and testing is not covered under Bid Item Number 5.0; see Alternative Bid Item Number 01.

6. Bid Item Number 6.0: Procure and Install Geocomposite Venting System.

   a) Measurement: Measurement for the geocomposite venting system shall be lump sum.

   b) Payment: Payment for procuring, fabricating, and installing the geocomposite venting system shall be lump sum. Payment includes all materials, labor, and equipment to complete the installation in accordance with the Contract Drawings, Specifications, and Construction Quality Assurance (CQA) and Construction Quality

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Control (CQC) requirements. The geocomposite venting system includes, but is not limited to, the procurement and installation of:

1) Geocomposite strips as shown on the Construction Drawings and as described in the Specifications.

2) Geomembrane cover strips as shown on the Construction Drawings and as described in the Specifications.

3) Vent piping along the top of the lagoon near the anchor trench as shown on the Construction Drawings and as described in the Specifications.

7. Bid Item Number 7.0: Procure and Install Secondary Geosynthetic Clay Liner (GCL).

a) Measurement: Measurement for procuring and installing the secondary GCL shall be by the square yard and installed based on a single footprint with limits from the outer vertical face of the anchor trench towards the center of the lagoon. Measurement shall not include material overlap.

b) Payment: Payment for procuring and installing the secondary GCL shall be by the square yard contract price and shall constitute full compensation for equipment, labor, materials, testing, and reporting required to furnish, install, repair, and maintain the GCL in accordance with the Construction Drawings, the CQA and CQC requirements, and Specifications.

c) This Bid Item shall not be considered for full payment until all Quality Control, Quality Assurance, and successful leak detection surveys are completed and are received and verified by the Owner's Representative. The Owner may retain 20% of this Bid Item until all requirements are fulfilled.

8. Bid Item Number 8.0: Procure, Install, and Test HDPE Geomembrane Primary Liner.

a) Measurement: Measurement for procuring, installing, and testing the HDPE geomembrane primary liner shall be by the square yard installed based on a single footprint with limits from the outer vertical face of the anchor trench towards the center of the lagoon. Measurement shall not include material overlap.

b) Payment: Payment for procuring, installing, and testing the HDPE geomembrane primary liner by the square yard contract price shall constitute full compensation for equipment, labor, materials,

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testing, and reporting required to furnish, install, repair, test, and maintain the liner in accordance with the Construction Drawings, the CQA and CQC requirements, and Specifications.

c) This Bid Item shall not be considered for full payment until all Quality Control, Quality Assurance, and successful leak detection surveys are completed and are received and verified by the Owner's Representative. Owner may retain 20% of this Bid Item until all requirements are fulfilled.

d) HDPE rub strip procurement and installation are not covered under Bid Item Number 8.0; see Bid Item Number 10.0.

9. Bid Item Number 9.0 (Schedule A and B): Anchor Trench Construction.

a) Anchor trench construction includes earthwork and CQA and CQC compliance.

b) Measurement: Measurement for anchor trench construction shall be by linear foot of anchor trench constructed along the center line of the anchor trench.

c) Payment: Payment for anchor trench construction by the linear foot contract price and shall constitute full compensation for all materials, labor, and equipment to complete the anchor trench. Work includes, but is not limited to:

1) Grading, trenching, excavations, placement of on-site fill material, compaction, and compaction testing, coordinated and scheduled hauling, regrading, and other earthwork.

d) This Bid Item shall not be considered for full payment until all Quality Control, Quality Assurance, and successful leak detection surveys are completed and are received and verified by the Owner's Representative. Owner may retain 20% of this Bid Item until all requirements are fulfilled.

e) The secondary GCL and the HDPE geomembrane primary liner procurement and installation within the anchor trench are not covered under Bid Item Number 9.0; see Bid Item Numbers 7.0 and 8.0, respectively.

10. Bid Item Number 10.0 (Schedule A and B): Procure and Install HDPE Rub Sheets.

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a) Measurement: Measurement for procuring and installing HDPE rub sheets shall be by the square yard installed, based on individual rub sheet footprint area.

b) Payment: Payment for procuring and installing HDPE rub sheets by the square yard shall constitute full compensation for equipment, labor, materials, testing, and reporting required to furnish, locate, install, repair, test, document, and maintain the rub sheets in accordance with the Construction Drawings, the CQA and CQC requirements, and Specifications.

11. Bid Item Number 11.0 (Schedule A and B): Install and Seal Pipe Penetration(s) to Liner System.

a) Measurement: Measurement for sealing (and larger) pipe penetration(s) to the liner system shall be per each pipe installed and sealed. Refer to Contract Drawings for information on size (diameter and length) and number of pipes that require sealing per lagoon.

b) Payment: Payment for sealing pipe penetration(s) to the liner system shall will be in a lump sum constituting full compensation for equipment, labor, materials, testing, and reporting required to:

1) Furnish full pipe length(s), geosynthetics, hardware, gaskets, and flexible coupling(s) where required and of the types, sizes, and materials as shown on the Contract Drawings and as described in the Specifications.

2) Expose existing pipes, excavate, trench, deploy trench safety systems, remove existing pipe to the length necessary, stockpile soils, grade, bed new piping, pipe backfill, compaction, and compaction testing.

3) Locate, install, test, document, and maintain the sealed pipe penetrations in accordance with the Construction Drawings, the CQA and CQC requirements, and Specifications.

c) Procuring and installing valve(s) is not included in Bid Item Number 11.0; see Bid Item Number 12.0.

12. Bid Item Number 12.0 (Schedule A and B): Procure and Install Gate Valves.

a) Measurement: Measurement for procuring and installing gate valves shall be per each valve installed.

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b) Payment: Payment for procuring and installing gate valves will be in a lump sum constituting full compensation for equipment, labor, materials, testing, and reporting required to:

1) Furnish gate valve as described and as shown in the Contract Drawings.

2) Locate and install gave valve, complete with accessory pipe (not pipe connected to the liner) and valve control structure to piping described in Bid Item Number 11.0 and in accordance with the Construction Drawings, the CQA and CQC requirements, and Specifications.

c) Procure and install piping for sealing pipe penetrations to the liner system is not included in this Bid Item Number 12.0; see Bid Item Number 11.0.

B. Additive Bid Item Number 1.0: Measurement for Additive Bid Item will be at the lump sum or unit price as indicated in the Bid Form for the items listed below. Payment shall be considered full compensation for furnishing all labor, materials, and equipment to complete the work specified.

1. Additive Bid Item Number 1.0: Extra Excavation, Fill, and Compaction.

a) This Additive Bid Item shall cover:

1) Overexcavation, fill, compaction, and testing

2) Additional earthwork that the Owner would otherwise complete, including, but not limited to, the removal of the earthen berms (and accessory features), removal of lagoon solids, rough grading of the lagoon interior, and embankment grading along the exterior of the lagoon.

b) Measurement: Measurement of extra excavation, fill, and compaction is by volume cubic yards, as measured by comparisons of the pre-construction survey to the final grading plan and/or progress surveys, as applicable. No allowance will be made for over-excavation or for the removal of any material outside the required lines unless authorized by the Engineer and/or Owner's Representative.

c) Payment: Payment for extra excavation, fill, and compaction is by volume cubic yards. Payment includes all materials, labor, and equipment to complete grading, excavations, placement of on-site fill material, compaction, testing, coordinated and scheduled hauling, disposal, regrading, and support work to complete the

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work. No payment shall be made for construction, maintenance, or obliteration of temporary access and haul roads.

2. Additive Bid Item Number 2.0: Furnish and Install Geotextile.

a) This additive bid item shall cover work by the Contractor to furnish and install geotextile at the direction of the Owner; applications may include, but are not limited to:

1) As a cushion on top of the final grade and under the geocomposite vent system and secondary GCL to provide an added layer of protection.

b) Measurement: Measurement for furnishing and installing the geotextile shall be by the square yard installed, based on footprint area(s). Measurement shall not include material overlap.

c) Payment: Payment for furnishing and installing the geotextile shall be by the square yard contract price and shall constitute full compensation for equipment, labor, materials, testing, and reporting required to furnish, install, repair, and maintain the geotextile in accordance with the Construction Drawings, the CQA and CQC requirements, and Specifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 20 00

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SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. The Work described in this Section includes the requirements for the Pre-construction Meeting, Progress Meetings, and coordination throughout the duration of the project.

B. The Contractor shall attend all required meetings and provide required preparatory and follow-up materials.

C. No separate payment will be made for effort associated with Work described in this Section. Work required to comply with this Section is inclusive to all other activities described in the Contract Documents.

D. This Work is included as part of, but not limited to:

1. Bid Item Number 1: Mobilization and Demobilization.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. The provisions and intent of the Contract, including the Procurement and Contracting Requirements and General Requirements, apply to this Work as if specified in this Section. Work related to this Section is described throughout the Technical Specifications.

1.03 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

B. Construction Quality Assurance (CQA)

C. Construction Quality Control (CQC)

D. Washington State Department of Ecology (Ecology)

E. U.S. Environmental Protection Agency (EPA)

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittal Procedures for further information.

B. Key Project Personnel List as described, herein.

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1.05 PROJECT MANAGEMENT PROCEDURES

A. Key project personnel list:

1. Include, as part of the Contractor's Construction Work Plan submittal, a list of key personnel assignments (including names and phone numbers), including the Project Manager, Superintendent, Foreman, Liner Installers, Surveyor, CQA/CQC Officer, Health and Safety Officer, and other personnel to be in regular attendance at the site.

B. Contractor coordination:

1. Coordinate construction operations, submittals, inspections, notifications, and Project management tasks included in this and other Contract Documents to ensure efficient, orderly, and complete installation of each part of the Work per the Project requirements and within the Contract Time for completion.

2. Coordinate personnel, Subcontractors, equipment and materials deliveries, meetings, and those items included in different Contract Documents that depend on each other for proper installation, connection, and operation.

C. Project management procedures: The Contractor shall perform all administrative duties to coordinate scheduling and timing of required administrative procedures with construction activities to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.

2. Delivery and processing of submittals.

3. Installation and removal of temporary facilities and controls.

4. Progress meetings.

5. Pre-installation conferences.

6. Startup and adjustment of systems.

7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

E. Coordination with external parties through Owners' Representative: The Contractor shall coordinate with the Owners' Representative access for external

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parties who are working or are involved with the project in various capacities. These entities include the following:

1. EPA representatives.

2. Yakima County representatives.

3. Other local, state, and federal agency representatives.

4. Contractors, vendors, or suppliers contracted with the Owners or Owners' Representatives; this may include, but is not limited to:

   a) Leak detection system installation and testing personnel.

   b) CQA/CQC inspector.

1.06 PRE-CONSTRUCTION MEETING

A. Pre-Construction Meeting shall be scheduled 1 week (7 calendar days) prior to mobilization to the Site. Pre-Construction Meeting procedures are as follows:

1. Attendees: Contractor's key construction operators/personnel, Owner, Owners' Representative, Engineer, regulatory agencies (as necessary and per permits), and key Subcontractors. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance for the related Project construction feature, including the following:

   a) Designation of key personnel and their duties.

   b) Safety plan and security.

   c) Construction Plan including Construction Schedule, major installation features, phasing, critical Work sequencing, and long-lead items.

   d) Environmental protection protocols.

   e) Communications.

   f) Submittal procedures.

   g) Procedures for testing and inspecting and acceptance.

   h) Procedures for measurement and payment.

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1.07 PROGRESS MEETINGS

A. General: The Owners and/or Owners' Representative shall schedule and conduct all meetings and conferences at the site, unless otherwise indicated by the Owners' Representative.

B. Weekly Progress Meetings: Weekly Progress Meetings will be scheduled by the Owners and the Owners' Representative. In the event that the Owners and the Owners' Representative cannot be present, the Contractor shall keep them informed of Work progress and issues. General Periodic Progress Meeting procedures are as follows:

1. Attendees: The minimum attendees at the Periodic Progress Meetings shall include the Contractor and the Owners' Representative. The Contractor may request additional attendees through the Owners' Representative, whose responsibility is to coordinate the attendance of others (e.g., the Owner, Engineers, and regulatory agencies).

2. Agenda: The meeting sponsor (the Owners and the Owners' Representative) shall provide an agenda at the meeting. In general, Periodic Progress Meetings will be used to discuss minor progress and to make field-related decisions.

3. Minutes: The meeting sponsor (the Owners and the Owners' Representative) shall provide notes to the meeting attendees in electronic format from the meeting as part of that particular week's progress report.

4. Contractor Meeting materials: The Contractor shall provide the following materials: pre-construction submittals, Construction Schedule and progress updates, payment, coordination issues, and permits. The material list is not intended to be complete but rather to provide guidance regarding Contractor expectations. Additional materials may be necessary to support meetings.

1.08 TAILGATE MEETINGS

A. During the course of the work, the Contractor shall schedule daily Tailgate Meetings to occur at the start of each work shift. Multiple Tailgate Meetings shall be required if the Contractor intends to work multiple shifts within a 24-hour period.

B. Tailgate Meeting agendas shall include, at a minimum, the following:

1. Sign-in of all attendees.

2. Planned Work activities and environmental considerations for that shift.

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3. Hazards associated with these work activities, including environmental hazards (e.g., potential for hypothermia, heat exhaustion, or heatstroke).

4. Appropriate job-specific safe work procedures.

5. Required personal protective equipment.

6. Appropriate emergency procedures.

1.09 PROJECT CLOSEOUT MEETINGS

A. See Specification Section 01 77 00 – Closeout Procedures.

1.10 PROJECT COMMUNICATIONS

A. The Contractor shall provide periodic communications (Weekly/Monthly Reports and daily updates as needed, as well as other communications). The following general procedures are to be used to ensure that Project communications include the appropriate pathways and individuals:

1. Project email: Project email shall be sent to both the Owners' Representative and the Engineer.

2. Phone calls: A phone log with information on who participated in the call, when the call took place, and the topic of discussion shall be kept on record by the Contractor for Project-related communications with the Owner, the Owners' Representative, or other Project personnel.

3. Mail: All mail shall be sent directly to the Owners' Representative and administrative contact.

4. Field discussions: Notes shall be taken in a record book and kept on file by the Contractor regarding all field discussions and construction- or Project-related decisions, to be available upon request from the Owner. Field discussion notes shall be entered into the Daily Field Reports for record.

5. Meeting notes: The Contractor shall record and provide copies of meeting notes to the Owners' Representative and the Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 31 00

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SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies requirements and procedures for preparing construction schedules, schedules of values, reports, and fixed asset information.

B. No separate payment will be made for effort associated with Work described in this Section. Work required to comply with this Section is considered to be inclusive to all other activities described in the Contract Documents.

C. This Work is included as part of, but not limited to:

1. Bid Item Number 1.0: Mobilization and Demobilization

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. The provisions and intent of the Contract, including the Procurement and Contracting Requirements and General Requirements, apply to this Work as if specified in this Section. Work related to this Section is described throughout the Technical Specifications.

1.03 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

B. Baseline Schedule: Includes comments and revision from the Revised Draft Construction Schedule. Utilized as the initial schedule for monitoring and completion of work.

C. Biweekly: Every two consecutive weeks.

D. Draft Construction Schedule: Clearly indicates constraints, and Contract Time. Includes a network diagram, tabular report, and logic tie report. Includes major submittals, material, and equipment, including procurement and construction Work.

E. Revised Draft Construction Schedule: Includes all the requirements for the draft construction schedule. Incorporates Owners' Representative's comments, precedence diagrams, cash flow projections, and cost leaded schedule.

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1.04 ADMINISTRATIVE REQUIREMENTS

A. Failure to comply with the requirements of this Section will be cause for delay in review and acceptance of the Application for Payment.

B. Purpose:

1. Construction Schedule: To plan the execution of the Work in the required Contract Time and avoid conflicts with other concurrent construction. Establishes the schedule standards against which completion of the Contract is judged. Used by the Owners' Representative and the Contractor in determining the completed work for approval of the Application for Payment.

2. Schedule of Values: To provide an allocation of the Contract Price for measurement of monthly progress and payment.

3. On-site documents: To maintain a ready, available, and current set of Contract-required documents representing Work completed and Contract compliance.

4. Reports: To provide a qualitative and quantitative document for record and discussion of Work progress to date, planned progress, schedule changes, and monthly Applications for Payment.

C. Construction scheduling:

1. Site work shall not be allowed until the Approved Construction Schedule is submitted to and approved by the Owners' Representative and following Contractor receipt of Notice to Proceed (NTP) by the Owners.

   a) Refer to Section 01 11 00 – Summary of Work; Article 1.06 Notices to Proceed.

2. All scheduling is the responsibility of the Contractor. The Approved Construction Schedule, in tandem with the Unit Cost Bid and Work items shown on the Construction Schedule, shall be used as the basis of progress reporting and payments.

3. All schedules shall include the date that the schedule was prepared and shall include "DRAFT," "PROGRESS," "APPROVED," or "FINAL" in the title of the schedules, as is appropriate.

4. The following items shall be included in the development and maintenance of the Construction Schedule.

5. Contractor shall develop a draft Construction Schedule and submit for review and approval by the Owners' Representative as described, herein.

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The first DRAFT Construction Schedule shall include the following elements and be the baseline for the Project timeline and implementation plans. The Construction Schedule shall be approved and titled APPROVED Construction Schedule prior to initiating field construction Work.

6. Construction Schedule organization:

   a) The Contractor Construction Schedule shall arrange scheduled tasks by major Project feature, and the subsequent Bid Item numbers listed on the Bid sheets and unit prices section of the Technical Specifications.

   b) The schedule shall show all Bid Form Work elements augmented with subtasks performed by specific subcontractors and trades.

   c) The schedule shall include work constraint dates, permit dates, work plan submittals and reviews, inclement weather delays expected each month (based on local weather record), contingency for unanticipated inclement weather days, specific soil conditioning Work elements, and other Work elements to track production rates and construction progress.

   d) The Contractor shall identify weather-dependent activities in the Construction Schedule based on the presence of greater than 0.01 and 0.1 inches of precipitation.

   e) Contractor shall include a minimum of 5 days' contingency for weather-sensitive work shown on the schedule.

7. The Construction Schedule shall start on the NTP date and extend through the Project Completion date specified in the Contract.

8. Activity durations: The duration of construction activity shall be shown at a minimum for the Project feature level of construction. Further detail on subtask durations is at the leisure of the Contractor and not required. Project Features shall include, but are not limited to:

   a) Mobilization

   b) Site preparation and establishing construction facilities

   c) Final grade preparation

   d) NOT USED

   e) Installation of geocomposite venting system

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f) Installation of GCL secondary liner

g) Installation of HDPE geomembrane primary liner

h) Installation of HDPE pipe inlets and outlets; includes related appurtenances

i) Liner welding testing

j) Site cleanup and punch list

k) Demobilization

9. The Construction Schedule shall include procurement lead times and delivery dates for major purchase items.

10. The Construction Schedule shall include notation or color schemes identifying different party responsibilities.

11. Modifications or Changes: The Construction Schedule will show modifications or changes as additions to the Construction Schedule and note changes to existing line items or Bid items. If the Bid item is no longer applicable or is superseded, then it may have strikeout lining or other notation for reference. Revised Construction Schedules will be labeled "Revised Construction Schedule" with approval dates shown on the schedule.

12. Sequencing: Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

13. Float and contingencies: The Contractor shall document and communicate in the Weekly Progress Report when Construction Schedules are exceeded and potential delays may occur.

D. On-site documents:

1. The Contractor shall maintain at the site, in good order for ready reference by the Owners' Representative, one complete, current record copy of the Contract Drawings (including the Addenda, Change Orders, and all Construction Drawings), the Project Construction Schedule, and other approved submittals.

2. The Contractor shall generate and keep on site all documents and reports required by applicable permit conditions.

3. Contract Drawings shall be marked to record all changes made during construction. Requirements include, but are not limited to, the following:

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a) The location of all existing or new underground piping, valves and utilities, and obstructions as located during the work shall be appropriately marked on the ground until the Contractor incorporates the actual field location dimensions and coordinates into the Project's As-Built drawings.

b) Contractor markup of the Contract Drawings shall be updated on a weekly basis and before elements of the Work are covered or hidden from view.

c) After the completion of the Work or portions of the Work and before requesting final inspection, two hard copies of As-Built Drawings for each consolidated lagoon shall be given to the Engineer and Owners' Representative.

d) The Owners reserve the right to withhold monthly Applications for Payment until such time as the As-Built Drawings are brought current.

E. Surveying:

1. The Contractor shall provide a Surveyor with current licensure in Washington State to establish survey control on the Project sites for the Work, collect survey data on Project-required elements, and develop As-Built Drawings for Project-required elements. Survey data and figures are required as part of progress reporting and As-Built Drawings.

2. As part of the Construction Work Plan, develop a survey control plan; see Section 01 71 13 – Mobilization for further details.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures.

B. Pre-Construction Submittals:

1. Construction Work Plan; see Section 01 71 13 – Mobilization.

2. Draft Construction Schedule.

a) The Contractor shall develop a Draft Construction Schedule for review and comment by the Owners' Representative; this schedule shall be included as part of the Contractor's Construction Work Plan submittal, which shall be submitted and completed at least 7 calendar days prior to the anticipated date of NTP.

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b) The Contractor shall update the Draft Schedule based on comments from the Owners' Representative and submit the schedule for review and approval by the Owners' Representative.

c) The Draft Schedule shall include all elements described in Article 1.04, herein and be the baseline for the Project timeline and implementation plans.

3. Approved Construction Schedule.

a) Following Owners' Representative's approval of the Draft Schedule, the Contactor shall submit the Approved Schedule to the Owners' Representative.

b) Field construction Work may begin following submittal of the approved construction schedule and following Contractor receipt of NTP by the Owners.

4. Preliminary Schedule of Values.

a) The Contractor shall develop and submit the Preliminary Schedule of Values to the Owners' Representative at the Pre-Construction Meeting.

5. Final/Corrected Schedule of Values.

a) The Contractor shall develop and submit the Final/Corrected Schedule of Values within 7 calendar days upon receipt of reviewed Preliminary Schedule of Values.

C. Progress submittals: Unless otherwise noted, progress submittals shall begin the week of NTP and shall continue through Project closeout.

1. Revised Construction Schedule.

a) The Contractor shall review the Approved Construction Schedule and subsequent revisions to the Approved Construction Schedule at least once every 2 weeks.

b) The Contractor shall revise and submit the Revised Schedule to the Owners' Representative as part of the Application for Payment. Revisions to the schedule shall include changes that are planned or incurred.

c) Include the date that the schedule was developed in the schedule title and filename.

2. Daily Construction Report.

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a) The Contractor shall develop and submit to the Owners' Representative a Daily Construction Report that documents all activities associated with the Work that are completed each day.

b) Specific submittal requirements for the Daily Construction Report are described in the individual Specification Sections and are summarized below (note that the following may not be a full list of required items):

1) Describe the day of the week, date, weather conditions, groundwater conditions (if applicable), number and type of personnel working on Contract by trade, major equipment on site, materials delivered and materials installed, activities worked on by personnel, and progress for the day.

2) Describe difficulties encountered, unanticipated conditions observed, environmental conditions, and testing and inspections completed. Environmental conditions include erosion and sediment controls, stormwater management, spill prevention, and other permit- or Contract-required elements.

3) Construction Quality Control and Construction Quality Assurance topics including A) Weather, minimum and maximum temperatures, rainfall, and other pertinent weather occurrences; B) Daily workforce of the Contractor and subcontractors, by trades; C) Description of work started, ongoing work, and work completed by each subcontractor; D) Coordination implemented between various trades; E) Approval of substrates received from various trades; F) Nonconforming and unsatisfactory items to be corrected; and G) Remarks.

4) Include copies of: progress surveys (figures and tabular data), testing results/reports, inspection forms, and a sample of photographs that are representative of the work completed.

c) Daily Construction Reports shall be submitted before noon on the day following completion of work for the previous day.

d) The report filename shall include the date for which the report is generated; for example: "Daily Constr Report 09-08-17".

e) The report shall include the date for which the report is generated for and the date that the report is prepared.

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D. Post-Construction Submittals.

1. As-Built Drawings.

a) See Section 01 77 00 – Closeout Procedures for additional details on post-construction submittal requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Submit Draft, Revised Draft, Baseline and the Revised Schedules as required. Include schedule data files and the Subcontractor sign-off when required by this Section.

B. Submit schedules, reports, and updates by hard copy and by email.

C. Failure to comply with the requirements of this Section will be a cause for delay in the payment for the Application for Payment.

3.02 UPDATES

A. When work is behind schedule, submit a written plan for completing the work within the Contract Time.

B. Include revisions in the construction schedule logic prior to implementation, along with a written statement and rationale. Use the same form and method employed in the Baseline Schedule.

C. Submit, in accordance with Section 00 72 00 – General Conditions, requests for time extensions to the critical path resulting from changes issued by the Owners' Representative. Include a complete schedule analysis to support the time extension. The analysis is to include, but not be limited to, a schedule incorporating the work change and a narrative report explaining the impacts, effects, and costs associated with the time extension.

D. Reflect the executed change order in both time and value in the next submission of the Application for Payment, schedule of values, and schedule updates following the execution of the change order. Incorporate executed Contract Time changes and schedule revisions into the Monthly Updated Schedule and Schedule of Values for each work change executed in the change order.

END OF SECTION 01 32 00

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the administrative and procedural requirements for submittals.

B. The Contractor shall be required to provide submittals to the Engineer and Owner's Representative in advance of, and throughout, the duration of the work.

C. This Section specifies general requirements and procedures for the Contractor's submissions of all required submittals following award of the Contract (including the Construction Work Plan, other plans, product samples, and product testing data) to the Engineer and Owner's Representative for review. Additional specific requirements for submissions are specified in the individual Sections.

D. No separate payment will be made for effort associated with work described in this Section. Work required to comply with this Section is considered to be inclusive to all other activities described in the Contract Documents.

1.02 RELATED SECTIONS

A. Section 00 72 00 – General Conditions.

1.03 SUBMITTAL PROCEDURES

A. The Contractor shall make all submittals in accordance with this procedure and the requirements of the Contract Documents.

B. The Contractor shall certify all submittals for accuracy, completeness, and compliance with Contract requirements. Contractor shall indicate approval on each submittal as evidence of coordination and review.

C. Submittals provided without evidence of the Contractor's approval will not be reviewed.

D. Where construction or erection procedures require design and calculations, a Professional Engineer licensed in the State of Washington shall perform these services, affix their seal, and provide their signature.

E. The review of submittals by the Engineer and Owner's Representative will be limited to general design requirements only and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.

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F. Acceptance of submittals shall not relieve the Contractor from responsibility for the safety of their method or equipment or from responsibility for complying with the requirements of all applicable codes and of this Contract, except with respect to specifically approved variations.

G. Work done prior to submittal approval shall be at the Contractor's risk.

H. Delays, resequencing, or other impact to Work resulting from the Contractor's submission of unchecked or unreviewed, incomplete, inaccurate or erroneous, or nonconforming submittals, which will require Contractor's resubmission of a submittal review, shall not constitute a basis of claim for adjustment in Contract Price or Contract Time.

I. The Engineer and Owner's Representative reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

J. Provide a "Priority List" when submitting several submittals at one time.

K. Submittal sequencing shall coincide with the Contractor's Submittal Schedule and scheduled progression of work.

L. Contractor shall allow for review coordination with regulatory agencies as specifically called out in the Contract Documents.

M. Allow necessary time for the following:

1. Review of product and sample data.

2. Review of resubmissions as necessary.

3. Ordering of accepted materials and/or products.

N. The Contractor shall allow a minimum of 7 calendar days for Owner's Representative's review of each submittal and an additional 7 calendar days for Owner's Representative's review of resubmittals. Unless stated otherwise in the Technical Specifications, the Contractor shall be allowed 7 calendar days for revising initial submittals and providing resubmittals to the Owner's Representative. The Contract Time shall not be extended on the basis that the Contractor experienced delays due to rejection of submittals.

1.04 SUBMITTAL SCHEDULE

A. Unless otherwise noted, days in the Contract refer to calendar days.

B. Prepare a Submittal Schedule, which provides columns for the following information in tabular format:

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1. Unique submittal number, numbered sequentially.
2. Submittal description.
3. Applicable Section and/or Article.
4. Planned submittal date.
5. Actual submittal date.
6. Required submittal approval date.
7. Actual submittal return date.
8. Disposition.
9. Notes or comments.

C. Provide an electronic copy of the Submittal Schedule in Microsoft Excel format.

D. Submittal Schedule shall be submitted no less than 10 calendar days prior to the anticipated date of Notice to Proceed (NTP).

a) Refer to Section 01 11 00 – Summary of Work; Article 1.06 Notices to Proceed.

E. Submittals requiring further action or resubmittal will be added to the register and tracked by the Contractor. Resubmittals are to have the original number with an alphabetic suffix.

F. In the event of a discrepancy between the Contract Documents and the Submittal Schedule, the Contract Documents shall take precedence.

1.05 SUBMITTAL REQUIREMENTS

A. Identify each submittal and resubmittal by showing the following information:

1. Name and address of submitter and name and telephone number of the individual who may be contacted for additional information.
2. Project name and schedule (as applicable) as it appears in the Contract Documents.
3. Contractor, subcontractor, or supplier name and address.
4. Drawing sheet and detail number(s) and Technical Specifications Section number to which the submittal applies.

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5. When applicable, the name, address, and telephone number of the local manufacturer's representative.

6. Submit only pertinent catalog pages, and mark each copy of standard printed data to identify pertinent products. All options, models, or other unnecessary information shall be clearly lined/crossed out, or the pertinent information shall be highlighted. Submittals received that do not clearly show the material being submitted shall be returned to the Contractor unreviewed.

7. Address no more than one topic or related topics under a single identification number.

B. Submittal format.

1. The Contractor shall transmit and receive documents electronically and in hard copy.

2. Make all Shop Drawing prints in blue or black line on white background.

3. Print size shall be 22 inches by 34 inches, 8-1/2 inches by 11 inches, or 11 inches by 17 inches.

4. Make all Shop Drawings accurate to a scale sufficiently large to show the pertinent features of the item and its method of connection.

5. Transmit each submittal with a sequentially numbered identification.

6. Resubmittals shall have the original number with an alphabetic suffix.

7. Submittals received from sources other than the Contractor will be returned without action.

8. Record relevant information, deviations, and requests for data, including minor variations and limitations from the Contract Documents.

9. In the event of the need to "Revise and Resubmit" a submittal, resubmit the same in acceptable form/content, clearly identifying deviations from previous submittal content.

1.06 SUBMITTAL INFORMATION

A. Shop Drawings.

1. Submit for review to check for conformance with information given and the design concept expressed in the Contract Documents.

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2. Indicate special utility and electrical characteristics and utility connection requirements.

B. Product data.

1. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.

2. For manufactured products other than the brand name specified in the Contract, submit a complete catalog for the product and obtain the approval prior to ordering.

3. Indicate product utility and electrical characteristics and utility connection requirements.

C. Samples.

1. Submit samples as specified in individual Specification Sections.

2. Include identification on each sample, with Project information.

D. Manufacturer's instructions.

1. When specified in individual Specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting, and finishing before the item is delivered to Project site.

2. Identify any conflicts between manufacturers' instructions and Contract Documents.

E. Manufacturer's certificates.

1. When specified in individual Specification Sections, submit manufacturers' certificate(s) for review.

2. Indicate that the material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

3. Certificates may be based on recent or previous test results on the material or product.

F. Submit Test Reports as required in individual Specification Sections.

G. Submit all other items as specified in individual Specification Sections.

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1.07 SUBMITTAL REVIEW

A. Make all submittals far enough in advance of scheduled installation to provide time for review and approval, for possible revision and resubmittal, and for orders and delivery.

B. Only those items required by the Contract Documents will be reviewed. Information submitted by the Contractor that is not required will be returned marked "Information Only."

C. In the event a single submittal contains both required and nonrequired information, only the required information is subject to review.

D. Submittals will be checked for conformance with the design concept of the Project and compliance with the information given in the Contract Documents.

E. Review of drawings or data prepared by a Professional Engineer licensed in the State of Washington will be limited to the submittal's effect on the integrity of the completed Project.

F. Submittals will be marked to indicate the result of the review as follows:

1. "NO EXCEPTION TAKEN" – Revision of Shop Drawing or data will not be required.

2. "MAKE CORRECTION NOTED" – Contractor shall revise the Shop Drawing or data as indicated. Resubmittal is not required.

3. "REVISE AND RESUBMIT" – Contractor shall revise the Shop Drawing or data and shall resubmit the revised Shop Drawing or data for review and approval.

4. "REJECTED" – Submittal does not conform to Contract Documents. Contractor shall resubmit in a form that conforms to Contract Documents for review and approval.

G. Copies marked "NO EXCEPTION TAKEN" or "MAKE CORRECTION NOTED" authorize the Contractor to proceed with construction or fabrication covered by those Shop Drawings or data sheets with corrections, if any, incorporated.

H. No revision in any way shall be made to a submittal marked "NO EXCEPTION TAKEN" without resubmitting for review.

I. When prints of Shop Drawings have been marked "REVISE AND RESUBMIT," the Contractor shall make the necessary corrections and resubmit. Every revision shall be shown by number, date, and subject in a revision block, and in addition, each revised Shop Drawing shall have its latest revision clearly indicated by

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clouding around the revised areas. Resubmittals without these indications will be considered nonconforming.

1.08 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Variations from the Contract Documents shall be specifically and separately approved by the Engineer.

B. If working Shop Drawings show variations from the Contract requirements, describe such variations in writing and submit for approval.

1.09 PROGRESS SCHEDULES

A. Progress Schedules shall comply with Section 01 32 00 – Construction Progress Documentation.

1.10 SUBMITTALS LIST

A. Individual submittals are required in accordance with the pertinent Sections of these Technical Specifications. Other submittals may be required during the course of the project and are considered part of the normal work to be completed under the Contract.

B. This summary lists are presented for the Contractor's convenience only, but no warranty is given to its accuracy or completeness. In the event of any discrepancies with the requirements of the individual Sections, those individual Sections apply.

Table 1. Pre-Construction Submittal List

Section	Article	Submittal Title	Submittal Schedule
00 21 10	1.02	Pre-bid RFIs	June 3, 2019, by 12:00 p.m.
00 11 13 00 21 10	Multiple Multiple	Bid Submittal	June 10, 2019, by 10:00 p.m. (email)
00 43 13	N/A	Bid Security Form	Bid Submittal
00 43 36	N/A	Proposed Subcontractors Form	Bid Submittal
00 45 19	N/A	Non-Collusion Affidavit	Bid Submittal
00 52 00	N/A	Agreement Form	Bid Submittal
00 61 13.13	N/A	Performance Bond	Bid Submittal
00 61 13.16	N/A	Payment Bond	Bid Submittal
00 72 00	3.01	Insurance, bonds	Bid Submittal
01 41 00	1.01.	Bid Forms	Bid Submittal
01 33 00 01 33 00	1.03.K. 1.04.D.	Submittal Schedule	No less than 10 calendar days prior to the NTP date.

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Section	Article	Submittal Title	Submittal Schedule
01 20 00 01 31 00 01 32 00 01 32 00 01 32 00 01 33 00 01 71 13 31 00 00 31 00 00 31 23 33 31 23 33	1.05.A.1.a)3) 1.05.A. 1.05.B.1. 1.04.F.2. 1.05.B.1 1.01.C. 1.03.B. 1.05.B. 1.05.D. 1.05.B. 1.05.C.	Construction Work Plan	Within 20 calendar days after Notice of Award date (NOA)
00 72 00 01 32 00	18.02 1.05.B.4.	Preliminary Schedule of Values	At the Pre-construction Meeting
01 32 00	1.05.B.5.	Corrected Schedule of Values	Within 7 calendar days upon receipt of reviewed Preliminary Schedule of Values
01 20 00 01 35 00	1.05.A.1.a)3) 1.04.A.1.	Site Health and Safety Plan	Within 20 calendar days after NOA and prior to commencing Work at the Sites.
00 72 00 31 00 00 31 23 33	17.03 1.05.B.10. 1.05.C.	Trench and Pit Safety Plan/Shoring Plan (if needed)	As part of Construction Work Plan submittal
01 43 00	1.05.B.	Construction Quality Control (CQC) Plan	Within 5 calendar days of NTP date; prior to commencing Work.
00 72 00 01 32 00 01 32 00 01 32 00 01 71 13	8.05 1.04.C.7. 1.05.B.2. 3.01 1.03.B.3.	Draft Construction Schedule	As part of Construction Work Plan submittal
01 32 00 01 32 00	1.03.B. 1.05.B.3.	Approved/Baseline Construction Schedule	Within 7 calendar days upon receipt of reviewed Preliminary Schedule of Values

Table 2. Progress Submittal List

Section	Article	Submittal Title	Submittal Schedule
00 72 00 01 33 00 01 43 00 33 31 19	9.01 1.06.C. 1.04. 1.04.C.	Shop Drawings and Samples/Certifications	As needed; prior to fabrication.
00 72 00	14.04	Request for Substitution	As needed.
00 72 00	15.02	Change Order Log	Weekly and Monthly Progress Reports
00 72 00	15.03	Requests for Proposal (RFPs) Response	Within 7 days of RFP issue date.

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Section	Article	Submittal Title	Submittal Schedule
00 72 00	15.04	Change Proposal	Within 7 days of the original change order notification.
01 33 00	1.04.F.	Updated Submittal Schedule	As part of monthly Application for Payment; more often as necessary
00 72 00 01 31 00 01 32 00 01 32 00 01 32 00	12.07, 15.03 1.07.B.4. 1.04.C. 1.05.C.2. 3.01, 3.02	Revised Construction Schedule	As part of monthly Application for Payment; more often as necessary
01 31 00 01 32 00 01 32 00 01 43 00 31 00 00 31 23 33	1.10.A.4. 1.05.C.3. 3.01 1.05.C. 3.05.I.2. 3.05.C.2.	Daily Construction Report	Before noon (12:00 p.m.) on the day following the previous day's Work
01 32 00 26 00 00	1.05.C.3. 1.12.B.	Progress Surveys	Included in the Contractor's Daily Construction Reports
31 05 19.13	1.05.C.	Geotextile Samples and Product Data (if used)	If used: prior to shipment to Site.
31 05 19.16 31 05 19.16	1.05.D. 1.08.D.	Geomembrane Samples and Product Data	Prior to shipment to Site.
31 05 19.16	3.06.E.	Geomembrane Destructive Testing Samples	During geomembrane installation; 1 sample per 500 feet of seam length.
31 05 19.16 31 05 19.16	1.05.E. 3.04.A.	Quality Control Documentation	Prior to installation on any given day; may be included in Daily Construction Report
31 05 19.23 31 05 19.23 31 05 19.23	1.05. 2.05. 3.03.	GCL Submittals	See Section 31 05 19.23.
31 05 19.26	1.05.	Geocomposite Submittals	See Section 31 05 19.26.
33 31 19 33 31 19	1.04.B. 1.04.D.	Piping Product Data, installer qualifications, etc.	Prior to shipment to Site. Prior to installation.
31 05 19.16 31 05 19.16	1.04.O. 3.09.B.	Panel Layout Drawings	Following installation.
01 20 00	1.02.C.	Draft Applications for Payment	On or before 5th of each month.
00 72 00 01 20 00	18.03 1.02.D.	Applications for Payment	On or before the 10th of each month.
00 72 00 01 71 00	20.01 1.07.B.2.	Applications for Final Payment	Work completion.

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Table 3. Post-Construction Submittal List

Section	Article	Submittal Title	Submittal Schedule
01 77 00	1.10. Table 1	Closeout Documents Checklist	See Table, therein.
01 20 00 01 32 00 01 71 00 01 71 00 01 71 00 26 00 00	1.05.A.1.a)7) 1.05.D.1. 1.03.C. 1.07.B.7. 1.08.E. 3.03.C.	As-Built Drawings and Record Information	Prior to Project closeout and within 30 calendar days following receipt of Substantial Completion
01 71 00	1.03.E.	Warranties	As part of the Record Information.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 33 00

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SECTION 01 35 00
HEALTH AND SAFETY

PART 1 GENERAL

1.01 SUMMARY

A. The Work includes the requirements for health and safety provisions necessary for all work at the Work sites for this project: H&S Bosma Dairy, LLC. The work also includes compliance with all laws, regulations, and ordinances with respect to safety, noise, dust, fire and police action, civil disobedience, security, emergency response, or traffic.

B. It is the Contractor's responsibility to ensure that all workers are qualified, competent, and certified to perform the work.

C. No separate payment will be made for effort associated with work described in this Section. Work required to comply with this Section is considered to be inclusive to all other activities described in the Contract Documents.

D. Construction of this project is being performed on, within, and adjacent to active dairy operations involving the storage of liquid and solid dairy cattle manure.

1. It is the responsibility solely of the Contractor to independently verify all hazards associated with working in proximity to and with cattle manure and to provide its employees with necessary training, engineering controls, work practices and personal protective equipment related to same.

2. As manure waste decomposes, it may generate gases that normally consist of carbon dioxide (CO_2), methane (CH_4), occasionally hydrogen sulfide (H_2S), and other gases, dependent on the composition of the stored liquid and solid manure.

3. Hazardous conditions due to gases include, but are not limited to, fires, explosions, oxygen deficiency, and toxic environments.

4. Gases have the potential to create hazardous conditions if not controlled or recognized. Some of the hazards include:

5. Fires and explosions that may occur in the presence of methane gas.

6. Gases that may have toxic effects or create an oxygen deficiency in trenches, vaults, conduits, and structures.

7. Hydrogen sulfide, a highly toxic and flammable gas that may be present.

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E. Other hazards at the site include, but are not limited to, working near heavy equipment, slips/trips/falls, working near pesticide and/or fertilizer applications, extreme weather conditions, noise, and biological hazards.

F. This Work is included as part of, but not limited to:

1. Bid Item Number 1.0: Mobilization and Demobilization.

1.02 RELATED SECTIONS

A. Specification Section 00 72 00 – General Conditions.

1.03 REFERENCES

A. Comply with the requirements of the following standards referenced in this Section:

1. Federal Water Pollution Control Act (FWPCA).

2. Hazardous Waste Operations and Emergency Response (HAZWOPER) – 29 CFR 1910.120.

3. National Institute for Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard (USCG)/U.S. Environmental Protection Agency (EPA): OSHA Guidance Publication 85-115: Manual for Hazardous Waste Site Activities, October 1985.

4. Puget Sound Clean Air Agency (PSCAA) Regulations.

5. Revised Code of Washington (RCW):

a) 49.17 – Washington Industrial Safety and Health Act. b. 70.105 - Hazardous Waste Disposal Act.

b) 70.105 - Hazardous Waste Disposal Act.

c) 70.105D - Hazardous Waste Cleanup-Model Toxic Control Act.

6. Washington Administrative Code (WAC).

a) Chapter 173-303: Dangerous Waste Regulations.

b) Chapter 173-351: Criteria for Municipal Solid Waste Landfills.

c) Chapter 296-24: Safety Standards for General Safety and Health.

d) Chapter 296-62: General Occupational Health Standards.

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e) Chapter 296-155: Safety Standards for Construction Work.

f) Chapter 296-842: Respirators.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures:

1. Site Health and Safety Plan.

a) Submit a Site Health and Safety Plan in accordance with Article 3.02 prior to commencing work at the site or within 10 days following the Notice to Proceed, whichever comes first.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall comply with health and safety rules, regulations, and ordinances promulgated by local, state, and federal governments, the various construction permits, and other Sections of the Contract Documents.

B. In addition to complying with health and safety rules, regulations, and ordinances promulgated by the local, state, and federal governments, the various construction permits, and other Sections of the Contract Documents, the Contractor shall inform its employees and subcontractors and their employees of the hazards and attendant mitigating measures associated with working on and near dairy lagoons/operations.

C. The Contractor shall perform whatever work is necessary for safety and be solely and completely responsible for conditions of the site within the Construction Limits, including safety of all persons (including employees of the Owner, Design Engineers, the Owner's Representative, any site visitors, and the Contractor) and property during the Contract period. This requirement applies continuously and is not limited to normal working hours.

D. The Design Engineer's review of the Contractor's performance does not include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

E. The Contractor shall provide for the protection of employees and all others from fire, explosion, or asphyxiation caused by any gases encountered during construction and other hazards that are present or may be present at the existing lagoons.

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F. The Contractor shall provide at all times proper facilities for safe access to the work by authorized government officials and all others.

G. Accidents causing death, injures, or damage must be reported immediately to the Owner's Representative by telephone or messenger.

H. The Contractor must promptly report in writing to the Owner's Representative all accidents, near misses or stop work events whatsoever arising out of or in connection with the performance of the work, whether on or adjacent to the site, giving full details and witness statements.

I. If a claim is made by anyone against the Contractor or any subcontractor related to any accident, the Contractor shall promptly report the facts in writing within 24 hours after occurrence to the Owner's Representative, giving full details of the claim.

3.02 SITE HEALTH AND SAFETY PLAN

A. Develop, implement, and maintain for the duration of this Contract a Site Health and Safety Plan prepared under the supervision of and signed by a Certified Industrial Hygienist or Certified Safety Professional that will effectively incorporate and implement all required county, state, and federal safety provisions.

1. The Site Health and Safety Plan shall be consistent with all applicable local, state, and federal health standards and guidelines, including, but not limited to, OSHA, the Washington Industrial Safety and Health Act (WISHA), NIOSH, the American Conference of Governmental Industrial Hygienists (ACGIH), and EPA. Where these are in conflict, the more stringent requirements shall be followed.

2. The plan shall be sufficient to protect personnel from the potential physical, chemical, and/or biological hazards particular to the site.

3. The Contractor shall provide a written Site Health and Safety Plan for the construction prior to commencing work at the site or within 10 days after receiving a Notice to Proceed, whichever comes first.

4. At least one copy of the written Site Health and Safety Plan shall be maintained at the work site.

5. The Contractor shall assign an individual to serve as a Site Health and Safety Officer at the site at all times during work that is responsible and authorized to supervise and enforce compliance with the Site Health and Safety Plan in accordance with this section.

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B. Preparation of the written Site Health and Safety Plan is the Contractor's responsibility, and no statement made in these provisions relieves the Contractor of responsibility for the information included and the implementation of the Site Health and Safety Plan.

C. The Contractor's written Site Health and Safety Plan shall include, but not be limited to:

1. A list of names of key personnel and alternates responsible for site health and safety, including the Site Health and Safety Officer.

2. A list of chemical and physical hazards, allowable OSHA exposure levels, threshold limit values, other regulatory exposure levels, and the emergency response should an exposure or injury occur.

3. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.

4. Personal protective equipment to be used by employees for each of the site tasks and operations and criteria for upgrading level of worker protection from Level D to Levels C and B.

5. A list of safety and monitoring equipment at the site and locations where equipment is stored or maintained.

6. An emergency evacuation plan for immediate removal to a hospital or a doctor's care any person who may be injured on the site, including routes to medical treatment and emergency telephone numbers including hospital, ambulance, fire, sheriff/police, poison control, the Engineer, and others as deemed necessary.

7. Employee training assignments.

8. Medical surveillance requirements.

9. Decontamination procedures.

10. Confined space entry procedures.

11. A spill containment program for handling contaminated liquids.

12. Copies of individual 40-hour HAZWOPER and 8-hour annual HAZWOPER refresher certificates for every employee that is to work in contact with waste material, if applicable.

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13. Documentation of participation in ongoing respiratory protection program, as per Part E of WAC 296-842, including results of fit-testing conducted within the past 6 months.

14. Any and all other components that may be required by regulation.

D. The Contractor shall inform all workers and the public visiting the site of the potential for the presence of methane and other gases emanating from the natural decomposition of waste buried at or near the site, any other hazards, and the importance of safety precautions to ensure the safety of workers and the public.

E. Failure on the part of the Contractor to follow the Site Health and Safety Plan or to continue any work in an unsafe manner may result in suspension of the work by the Owner. The Contractor shall not be entitled to extra compensation for health- and safety-related suspensions, nor shall the Contract Time be extended.

3.03 CONTRACTOR SAFETY EQUIPMENT

A. Contractor shall maintain at the site safety equipment applicable to the Work as prescribed by the governing safety authorities in quantities that are adequate for the construction workers, as well as the Owner's Representative's team, and all articles necessary for giving first aid to the injured.

B. Contractor shall train all personnel in use of the appropriate safety equipment that would be utilized during the course of the work. It is the responsibility of the Site Health and Safety Officer, or person(s) in authority, to ascertain that all safety equipment is being used when appropriate.

3.04 SITE HEALTH AND SAFETY OFFICER

A. The Contractor shall provide a person designated as the Site Health and Safety Officer who is thoroughly trained in rescue procedures, the use of safety equipment and gas detectors, and the potential hazards that may be present at dairy lagoons. The person must be present at all times while work is being performed and implement the written Site Health and Safety Plan and conduct testing.

B. The Contractor shall provide the resume and qualification of the Site Health and Safety Officer for Owner's review prior to assignment.

C. The Contractor's Site Health and Safety Officer shall be delegated the authority to require any person or worker on the lagoon site to follow the safety rules. Failure to observe these rules is sufficient cause for removal of the person or worker(s) from the project.

D. The Site Health and Safety Officer shall have taken a course satisfying the training requirements of 29 CFR 1910.120 for Hazardous Waste Site Operations

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for supervisory personnel. A copy of the Site Health and Safety Officer's 40-hour and 8-hour Supervisory OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Certificates shall be included in the Contractor's Health and Safety Plan.

E. The Site Health and Safety Officer is responsible for determining the extent to which any safety equipment must be utilized, depending on conditions encountered at the site.

END OF SECTION 01 35 00

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SECTION 01 41 00
BID FORMS

PART 1 SUMMARY

1.01 BID FORMS

A. Bids are to be submitted before the deadline date and time as described in Section 00 21 10 – Instructions to Bidders, we offer to furnish all necessary labor, tools, materials, appliances, and equipment for and perform all Work mentioned in the Notice Inviting Bids in full compliance with Construction Drawings and Technical Specifications at the time and materials not to exceed the amounts listed below.

B. We certify that we have examined the site and that the Bid is complete. By signing the Bid, we certify that the Contractor will not submit a claim based on failure to examine the site thoroughly. The basis for determination of the most responsive bid shall be the Total Amount Bid that includes the base bid items and additive bid items for both Schedules.

C. Bidders shall, in addition to filling out the Bid Forms below, fill out the Bid Form in Microsoft® Excel® worksheet format, that is included in the Bidder Solicitation email. Both formats shall be included in the Bid Submittal; the Bid Form below shall be included in PDF format; the worksheet Bid Form shall be in Excel® format.

D. Bid Item 5.0 assumes 80% of Earthwork is completed by the Owners.

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Schedule 1 – H&S Bosma Dairy Lagoon No. 6					
Item Number	Item Description	Bid Quantity	Unit	Unit Price (In Figures)	Item Total (In Figures)
Schedule 1 – Base Bid Items (Bid Price Mandatory)					
1.0	Mobilization and Demobilization	1	LS	$	$
2.0	Site Preparation and Construction Facilities	1	LS	$	$
3.0	Construction Surveys	1	LS	$	$
4.0	Construction Quality Control	1	LS	$	$
5.0	Grading and Testing	1,809	CY	$	$
6.0	Procure and Install Geocomposite Venting System	1	LS	$	$
7.0	Procure and Install Secondary Geosynthetic Clay Liner (GCL)	7,263	SY	$	$
8.0	Procure, Install, and Test HDPE Geomembrane Primary Liner	7,263	SY	$	$
9.0	Anchor Trench Construction	958	LF	$	$
10.0	Procure and Install HDPE Rub Sheets	750	SY	$	$
11.0	Install and Seal Pipe Penetration(s) to Liner System	1	LS	$	$
12.0	Procure and Install Gate Valve(s)	1	LS	$	$
Line 1: Schedule 1 – Base Bid Subtotal Amount				$	
Schedule 1 – Additive Bid Items (Bid Price Mandatory)					
1-1.0	Extra Excavation, Fill and Compaction	250	CY	$	$
Line 2: Schedule 1 – Additive Bid Subtotal Amount				$	
Line 3: Schedule 1 – Subtotal Amount (Line 1 Plus Line 2)				$	

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Schedule 2 – H&S Bosma Dairy Consolidated Lagoon No. 10					
Item Number	Item Description	Bid Quantity	Unit	Unit Price (In Figures)	Item Total (In Figures)
Schedule 2 – Base Bid Items (Bid Price Mandatory)					
1.0	Mobilization and Demobilization	1	LS	$	$
2.0	Site Preparation and Construction Facilities	1	LS	$	$
3.0	Construction Surveys	1	LS	$	$
4.0	Construction Quality Control	1	LS	$	$
5.0	Grading and Testing	2,329	CY	$	$
6.0	Leak Detection System Support	1	LS	$	$
7.0	Procure and Install Geocomposite Venting System	1	LS	$	$
8.0	Procure and Install Secondary Geosynthetic Clay Liner (GCL)	6,069	SY	$	$
9.0	Procure, Install, and Test HDPE Geomembrane Primary Liner	6,069	SY	$	$
10.0	Anchor Trench Construction	932	LF	$	$
11.0	Procure and Install HDPE Rub Sheets	720	SY	$	$
12.0	Install and Seal Pipe Penetration(s) to Liner System	1	LS	$	$
13.0	Procure and Install Gate Valve(s)	1	LS	$	$
Line 4: Schedule 2 – Base Bid Subtotal Amount				$	
Schedule A-2 – Additive Bid Items (Bid Price Mandatory)					
2-1.0	Extra Excavation, Fill and Compaction	250	CY	$	$
Line 5: Schedule 2 – Additive Bid Subtotal Amount				$	
Line 6: Schedule 2 – Subtotal Amount (Line 4 Plus Line 5)				$	

Notes:
CY: cubic yard
EA: each
LF: linear foot
LS: lump sum
SY: square yard

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SECTION 01 43 00
QUALITY ASSURANCE AND CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control measures by the Contractor and references quality assurance duties which have combined responsibilities.

B. This Work is included as part of, but not limited to:

1. Bid Item Number 4.0: Construction Quality Control

1.02 GENERAL

A. The Contractor shall be fully responsible for the quality of its work.

B. Quality control services include inspections, tests, and related actions, including reports performed by independent agencies, government authorities, and the Contractor. They do not include Contract enforcement activities performed by the Owner's Representative.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Quality control requirements for individual construction activities are shown in the Sections that specify those activities.

E. Inspections, tests, and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

F. Requirements for the Contractor to provide quality control services required by the Owner's Representative, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

B. Construction Quality Control (CQC): Refers to those actions taken by the Contractor (including those parties charged with the manufacture, supply, fabrication, delivery, and installation) to demonstrate and sometimes quantify the

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characteristics of the product. The results of the CQC program are compared to the Contract Documents and any other contractual or regulatory requirements. During each aspect of the Work, quality control shall be provided by the Contractor to ensure and document that the materials and workmanship conform to the Contract Documents.

C. Construction Quality Assurance (CQA): Refers to those actions (including inspections, verifications, audits, testing, and evaluation), taken by the Owner's Representative on behalf of the Owner, intended to provide adequate confidence that the materials and workmanship provided by the Contractor conform to the Contract Documents and any applicable regulatory requirements.

1.04 SAMPLES AND CERTIFICATION

A. Samples.

1. The Contractor shall supply samples when required by the Contract Documents or the Owner's Representative.

2. Samples or test specimens shall be prepared and specified furnished with information as to their source in such quantities and size as may be required for proper examination and tests, with all freight charges prepaid.

3. Samples shall be submitted in ample time to permit the making of proper tests, analysis, examination, rejections, and resubmissions prior to shipping or installation or continued construction or as otherwise required by the Contract Documents.

4. Samples of materials shall be retained by the Owner's Representative for reference and comparison purposes.

B. Certification.

1. Producers and associations that have instituted accepted systems of quality control and have been accepted by accepted associations may submit certifications of compliance in lieu of further testing.

2. Materials from which samples have been taken shall not be incorporated in the work or accepted as part of the work until the samples testing results have been accepted in writing by the Owner's Representative.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittal Procedures.

B. A Construction Quality Control Plan (CQC Plan) shall be submitted by the Contractor within 5 calendar days of the Notice to Proceed and reviewed for approval by the Owner's Representative prior to commencing any work.

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1. The CQC Plan shall, at a minimum identify personnel, procedures, methods, instructions, inspections, records, and forms to be used in the CQC system.

2. Specifically, the CQC Plan will include a description of procedures for:

   a) Maintaining and updating daily activity logs

   b) Reporting out-of-spec conditions

   c) Record-keeping for personnel, equipment maintenance, and equipment calibration

   d) Progress reporting requirements.

C. The Contractor shall submit Daily Construction Reports; see Section 01 32 00 – Construction Progress Documentation for further details.

D. The Contractor shall provide inspections, tests, and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's Representative's responsibility or are provided by another identified entity.

E. The Contractor shall employ and pay an independent agency to perform quality control services as specified in the Contract Documents. No separate payment will be made for quality control services specified by the Contract Documents. Additional inspection and tests required because of defective work or ill-timed notices shall be performed at the Contractor's expense.

F. Coordination.

1. The Contractor and each agency engaged by the Contractor to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with a minimal delay.

   a) In addition, the Contractor shall coordinate activities with the Owner's Representative to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

   b) The Contractor is responsible for scheduling times for observations, tests, taking samples, and similar activities as described by this Specification.

G. Access.

1. The Contractor shall furnish free access to various parts of the Work and assist the Owner's Representative in performance of their duties, at no additional cost to the Owner.

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H. Data.

1. The Contractor shall furnish all samples, records, Construction Drawings, certificates, and similar data as may be required to assure compliance with the Contract Documents.

I. Retesting.

1. The Contractor is responsible for the cost of the Owner's Representative's retesting where results of required inspections, tests, or similar services prove unsatisfactory and do not indicate compliance with the Contract Documents.

   a) Cost of retesting construction revised or replaced by the Contractor shall be at the Contractor's cost, where required tests were performed on original construction.

2. The Owner's Representative will separately track and accumulate all such extra work. The costs incurred by the Owner's Representative will be reported and deducted from the subsequent payments to the Contractor.

   a) The Contractor may request copies of the Owner's Representative's documentation of the cost of extra Work, but the amounts are not subject to negotiation or reduction.

   b) The Contractor shall not be entitled to a change in Contract time or price due to delays caused by testing or rejected work or materials.

J. Associated services.

1. The Contractor shall cooperate with the Owner's Representative or their agents performing required observations, tests, and similar services and provide reasonable auxiliary services as requested. Auxiliary services required include, but are not limited to, the following:

   a) Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate observations and tests.

   b) Taking adequate quantities of representative samples of materials at locations directed by the Owner's Representative.

   c) Providing facilities for storage of test samples.

   d) Security and protection of samples and test equipment at the site.

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1.06 OWNER'S REPRESENTATIVE'S RESPONSIBILITIES

A. The Owner's Representative will perform observations and tests specified in the Contract Documents.

B. Where the Owner's Representative has engaged a testing agency or other entity for testing and observation of a part of the Work, the Contractor shall not employ the entity engaged by the Owner's Representative unless otherwise agreed in writing with the Owner's Representative.

1.07 DEFECTIVE WORK

A. Remove, replace, and retest any work found defective or not complying with requirements of Contract Documents, at no additional cost to the Owner.

B. Work will be observed as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Owner's Representative for Final Acceptance.

C. All observation and testing required because of defective work or ill-timed notices shall be performed at the Contractor's expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

A. Upon completion of observation, testing, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. See Specification 26 00 00 – Electrical General, Section 31 00 00 – Earthwork, Section 31 05 19.13 – Geotextiles for Earthwork, Section 31 05 19.16 – Geomembranes for Earthwork, Section 31 05 19.23 – Geosynthetic Clay Liners, Section 31 23 33 – Trenching and Backfilling, and Section 33 31 19 – Agricultural Waste Utility Piping for additional information on repair procedures.

B. Protect construction exposed by or for quality control and quality assurance activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for observation, testing, or similar services.

END OF SECTION 01 43 00

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Requirements for Temporary Utilities, Construction Facilities, Temporary Controls, removal of Utilities, Facilities and Controls and Mobilization and Demobilization.

B. This Work is included as part of, but not limited to:

1. Bid Item Number 1: Mobilization and Demobilization

1.02 GENERAL

A. Where on-site space for temporary facilities is limited, the Owner's Representative will make the allocation of the available space. The area shown on the Construction Drawings for parking shall be shared with the Contractors of other projects under construction at the Project site. Should the Contractor require space in addition to that allocated, the Contractor shall make arrangements for storage of materials and equipment in locations off site at no additional cost to the Owner.

B. Limit operations and storage of equipment and materials to the areas designated on the Construction Drawings. Maintain the area during construction without obstructing operations of any Owner operations or access roads to the site as set forth in the Contract Documents. Proceed with the Work in an orderly manner, maintaining the construction site to be free of debris and unnecessary equipment or materials. Store materials such as well casing or pipe and geosynthetics off the ground on pallets or racks, and store materials in a manner to allow access for inspection.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. The Contractor shall provide temporary lighting at least to meet all applicable safety requirements to allow erection, application, or installation of materials and equipment and observation or inspection of the Work.

B. If night Work is allowed, the Contractor shall provide lighting as required.

C. The Contractor shall provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required. The Contractor shall maintain lighting and provide routine repairs.

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1.04 TEMPORARY WATER SERVICE

A. Non-potable water required for dust control shall be obtained from on-site sources identified by the Owner. If non-potable water is not available on site, then the Contractor may obtain water from a non-potable water tank.

1.05 TEMPORARY SANITARY FACILITIES

A. The Contractor will provide and maintain all required sanitary facilities and enclosures and litter containers for the Work, including recycling collection and containers. Use of the existing Owner facilities will not be permitted. Facilities shall be provided for the duration for the Work and shall be installed at time of Project mobilization. Place secure facilities on flat surfaces at convenient locations. At the end of the job, such facilities and enclosures shall be removed completely.

1.06 VEHICULAR ACCESS

A. Vehicular access shall be restricted as indicated on the Construction Drawings.

B. Provide unimpeded access for emergency vehicles. Maintain 20-foot-wide driveways with turning space between and around combustible materials.

C. Provide and maintain access to fire hydrants and control valves free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering public roads and streets, as required.

1.07 PARKING

A. Parking on site shall be limited to the areas shown on the Construction Drawings and as specified by the Owner's Representative.

B. Maintenance.

1. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.

2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies to maintain paving and drainage in original or specified condition.

1.08 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

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B. Collect and remove waste materials, debris, and rubbish from site weekly and dispose pursuant to local regulations.

C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.09 TRAFFIC REGULATION

A. Traffic control on public rights-of-way shall be provided, as necessary, and in accordance with local, state, and federal requirements.

1.10 SECURITY AND PROTECTION

A. Temporary fire protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with National Fire Protection Association (NFPA) 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations" by performing the following actions:

1. Locate fire extinguishers where convenient and effective for their intended purpose.

2. Store combustible materials in containers in fire-safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

B. Security enclosure and lockup: Where the Contractor's materials and equipment must be stored, and when they are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of materials to minimize the opportunity for theft and vandalism.

C. Environmental protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, wetlands, waterways and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

D. Protection of site: Prohibit construction traffic from landscaped areas.

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E. Security program.

1. Protect the Work, existing premises, and the Owner's operations impacted by the Work from theft, vandalism, and unauthorized entry.

2. Initiate program in coordination with the Owner's existing security system at Project mobilization.

3. Maintain program throughout construction period until the Owner's Final Acceptance precludes the need for Contractor security.

1.11 DUST CONTROL

A. Monitor weather and site conditions for dust generation during the Work.

B. Maintain dust control with best practices, including, but not limited to, limiting the area of exposed soils, compacting the surface of exposed soils, covering exposed soils, wetting exposed soils, and street-sweeping pavements (where applicable).

C. Maintain dust control in accordance with permits and local, state, and federal regulations.

1.12 EROSION AND SEDIMENT CONTROL

A. Provide erosion control measures for exposed soils at all times, to be deployed if projected precipitation exceeds 0.3 inch over a 24-hour period.

1.13 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.14 PEST AND RODENT CONTROL

A. Provide methods, means, and facilities to prevent pests, rodents, and insects from invading the premises and damaging the Work.

1.15 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Prevent surface water runoff from entering excavations at all times.

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1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Clean and repair damage caused by installation or use of temporary work.

B. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.17 QUALITY CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control.

B. Temporary facility installation shall meet the construction safety requirements of the Occupational Safety and Health Administration, state, and other governing agencies. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including, but not limited to:

1. Health and safety regulations.

2. Utility company regulations.

3. Police, fire department, and rescue squad rules.

4. Environmental protection regulations.

5. Construction Drawings.

C. Inspections: If required by local ordinance or code, arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.18 MOBILIZATION AND DEMOBILIZATION

A. Mobilization consists of preparatory work and operations including, but not limited to, those necessary for the movement of personnel; project safety (including adequate personnel, equipment, supplies, and incidentals to the Project site); and other work and operations the Contractor must perform or costs the Contractor must incur before beginning work on the Project, which are not covered in other Bid Items. Demobilization consists of work and operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, incidentals, and offices off site. Demobilization includes cleaning of the site.

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 50 00

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SECTION 01 71 13
MOBILIZATION

PART 1 GENERAL

1.01 SUMMARY

A. Mobilization is defined as the preparatory Work performed by the Contractor, including:

1. Procurement, loading, and transportation of tools, materials, supplies, labor, and equipment.

2. Establishing and maintaining necessary facilities for the Contractor's operations.

3. Personal travel time when such travel time is a contractual obligation of the Contractor or a customary payment for the Contractor to all employees.

4. The Owner will pay for mobilization for off-site preparatory Work, provided notice has been provided sufficiently in advance to allow the Owner's Representative to witness the activity, if desired.

B. Mobilization also includes the costs incurred during demobilization. The site will be inspected upon completion by the Owner to ensure all Contractor/Vendor property and personnel have been properly removed. Final payment will not be made prior to said inspection and Owner site approval.

C. This Work is included as part of, but not limited to:

1. Bid Item Number 1: Mobilization and Demobilization

1.02 GENERAL

A. Mobilization shall include, but not be limited to, the following:

1. Movement of personnel, tools, equipment, materials, supplies, and incidentals to the site and all preparatory Work, including installation of Project signage.

B. Upon completion of the Work, the Contractor shall remove tools, equipment, and unused materials and supplies from the site and restore all disturbed areas outside the Project area to their pre-construction condition.

C. The Owner have the right to reject construction tools, equipment, materials, and supplies that are, in the Owner opinion, unsafe, improper, or inadequate. The

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Contractor shall bring rejected construction tools, equipment, materials, and supplies to an acceptable condition, as approved by the Owner, or remove them from the project site.

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures for submittal procedures.

B. Construction Work Plan: the Construction Work Plan is a pre-construction submittal that includes Contractor means and methods and sequencing for the completion of the work of the Contract.

1. The Construction Work Plan must be reviewed and accepted by the Owner's Representative prior to the start of work.

2. Include the Draft Construction Schedule; see Section 01 32 00. Updates shall include the Approved Construction Schedule; see Section 01 32 00.

3. Include proposed working hours and days.

4. Include a temporary facilities and controls plan that shows Contractor's and Owner's Representative's office, employee parking, material delivery area(s), fueling area, storage/staging/stockpiling area(s), fencing (if used), temporary utility connections (if used), traffic control where and when needed, TESC measures (see below), and other pertinent information.

5. Include a survey control plan that describes who will perform the various surveys required by the Work, what equipment will be used, and the qualifications of the Surveyor(s), including current licensure in Washington State.

6. Include an earthwork plan that describes:

   a) The equipment to be used for earthwork and installation of the liner system

   b) Trench safety systems to be used for excavations requiring trench safety.

   c) Temporary access ramps, if anticipated.

7. Include a temporary erosion and sediment control (TESC) plan that describes how Contractor will manage TESC during the Work; include TESC measures on the temporary facilities and controls plan.

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 71 13

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. The Work shall consist of demobilizing equipment from the site, conducting final cleaning, and submitting closeout documents.

B. This Section also presents processes and requirements for inspection and declaration that the Work has been completed as required by the Contract Documents. Upon formal review and acceptance of the work by the Engineer or Owner's Representative, the Work will be determined to be complete, and the Contractor shall then demobilize from the site.

C. Demobilization is a part of the closeout process; see Section 01 71 13 – Mobilization for further details.

D. This Work is included as part of, but not limited to:

1. Bid Item Number 1: Mobilization and Demobilization.

1.02 RELATED SECTIONS

A. Section 00 72 00 – General Conditions.

B. Section 01 71 13 – Mobilization

1.03 SUBMITTALS

A. Refer to Section 00 21 10 – Instructions to Bidders for information related to Project Dates.

B. Refer to Section 01 33 00 – Submittal Procedures for further information.

C. At least 14 calendar days prior to Final Completion, submit to the Engineer and Owner's Representative final hard copies of all As-Built Drawings and other required post-construction documents and one set of electronic files of all the As-Built Drawings and "Record" Information via email or CD-ROM(s).

1. All hard copies and electronic files shall be legible and reproducible to the satisfaction of the Owner.

D. Submit the Record Specifications to Owner's Representative and Engineer with the claim for final Application for Payment.

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E. Submit warranties for Geomembrane Primary Liner as described herein.

F. When directed by the Owner, submit the Contract Closeout Checklist as described herein.

1.04 FINAL CLEANING

A. Execute final cleaning, as required by the Contract Documents, prior to the final inspection and Final Acceptance.

B. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Materials suitable for classification as solid waste may be accepted for burial in an active landfill with written consent from both the Owner's Representative and the Owner.

1.05 SUBSTANTIAL COMPLETION

A. The Substantial Completion Date is the day the Owner's Representative determines the Owner has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoints, and only minor incidental Work, replacement of temporary substitute facilities, or correction or repair remains for the Physical Completion of the total Contract.

B. In order to achieve Substantial Completion, the Contractor must:

1. Have installed the liner system and satisfactorily completed necessary repairs following the Construction Quality Control testing conducted by the qualified third-party monitor.

2. Have completed the under-liner vent system Work.

3. Have completed backfill, compaction, and rough grading of areas affected by the Work including, but not limited to, trenching for the installation of the leak detection system components, trenching for the installation of piping improvements, and the perimeter access roads.

4. Have stabilized remaining soil stockpiles in accordance with permits and to the satisfaction of the Owner.

5. Deliver tools, spare parts, extra stock of materials, and similar physical items to the Owner, in accordance with requirements of the Contract Documents.

6. Satisfactorily pass the Substantial Completion inspection.

C. See Section 00 72 00 – General Conditions for further details.

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1.06 PUNCH LIST PROCEDURES

A. Contractor inspection: The Contractor and its Subcontractors shall conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to requirements of the Contract Documents.

1. The Contractor shall prepare a Punch List prior to requesting an inspection by the Owner's Representative. An inspection shall not be requested or granted if the Work is incomplete.

2. Notify the Owner's Representative in writing of satisfactory completion of Contractor inspection and that corrections have been made.

3. Request Owner's Representative inspection: Contractor shall make the request for inspection in writing and with the Punch List attached at least 3 working days prior to the requested date of inspection.

4. Owner's Representative inspection: The Owner's Representative and Contractor will perform inspection of the work to identify defects or deficiencies. The Contractor shall correct work accordingly, as required by the Owner's Representative, at no cost to the Owner.

B. Final inspection: When items noted above are completed, Contractor shall request final inspection of work by the Owner's Representative at least 3 working days prior to the requested final inspection date.

C. If Work is deemed incomplete by the Owner's Representative, complete outstanding items and request re-inspection, at no cost to the Owner.

1.07 FINAL COMPLETION, FINAL ACCEPTANCE, AND PAYMENT

A. Notice of Final Completion will be issued in writing by the Owner's Representative when all the physical Work is complete.

B. Notice of Physical Completion will be issued in writing by the Owner only after:

1. Contractor demobilization is satisfactorily completed.

2. Contractor has submitted the final Application for Payment and Final Affidavit of Amounts Paid.

3. All temporary locks, keys, or other items loaned or signed out to the Contractor, including subcontractors, sub-subcontractors, suppliers, and vendors are returned.

4. Project Record Documents have been submitted to and approved by the Engineer and Owner's Representative.

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5. Satisfactory completion of the Punch List items resulting from the Owner's Representative's inspection.

6. Final Cleaning of the Project site has been performed as required by the Contract Documents.

7. Any Special Warranties or follow-on Contracts required by the Contract Documents are submitted for approval to the Owner's Representative.

C. The Owner's Representative shall notify the Contractor of Final Acceptance of the Project as required by the Contract Documents.

D. The Owner's Representative and the Contractor shall follow the procedures stated in Section 00 72 00 – General Conditions for determining Final Completion, Final Acceptance, and Final Payment for further details.

1.08 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Contract Documents.

2. Addenda.

3. Change Orders and other Modifications to the Contract.

4. Reviewed Shop Drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Contractor shall redline the Record Documents on a weekly basis concurrent with construction progress. The Contractor shall supply a redline copy of the Record Documents that shall document all additions and modifications to the original Contract Documents, as follows:

1. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

a) Manufacturer's name and product model and number.

b) Product substitutions or alternates utilized.

c) Changes made by Addenda and Modifications.

2. Record Documents and Shop Drawings: Legibly mark each item to record actual construction, including:

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a) Measured horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

b) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

c) Field changes of dimension and detail.

d) Details not on original Contract Documents.

D. Delete the Engineer's title block and seal from all documents.

E. Submit the following items to Owner's Representative and Engineer with the claim for final Application for Payment:

1. One complete full size set of As-Built Drawings on Bond.

2. One complete set of Record Specifications.

1.09 WARRANTY

A. In addition to the 1-year warranty applicable to all the Work, as specified in Section 00 72 00 – General Conditions, certain elements of the project are to be warranted for an extended period following the completion of the initial 1-year warranty.

B. Refer to Section 31 05 19.16 – Geomembranes for Earthwork for warranty requirements for the geomembrane primary liner.

C. Sample warranty documents are contained as attachments, herein.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 77 00

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ATTACHMENT A

H&S BOSMA/LIBERTY DAIRIES WARRANTIES

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Attachment 1 – H&S Bosma/Liberty Dairies Lagoon No. 6

Two (2) Year Non-Pro-Rata Installation Warranty	
ISSUE TO: H&S Bosma/Liberty Dairies CONTACT PERSON: ADD CONTACT HERE	**Installed At:** H&S Bosma/Liberty Dairies 823 North Liberty Drive Granger, Washington 98932
ISSUE BY: Contractor Address – Line 1 Address – Line 2 Phone Number WA Contractor License No.	CONTRACTOR CONTACT PERSON: Name, Title Phone Number E-mail Address
Emergency hours (6:00pm – 7:00am) contact information CONTRACTOR CONTACT PERSON: Name, Title Phone Number(s)	
We, [CONTRACTOR NAME], certify that the **welded geomembrane primary liner** was installed at H&S Bosma/Liberty Dairies, and the work performed is in strict compliance with the Contract Documents. In compliance with the General Conditions of the Contract; and Section 01 77 00, [CONTRACTOR NAME] shall, in cooperation with H&S Bosma/Liberty Dairies, promptly repair, replace, or otherwise appropriately correct any such defect or nonconformity discovered during the Warranty Period. [CONTRACTOR NAME] warrants and guarantees that the installation work on the **welded geomembrane primary liner** is free from defects and nonconformities in equipment, material, design, or workmanship performed by [CONTRACTOR NAME] and or its subcontractors and suppliers for a period of two (2) years. The Warranty Period is effective from the Substantial Completion date of [DATE]. The Warranty Period will expire on [DATE].	
[NAME] AUTHORIZED OFFICER FOR [CONTRACTOR NAME]	**NOTARY**
[NAME] AUTHORIZED PROJECT MANAGER FOR [CONTRACTOR NAME]	

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Attachment 2 – H&S Bosma/Liberty Dairies Consolidated Lagoon No. 10

Five (5) Year Pro-Rata Manufacturer Warranty	
ISSUE TO: H&S Bosma/Liberty Dairies CONTACT PERSON: ADD CONTACT HERE	**Installed At:** H&S Bosma/Liberty Dairies 823 North Liberty Drive Granger, Washington 98932
ISSUE BY: Contractor Address – Line 1 Address – Line 2 Phone Number WA Contractor License No.	CONTRACTOR CONTACT PERSON: Name, Title Phone Number E-mail Address
Emergency hours (6:00pm – 7:00am) contact information CONTRACTOR CONTACT PERSON: Name, Title Phone Number(s)	
We, [CONTRACTOR NAME], certify that the **welded geomembrane primary liner** was installed at H&S Bosma/Liberty Dairies, and the work performed is in strict compliance with the Contract Documents. In compliance with the General Conditions of the Contract; and Section 01 77 00, [CONTRACTOR NAME] shall, in cooperation with H&S Bosma/Liberty Dairies, promptly repair, replace, or otherwise appropriately correct any such defect or nonconformity discovered during the Warranty Period. [CONTRACTOR NAME] warrants and guarantees that the installation work on the **welded geomembrane primary liner** is free from defects and nonconformities in equipment, material, design, or workmanship performed by [CONTRACTOR NAME] and or its subcontractors and suppliers for a period of two (2) years. The Warranty Period is effective from the Substantial Completion date of [DATE]. The Warranty Period will expire on [DATE].	
[NAME] AUTHORIZED OFFICER FOR [MANUFACTURER NAME]	**NOTARY**
[NAME] AUTHORIZED PROJECT MANAGER FOR [MANUFACTURER NAME]	

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SECTION 31 00 00
EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes general requirements for earthwork and includes: excavation, fill, compaction, grading, processing, stockpiling, disposal of unsuitable materials, aggregates, embankment, subgrade preparation, and over-excavation/replacement.

B. This Work is included as part of, but not limited to:

1. Bid Item Number 5: Grading and Testing

2. Additive Bid Item Number (A or B)-1.0: Extra Excavation, Fill, and Compaction

C. See Section 31 23 33 – Trenching and Backfilling for earthwork relating to the construction of ancillary systems including, but not limited to: conveyance piping and geomembrane anchor trenches.

1.02 RELATED SECTIONS

A. The Work of the following Sections is related to the Work of this Section. It is the Contractor's responsibility to perform all Work required by the Contract Documents. Other Sections not referenced below may also be related to the proper performance of this Work.

1. Section 31 05 19.13 – Geotextiles for Earthwork

2. Section 31 05 19.16 – Geomembranes for Earthwork

3. Section 31 05 19.23 – Geosynthetic Clay Liners

4. Section 31 05 19.26 – Geocomposites

5. Section 31 23 33 – Trenching and Backfilling

1.03 REFERENCES

A. The referenced publications form a part of this Section. The publications are referenced in the text by basic designation only. The version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

B. ASTM International

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1. D422 Standard Test Method for Particle-Size Analysis of Soils

2. D1557 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 [2,700 kN-m/m3])

3. D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

4. D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System [USCS])

5. D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. Construction Quality Assurance Plan (CQAP)

D. Washington Department of Transportation (WSDOT) Standard Specifications 2016

1.04 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

B. Compaction: The application of controlled forces to soils placed in lifts, using mobilized equipment, to achieve a prescribed soil density in accordance with established standards.

C. Construction Quality Control (CQC): Refer to Section 01 43 00 – Quality Assurance and Control.

D. Construction Quality Assurance (CQA): Refer to Section 01 43 00 – Quality Assurance and Control.

E. Excavation: Includes removal, loading, hauling, placing, compacting, and stockpiling as required to place the excavated materials in intermediate and ultimate destinations.

F. Imported fill material: Material obtained by the Contractor from sources off site.

G. On-site fill material: Material excavated on the site or taken from borrow areas with written approval by the Owner's Representative.

H. Over-excavation: Excavation below the depths shown on the Construction Drawings.

I. Owner-designated staging/stockpiling area: Stockpile areas containing material from on-site excavations as shown on the Construction Drawings.

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J. Optimum moisture content: The moisture content for a given soil that will result in the maximum dry unit weight when compacted in accordance with ASTM D1557.

K. Percent compaction: The percent compaction in-place shall be conducted by a nuclear density gauge (ASTM D6938) and shall be calculated as the ratio (in percent) of the in-place dry density to the estimated maximum dry density, in accordance with ASTM D1557, of the representative material at the location of the in-place density test.

L. Prepared subgrade: The prepared base soils that meet the grading, smoothness, and compaction requirements for the placement of the geosynthetic clay liner (GCL). Preparation includes grading, excavation, smoothing, hauling, filling, moisture conditioning (if necessary), compaction, and removal of unsuitable materials (e.g., organics, debris, angular rock or aggregate) to meet the requirements overlying materials.

M. Proof-rolling: Rolling a soil or rock surface with a minimum of three passes with equipment approved by the Owner's Representative for the purpose of detecting soft or loose areas.

N. Screening: The act of segregating rock and other earth material into specific size ranges. Screening may be accomplished by manual bar or mechanical screens.

O. Site: The property owned by the Owner within the boundaries shown on the Construction Drawings, easements and rights-of-way for roads, drainage facilities, and pipelines, and the Contractor's working and storage areas adjacent to the facilities.

P. Stockpiles: Soil temporarily placed in piles at locations designated by the Construction Drawings or the Owner's Representative for future use by the Owner or the Contractor.

Q. Suitable Material: Material imported or excavated from the cut areas, which is suitable for use as fill.

R. Track out: Material including soil and organic waste that is dropped onto roads from haul vehicles travelling throughout the site. Track out caused by the Contractor shall be cleaned up and managed by the Contractor at no additional cost to the Owner.

S. Unsuitable material: Screenings generated during material processing or material from excavations that, in the opinion of the Owner's Representative, are not suitable for use as on-site fill material. Should the Owner's Representative deem screenings unsuitable, the Contractor shall stockpile unsuitable screenings at the location designated by the Owner's Representative.

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1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittal Procedures.

B. A Construction Workplan shall be submitted by the Contractor as part of the pre-construction submittals; refer to Section 00 21 10 – Instructions to Bidders. The Construction Workplan shall, at a minimum, include the following:

1. Proposed source(s) and proposed method(s) of sampling source(s) of imported fill material (if used) for acceptance.

2. Proposed soil processing, crushing, screening, placement, compaction, and moisture control equipment, including equipment catalogs with weight, dimensions, and operating data.

3. Proposed work schedule.

4. Proposed method of protecting Work, including, but not limited to, temporary drainage measures (during rain events), dust control, and freeze protection (if work is conducted during the winter months).

5. Proposed CQC inspection firm, including the names, resumes, and qualifications of CQC inspection personnel.

6. Proposed excavation, stockpiling, regrading and staging plan describing handling and transport of on-site and off-site materials, including waste haul.

7. Proposed proof-rolling method and equipment for each subgrade condition.

8. Proposed soil disturbance plan that contains a construction sequencing plan for the anchor trenches, subgrade preparation, and the deployment of all geosynthetic materials; backfilling trenches and capping; and all information necessary to guide the safe execution of excavation and/or soil disturbances.

9. A Trenching and Backfilling Plan; see Section 31 23 33 – Trenching and Backfilling.

10. Shoring Plan; see Section 31 23 33 – Trenching and Backfilling.

C. The Contractor shall provide the Owner's Representative with a written moisture conditioning methodology. Moisture conditioning Work shall not commence until the method has been reviewed and accepted by the Owner's Representative.

D. For final acceptance of Earthwork, submit written Certification Documents and reports described, herein.

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1.06 CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control.

B. CQA will be performed by the Owner's Representative in accordance with the CQAP.

C. Any Work by the Contractor that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Contract Documents or as accepted by the Owner's Representative or Owner at the sole expense of the Contractor.

D. Imported fill material may be used only if necessary based on the quality and available quantity of the on-site fill material. Imported fill material source quality assurance testing will be performed by the Contractor to verify suitability for use as Imported Fill Material and will be approved by the Owner's Representative prior to use or delivery to the site. Tests will be conducted when there is a noticeable change in material type. A minimum of three tests per borrow material type will be conducted. The following tests will be conducted:

1. Soil Classification; ASTM D2487; perform a minimum of one test per 2,000 cubic yards of material.

2. Moisture Density Relationship; ASTM D1557; perform a minimum of one test per 2,000 cubic yards of material.

3. Particle Size Analysis; ASTM D422; perform a minimum of one test per 2,0000 cubic yards of material.

E. The Contractor shall procure a CQC testing firm to confirm that the Contractor is meeting the compaction requirements. Further information is provided in Article 3.05 of this Section.

F. All Contractor's quality control testing and results shall be as provided herein for the specific material and/or application.

1.07 PROTECTION

A. All existing roads, structures, utilities, and other improvements that are not specifically designated to be cleared, removed, stripped, or altered as a part of the Work shall be protected from damage throughout the construction period. Any damage caused by the Contractor, its employees, agents, or any lower-tiered subcontractors shall be immediately repaired to the original condition and to the satisfaction of the Owner's Representative at no additional cost to the Owner. Completed work (e.g., earthwork and geosynthetics) shall be protected from

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wetting, drying, and freezing by providing temporary drainage, features, and blankets or protective cover layers as necessary.

B. Existing utilities and facilities

1. Known existing utilities are indicated in the Construction Drawings. The Contractor shall hand excavate all excavations within 3 feet of areas where existing utilities are indicated, unless directed otherwise by the Owner's Representative.

2. The Contractor shall verify the actual locations of all existing utilities within the excavation area through the use of a qualified utility location services firm and by hand-excavation.

3. The Contractor shall record the utility locations on the Record Drawings.

4. After the actual locations and routing of the existing utilities have been found to be accurately determinable through hand-excavation and after approval from the Owner's Representative, the Contractor may begin excavation using machinery in a manner acceptable to the Owner's Representative.

5. After excavation by machinery has begun, the Contractor shall continue to be fully responsible for all utilities found through the location services by hand-excavation and/or as indicated in the Construction Drawings.

6. Any existing utility indicated in the Construction Drawings that is damaged by the Contractor shall be immediately repaired in a manner acceptable to the Owner's Representative and at no additional cost to the Owner.

7. If excavation or other work will be within 10 feet of any existing electrical utility either aboveground or belowground, lockout/tagout is required. The Contractor shall provide 1 working day's prior notice to the Owner's Representative of planned excavations of this type. The Contractor shall coordinate with the Owner and the applicable utility companies to arrange for and perform this lockout/tagout.

8. Notify the Owner's Representative immediately if any existing utilities that were not indicated on the Construction Drawings are encountered during excavation.

9. Obtain approval from the Owner's Representative before backfilling existing utilities. Utility warning tape (provided by the Contractor) shall be placed 12 inches above existing utilities.

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10. Equipment and methods shall be utilized to protect the integrity of all lining/cover materials scheduled to remain in place. The Owner's Representative may inspect for damage at any time. Repair damage as approved by the Owner's Representative and modify construction methods to prevent further damage. Damage to existing liner/cover systems that, in the opinion of the Owner's Representative, has been caused by the Contractor's work, shall be repaired at the Contractor's sole expense.

C. Protection of placed soil layers

1. The Contractor shall be responsible for protection of all Work during construction. Contractor shall include additional erosion control measures to protect soils placed throughout the project as necessitated by the Contractor's construction sequencing.

2. No additional payment will be made for repair of eroded or damaged slopes.

PART 2 PRODUCTS

2.01 MATERIALS

A. On-site fill material: Material shall be free from unsuitable material.

B. Imported fill material: Material shall be free from unsuitable material and:

1. Maximum particle size shall not exceed 3/8 inches in any direction. Larger-sized particles may be removed through screening or segregation during excavation.

2. Imported fill material shall meet the Washington Department of Transportation (WSDOT) standard specifications for Common Borrow (WSDOT 2016 Standard Specification 9-03.14(3)).

2.02 SOURCE QUALITY CONTROL

A. Imported fill material is subject to the following requirements:

1. All tests necessary for the Contractor to locate an acceptable source of imported fill material shall be made by the Contractor and submittals provided as stated above.

2. No materials shall be delivered to the site until the proposed materials have been accepted in writing by the Owner's Representative.

3. Final acceptance shall be based on tests made on samples of material taken from the completed and compacted course. All testing for final acceptance shall be approved by the Owner's Representative.

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4. If additional testing conducted by the Owner's Representative (as part of the CQA) indicate that the material does not meet Specification requirements, material placement shall be terminated until corrective measures are taken. Material not conforming to the Specification requirements that is placed on site shall be removed and replaced at the Contractor's sole expense. Sampling and testing performed by the Owner's Representative due to failure of the materials to meet specifications shall be done at the Contractor's sole expense.

B. Pre-construction material quality evaluations shall be performed by the Contractor. The Owner's Representative will be provided the opportunity to review all of the Contractor's pre-construction test results for acceptance and to classify the materials prior to incorporation in the work.

PART 3 EXECUTION

3.01 GENERAL

A. Equipment

1. All equipment and tools used in the performance of this work are subject to the approval of the Owner's Representative before work is started.

2. Provide compaction equipment appropriate for the material types to obtain the densities specified.

3. Provide hand-operated compaction equipment in areas closer than 2 feet to structures to obtain the compaction densities specified.

4. Operate compaction equipment in accordance with the Manufacturer's instructions and recommendations. If inadequate densities are obtained, provide larger and/or different type equipment at no additional cost to the Owner.

5. Provide equipment for applying water of a type and quantity adequate for the Work, free of leaks, and equipped with a distributor bar or other approved device to ensure uniform application.

6. Provide equipment for mixing and drying out material, such as blades, discs, or other approved equipment.

7. Provide equipment to control track out. Any track out noted by the Contractor, Owner's Representative, or Owner shall be cleaned by the Contractor immediately at no additional cost to the Owner.

B. Equipment for operating above geocomposite gas venting strips, geotextile (if required by the Owner), geomembrane cover strips (for geocomposite gas venting

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Strips), GCL, and geomembrane (collectively referred to as a geosynthetic product):

1. Track-mounted equipment with low ground-pressure tracks, having a ground pressure of 5 pounds per square inch or less, shall be used for spreading materials over the geosynthetics. In no case shall tracked equipment be allowed to operate on less than 12 inches of cover over the geosynthetic products.

2. No equipment of any kind shall be allowed directly on top of the geosynthetic products.

3. If equipment other than the above described track-mounted equipment is needed to complete the work, this equipment shall be operated above the geosynthetic products on temporary haul roads at least 3 feet thick. Material used in temporary haul roads can be incorporated as part of the overall required grading, provided the material has not been or will not be contaminated and meets the specified imported fill material requirements.

C. Verification of conditions

1. Verify all lines, limits, and grades prior to beginning construction activities. Adjust as necessary to accommodate settlement that may have occurred between the design survey and construction.

2. Verify that the survey control system is installed and properly protected from construction operations prior to earthwork.

3.02 EXCAVATION

A. For excavations related to trenching, see Section 31 23 33 – Trenching and Backfilling.

B. Protect bottoms of all excavations from free-standing water and frost. All soils in excavations or where fills will be placed shall be protected from movement or other damage due to frost penetration. Soil backfill, insulation, heat, or other methods acceptable to the Owner's Representative shall be used to protect soils during periods of the year in which frost penetration is possible.

C. Proceed with excavation and stockpiling in an orderly manner that prevents the different materials from being mixed together during or after excavation.

D. If excess fill is generated from the grading operations, the Contractor shall coordinate with the Owner's Representative and Owner on whether the material may be reused at other locations within the Owner's property or the material must be disposed of. If the excess fill is a result of the Contractor's over-ordering of import material, the disposal of the fill (whether on the Owner's property or an

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Owner's Representative approved disposal facility) will be completed at the Contractor's sole expense.

E. Limits of excavation

1. Excavate to lines, grades, and dimensions shown on the Construction Drawings.

2. Minimize excavation beyond limits shown on the Construction Drawings.

F. Under no circumstances shall excavations be allowed within 5 feet horizontally of the geomembrane edge without approval of the Owner's Representative. All such approved excavation shall be done with hand tools unless authorization is received in writing from the Owner's Representative.

3.03 OVER-EXCAVATION AND REPLACEMENT OF UNSUITABLE MATERIAL

A. If during the excavation for elements of the work unsuitable material is encountered, over-excavation may be required.

B. Any work associated with the over-excavation and replacement of unsuitable materials shall only be performed on the written approval of the Owner's Representative.

C. When approved, over-excavations for replacement of unsuitable material shall be completed in 1-foot-vertical increments. Notwithstanding other factors, this excavation shall be completed in accordance with Article 3.02 of this Section.

D. Over-excavation shall be replaced using imported fill material or on-site fill material, unless otherwise directed by the Owner's Representative, and compacted as required in this Section.

E. If the over-excavation is a result of the Contractor's means and methods or due to the Contractor's negligence, the Contractor shall correct all unauthorized over-excavated areas at their sole expense.

F. The Contractor shall provide the Owner's Representative two working days' notice prior to the start of any work associated with the over-excavation and replacement of unsuitable materials.

G. This work shall be tracked and paid for under the Schedule A or Schedule B Additive Bid Items. Quantities of unsuitable material replaced shall be maintained by the Contractor for submission upon the request of the Owner's Representative.

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3.04 STOCKPILING

A. Stockpile materials in a manner that segregates different material types in different stockpiles as directed by the Owner's Representative. The Contractor shall identify those stockpiles that are to be sorted, crushed, or screened.

B. Materials shall only be stockpiled in the Owner-designated staging/stockpiling area shown on the Construction Drawings. Any stockpiles outside of the Owner-designated staging/stockpiling area must be approved by the Owner's Representative.

C. Before stockpiling any materials, the surface below the stockpile shall be cleared of vegetation, rocks, or other debris.

D. Care shall be taken to prevent the contamination or deterioration of all stockpiled materials during construction, storage, and handling.

E. Protect Owner-designated staging/stockpiling areas:

1. All stockpiles shall have erosion control best management practices in place prior to any stockpiling.

2. Direct surface water away from the stockpile sites so as to prevent erosion or deterioration of materials.

3. The stockpiles must not be allowed to become contaminated with mud or other material.

4. If the surrounding ground is wet and soft, or for any reason contaminants are carried into the stockpile, the Contractor shall provide and place granular material on the haul routes at no additional cost to the Owner and provide means of keeping the equipment tires clean.

5. All costs for storing, protecting, re-handling, and placing stockpiled material shall be considered incidental to the construction.

6. If the stockpiled material becomes too wet, contaminated, or otherwise unusable during stockpiling, removal, handling, and/or placement, the Contractor shall dispose of and replace with an equal amount of material acceptable to the Owner's Representative.

7. All costs for replacement of contaminated or unusable materials due to the Contractor's actions or inaction, as determined by the Owner's Representative, will be borne solely by the Contractor.

F. Stockpiles shall be made such that maximum long-term slope is at a ratio of 3 horizontal to 1 vertical.

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G. The Contractor shall maintain Owner-designated staging/stockpiling area during the Contract period in a neat and free-draining condition that prevents stormwater sediment transport.

H. Upon completion of the work, the Contractor shall inventory all Contractor-imported materials remaining on site and coordinate with the Owner's Representative and Owner if any of these materials may be utilized in other portions of the Owner property. If they are unable to be reused, the Contractor shall bear all costs for removing any remaining Contractor-imported materials from the site. Payment shall not be made for materials that have not been incorporated in the Work unless they are otherwise specified or called for in the Construction Drawings. Leave Owner-designated staging/stockpiling area in clean and neat condition after materials are removed. Grade site surface to prevent freestanding surface water.

I. Any materials deemed unsuitable for the Work and not used shall remain the responsibility of the Contractor during the duration of the Work. The Contractor shall off-haul, dispose of properly, and clean the areas used for stockpiling at the conclusion of the Work at no additional costs to Owner.

3.05 PLACING AND COMPACTION OF MATERIALS

A. Do not place fill materials until preparation of the underlying surface has been completed and has been accepted by the Owner's Representative.

B. Place fill materials to the lines and grades shown on the Construction Drawings.

C. Fill materials shall not be placed over wet, frozen, or unstable subgrade surfaces.

D. Stop fill placement temporarily during unsuitable weather conditions or as approved by the Owner's Representative. Fill materials that do not meet specified moisture content shall not be placed, spread, or compacted. When Work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate the moisture content is within the specified tolerances. Moisture content ranges indicated in this Section represent the moisture content required at the time the material is undergoing compaction.

E. Uniformly grade areas to provide a finished surface that is smooth, compacted and free of irregularities. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

F. If, in the opinion of the Owner's Representative, the underlying surface is not suitable for subgrade fill placement, the underlying surface shall be corrected. Additional work shall include, but not be limited to, the following:

1. If the underlying surface of any layer of the fill is too dry and/or too smooth to bond properly with the layer of material to be placed thereon,

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moisten and/or scarify to provide a satisfactory bonding surface before the next layer of fill material is placed.

2. If the underlying surface of any layer of the fill is too wet, either remove and allow drying and/or scarifying in place to reduce the moisture content to the required amount in accordance with the requirements in the Contract Documents. Recompact before the next layer of fill is placed.

G. Distribute the moisture content of the fill material uniformly throughout each layer of the material prior to and during compaction.

H. If the Contractor cannot attain the specified densities with the maximum lift thicknesses specified, the lift thickness shall be reduced and/or heavier compaction equipment shall be provided. Adjustments to achieve compaction shall be at no additional cost to the Owner.

I. Specific compaction methods, as described below, shall be used in the areas indicated on the Construction Drawings:

1. Each layer of the entire embankment, lagoon bottom, and other areas outside of the lagoon that will require compaction shall be compacted to 92% of the maximum density as determined by ASTM D1557. Horizontal layers shall not exceed 12 inches in depth before compaction. In the top 2 feet, horizontal layers shall not exceed 4 inches in depth before compaction. No layer below the top 2 feet shall exceed 8 inches in depth before compaction.

2. The Contractor shall procure a CQC testing firm to confirm that the Contractor is meeting the compaction requirements. This testing shall be completed using a nuclear density gauge (ASTM D6938), at the minimum testing frequency of one test per 10,000 square feet per lift. The results of this testing shall be included in the Contractor's Daily Construction Report (Section 01 32 00 – Construction Progress Documentation).

3.06 SURFACE PREPARATION

A. Tolerances

1. Finished grades and subgrade surfaces for placement of geosynthetic products and final grades shall be within plus or minus 0.1 foot from required elevations unless otherwise noted.

B. Prepared subgrade for GCL

1. Prepare the subgrade surface for placement of the geomembrane and GCL by grading, scarifying, and compacting the upper 6 inches of material and recompacting to 92% of maximum dry density and to within 2% of the

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optimum moisture content determined by ASTM D1557. Recompact using a heavyweight (10- to 12-ton) smooth drum vibratory roller.

2. After completion of excavation and prior to GCL deployment, proof-roll the surface with approved compaction equipment to detect soft or loose zones. As shown in the Construction Drawings, a geotextile may be installed at the Owner's direction below the GCL for additional protection.

3. If soft or loose zones are found during proof-rolling, excavate the soft or loose material to a depth approved by the Owner's Representative and backfill and compact as specified.

4. GCL shall be placed on subgrades free of unsuitable material, including, but not limited to coarse particles, earth clods, uneven areas, ruts, roots, debris, and wood pieces. The following activities should be followed to ensure that a GCL is not damaged from underlying surface during installation:

   a) Use offset stakes for areas where GCL are present (either visible or below the surface). Do not stake within these areas.

   b) Any survey stakes, if used, shall be pulled out of the soil surface. Breaking off the survey stakes at the ground surface is not allowed.

   c) Contractor shall rake or remove by hand, as necessary, any rocks or debris that protrudes from the surface greater than 3/8 inches.

5. The Contractor shall shape the entire subgrade to a uniform surface running reasonably true to the line, grade, and cross section shown on the Construction Drawings. Leave subgrade with a surface that is smooth and without ruts.

6. The Contractor shall take precautions not to disturb the exposed subgrade by minimizing construction traffic across the subgrade or using special equipment and/or construction methods to prepare the subgrade.

7. The GCL installer and Owner's Representative must inspect and approve the surface prior to the placement of the GCL.

3.07 ACCEPTANCE

A. The Contractor shall cooperate with the Owner's Representative in the performance of compaction and gradation testing performed for Quality Assurance purposes.

B. The Contractor retains all Ownership and responsibility for the earthwork until written acceptance by the Owner's Representative.

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C. The Owner's Representative will accept earthwork when:

1. Conformance test results meet the requirements of the Contract Documents.

2. Required documentation from the field and laboratory testing laboratories has been received and accepted.

3. All repairs have been completed to the Owner's Representative's satisfaction.

4. Written Certification Documents have been received by the Owner's Representative.

5. All required documentation from the material supplier and Contractor has been received and accepted.

6. The material installation and compaction are complete.

7. The Contractor has submitted to the Owner's Representative all written Certification Documents and reports required by this Section.

END OF SECTION 31 00 00

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SECTION 31 05 19.13
GEOTEXTILES FOR EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. Manufacturing and installation of geotextiles for separation, cushioning, and other applications as shown on the Construction Drawings.

B. A geotextile may be installed under the liner system between the subgrade and the geosynthetic clay liner (GCL) at the option and direction of the Engineer and/or Owner's Representative. In general, the geotextile may be required if sharp angular stones or particles larger than 3/8-inch in diameter are observed in the liner subgrade.

C. This Work is included as part of, but not limited to:

1. Additive Bid Item Number 2.0: Furnish and Install Geotextile

D. Unless otherwise noted, test methods and material properties shall conform with the Geosynthetic Research Institute (GRI) Test Method GT12(a) – ASTM Version Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials (2016).

1.02 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

B. Section 31 05 19.16 – Geomembranes for Earthwork

C. Section 31 05 19.23 – Geosynthetic Clay Liners

D. Section 31 05 19.26 – Geocomposites

1.03 REFERENCES

A. The publications listed herein form a part of this Section to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

B. ASTM International

1. D4439 Standard Terminology for Geosynthetics.

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2. D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

C. Geosynthetic Research Institute

1. GT12(a) GRI Test Method GT12(a) – ASTM Version, Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials

D. Washington National Resource Conservation Service (WA NRCS)

1. MS-209 Woven and Nonwoven Fabrics

2. Code 521A Pond Sealing or Lining – Flexible Membrane (2013)

E. Construction Quality Assurance Plan (CQAP)

1.04 DEFINITIONS

A. Definitions shall be in accordance with ASTM D4439, unless otherwise indicated.

B. Construction Quality Assurance (CQA): Refer to Section 01 43 00 – Quality Assurance and Control.

C. Construction Quality Control (CQC): Refer to Section 01 43 00 – Quality Assurance and Control.

D. Geotextile: A nonwoven, pervious fabric sheet comprised of fibers held together through needle-punching.

E. Installer: The party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining (against wind), and installation of the geotextiles. The installer may also be referred to as the geotextile subcontractor.

F. Manufacturer: The party, also referred to as the geotextile manufacturer or fabricator, responsible for the production of the geotextile.

G. Minimum Average Roll Value (MARV): Minimum of a series of average roll values representative of geotextile furnished.

H. Overlap: Distance measured perpendicular from overlying edge of one sheet to underlying edge of adjacent sheet.

1.05 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00 – Submittal Procedures.

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B. At least 10 working days prior to shipping geotextile to the site, the Contractor shall notify the Owner's Representative of the shipping date.

C. Prior to shipping geotextile to the site, the Contractor shall submit the following:

1. Written procedures for storing, handling, installing, repairing, and seaming geotextiles.

2. Manufacturer's material specifications, product literature, and product sample for all materials.

3. Manufacturer certifications for all geotextiles to be used, verifying that furnished products have specified property values. Certified property values shall be MARV for geotextiles furnished.

4. Manufacturer's Source Quality Control testing results as required by this Section.

D. Samples

1. Geotextile: Label each with brand name, include furnished documentation of lot, and roll number from which each sample was obtained.

2. Field-Sewn Seam: 5-foot length of seam, 1 inch wide with seam along center, for each type and weight of geotextile required for the Project.

1.06 QUALITY CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control. These Technical Specifications apply to quality control and not to quality assurance.

B. The Contractor shall be responsible for CQC. The Contractor shall engage and pay for the services of qualified staff to perform CQC for monitoring and documenting the quality of the geotextile in accordance with the Contract Documents.

C. Unless otherwise specified, the Contractor shall complete CQC inspection, sampling, testing, or any other action as considered necessary by the Contractor to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, compliance of the Work with the Contract Documents shall be defined by the results of the Owner's Representative's CQA program.

D. Any Work that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Contract Documents or as approved by the Owner's Representative, at the sole expense of the Contractor.

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1.07 DELIVERY, STORAGE AND HANDLING

A. Follow shipment and storage requirements in GRI Test Method GT12(a).

B. Delivery, storage, and handling of the geotextile shall conform to ASTM D4873.

C. Ship the geotextile in an enclosed trailer. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure.

D. Deliver each roll with sufficient information attached to identify it for inventory and CQC and CQA.

E. Handle products in a manner that maintains undamaged condition.

F. Immediately restore any damaged protective covering.

G. Do not store products directly on the ground. Protect the geotextile from ultraviolet light exposure, precipitation, inundation, mud, dirt, dust, puncture, cutting, and other damaging or deleterious conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. The sheet edges shall be selvaged or finished to prevent outer material from separating from sheet. The unseamed sheet width shall be a minimum of 6 feet.

B. Geotextiles shall be furnished in complete rolls as manufactured.

2.02 GEOTEXTILE CUSHION

A. Products comprised of nonwoven, continuous-filament needle-punched polypropylene or polyester fabric; staple-filament needle-punched yarn oriented into a staple network that maintains its structure during handling, placement, and long-term service.

B. The product cannot be heat burnished.

C. The product must be resistant to soil chemicals.

D. The product must be new product made from virgin materials.

E. The product must meet the requirements from WA NRCS 521A (2013).

F. The product must meet the Minimum Average Roll Values (MARVs) in Table 1:

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Table 1 – Product Specifications

Test Property	Test Method	Test Frequency	MARV
Mass per Unit Area	ASTM D5261	90,000 sf	10.0 ounces/square yard
Grab Tensile Strength	ASTM D4632	90,000 sf	260 pounds or greater
Grab Elongation	ASTM D4632	90,000 sf	50%
CBR Puncture Strength	ASTM D6241	540,000 sf	725 pounds or greater
Trapezoidal Tear Strength	ASTM D4533	90,000 sf	100 pounds or greater
Apparent Opening Size	ASTM D4751	540,000 sf	Approximately No. 100 sieve
Permittivity	ASTM D4491	540,000 sf	1.0 second^{-1} or less
UV Resistance % retained after 500 hours	ASTM D4355	Per formulation	70

2.03 LABELING

A. Mark or tag all geotextile rolls with the following information:

1. Manufacturer's or supplier's name.
2. Product identification.
3. Lot number.
4. Roll number.
5. Roll dimensions.

B. Mark special handling requirements on rolls.

2.04 SEWING THREAD

A. Polymeric thread with strength properties equal to or greater than the geotextile.

B. Chemical resistant.

2.05 MANUFACTURER SOURCE QUALITY CONTROL

A. Perform quality control tests of geotextiles as specified in Table 1.

B. Reject rolls for which quality control requirements are not met.

C. Certify the quality of the rolls of geotextile.

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D. Provide quality control certificates for each lot and each shift's production. The quality control certificates shall include:

1. Roll numbers and identification.

2. Sampling procedures.

3. Results of quality control tests, including a description of test methods used.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare areas in which geotextile is to be placed to the lines and grades shown on the Construction Drawings. The surface shall be prepared in accordance with the Section 31 00 00 – Earthwork.

B. Prior to installation of the geotextile, examine underlying surface for conformance with Contract Documents and for anything that may damage the geotextile; remove objectionable materials.

3.02 INSTALLATION

A. Geotextile shall be placed at the locations shown on the Construction Drawings.

B. Geotextile shall be placed in accordance with the manufacturer's recommendations, standards, and guidelines and the requirements of this Section.

C. At the time of installation, geotextile shall be rejected if it has defects, ribs, holes, flaws, presence of needles or needle fragments, deterioration, or damage incurred during manufacture, transportation, storage, or placement. Visual review of the geotextile shall be performed once the geotextile has been placed and prior to placement of any overlying materials.

D. The geotextile shall be placed with the machine direction (long dimension) downslope, unless otherwise approved by the Owner's Representative. The placed geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

E. Adjacent strips shall be laid smooth and provide a minimum width of 12 inches of overlap for each joint. Overlap joints and seams shall be measured as a single layer.

F. Cut geotextile using approved cutter only. Take care to protect other in-place geosynthetic materials when cutting geotextile.

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G. Securing pins or other methods that may damage the geomembrane shall not be permitted. Sandbags or other methods approved by the Owner's Representative shall be used to secure the geotextile during installation and remain until replaced with cover material.

H. The geotextile shall be protected at all times during construction from contamination by surface water runoff or any other means. Do not entrap in the geotextile excessive dust, stones, or moisture that could damage or clog drains or filters or hamper subsequent seaming. Any geotextile so contaminated shall be removed and replaced with uncontaminated material, at the Contractor's sole expense.

I. After deployment, all geotextile shall be covered within 4 weeks to prevent exposure to ultraviolet radiation.

3.03 SEAMS AND OVERLAPS

A. Ensure that no soil material could be inadvertently inserted beneath the geotextile at the seams of geotextiles.

B. Continuously sew all geotextiles where the minimum overlap width cannot be achieved. Overlap 3 inches prior to seaming.

C. Sew using polymeric thread with chemical resistance and strength properties equal to or exceeding those of the geotextile.

D. For sewing, use a 401 two-thread chain stitch or equivalent.

3.04 PROTECTION OF GEOTEXTILE

A. When placing soil or other cover materials over geotextile, the Contractor shall ensure that:

1. The geotextile is not damaged through puncturing, tearing, or any other mechanism.

2. There is no slippage of the geotextile on underlying layers.

3. No excessive tensile stresses are generated in the geotextile.

4. Any damage to the geotextile shall be repaired at the Contractor's sole expense.

B. Do not operate machinery directly on the geotextile. If the geotextile is covered with less than a 2-foot thickness of soil, no equipment with a ground pressure greater than 5 pounds per square inch shall operate within 2 feet of the area underlain by the geotextile.

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3.05 REPAIRS

A. Replace torn or damaged areas and holes by placing an overlay of the same geotextile having dimensions at least 12 inches greater than the tear or hole in all directions.

B. When the maximum dimension of the tear or puncture exceeds 10% of the width of the geotextile roll, the entire sheet shall be removed and replaced with a new sheet.

C. Remove any soil or other material which may have penetrated the torn geotextile and repair any damage to other materials or layers.

3.06 FIELD QUALITY ASSURANCE

A. The Owner's Representative will collect samples of geotextile delivered to the site for conformance testing and perform tests to determine product compliance with specified values.

B. Samples will be taken across the entire width, excluding the first 3 feet of the roll, unless otherwise approved. Sample size will be 3 feet long by the roll width.

3.07 ACCEPTANCE

A. The Contractor retains all Ownership and responsibility for the geotextile until acceptance by Owner's Representative.

B. The Owner's Representative accepts the geotextile when:

1. Conformance tests verify product requirements.

2. The installation is complete.

3. Verification of the adequacy of all seams and repairs, including associated testing, is complete.

4. Written certification documents have been received by the Owner's Representative.

END OF SECTION 31 05 19

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SECTION 31 05 19.16
GEOMEMBRANES FOR EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. Manufacture, storage, delivery, and installation of HDPE geomembrane materials for the construction of the liner system as shown on the Construction Drawings.

B. This Work is included as part of, but not limited to:

1. Bid Item Number 4: Construction Quality Control
2. Bid Item Number 8: Procure, Install, and Test HDPE Geomembrane Primary Liner
3. Bid Item Number 9: Anchor Trench Construction
4. Bid Item Number 10: Procure and Install HDPE Rub Sheets
5. Bid Item Number 11: Install and Seal Pipe Penetration(s) to Liner System
6. Bid Item Number 12: Procure and Install Gate Valve(s)

1.02 RELATED SECTIONS

A. The Work of the following Sections is related to the Work of this Section. It is the Contractor's responsibility to perform all Work required by the Contract Documents. Other Sections not referenced below may also be related to the proper performance of this work.

1. Section 31 00 00 – Earthwork
2. Section 31 05 19.13 – Geotextiles for Earthwork
3. Section 31 05 19.23 – Geosynthetic Clay Liners
4. Section 31 05 19.26 – Geocomposites
5. Section 31 23 33 – Trenching and Backfilling
6. Section 33 31 19 – Agricultural Waste Utility Piping

1.03 REFERENCES

A. The publications listed herein form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

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The most recent version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

B. ASTM International

1. D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

2. D1505 (or D792, Method B) Standard Test Method for Density of Plastics by the Density Gradient Technique.

3. D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

C. Geosynthetic Research Institute (GRI)

1. GM13 Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

D. Washington Natural Resources Conservation Service (WA NRCS)

1. WA NRCS Code 521A

2. MS-594 Geomembrane Liner

E. Construction Quality Assurance Plan (CQAP)

1.04 DEFINITIONS

A. See Section 00 72 00 – General Conditions for contract definitions not described herein.

B. Definitions shall be in accordance with ASTM D4439 unless otherwise indicated.

C. Batch: Refers to the quantity of resin, usually the capacity of one railcar, used in the manufacture of the HDPE geomembrane sheet. The finished sheet shall be identified by a roll number corresponding to the particular batch of resin used.

D. Bridging: When the geomembrane becomes suspended over the subgrade due to expansion or contraction of the material or poor installation.

E. Construction Quality Control (CQC): Refer to Section 01 43 00 – Quality Assurance and Control.

F. Construction Quality Assurance (CQA): Refer to Section 01 43 00 – Quality Assurance and Control.

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G. Extrudate: The molten polymer that is produced from an extruder during extrusion seaming. The polymer is initially in the form of a ribbon rod, bead, or pellets.

H. Geomembrane: Refers to HDPE geomembrane manufactured and installed in accordance with the requirements of this Specification.

I. Geomembrane subgrade: The surface upon which the geomembrane lies.

J. Installer: The Contractor (or a subcontractor to the Contractor) shall act as the installer, i.e., the party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining (against wind), and installation of the geomembrane. At least one installer crew member must be fluent in English.

K. Manufacturer: The party, also referred to as the geomembrane manufacturer or fabricator, responsible for the production of the geomembrane rolls from resin and for the quality of the resin.

L. Master welder: The individual to whom the installer delegates responsibility for oversight of geomembrane seaming operations. The master welder shall be qualified in accordance with the requirements of this Specification.

M. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

N. Owner's Representative: Personnel employed by the Owner to conduct construction management services during construction.

O. Panel: The unit area of geomembrane that will be seamed in the field. A panel is identified as a roll or portion of a roll without any internal seams.

P. Panel Layout Drawings: Drawings submitted by the installer indicating panel numbers, field seams, and details.

1.05 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00 – Submittal Procedures.

B. At least 10 calendar days prior to shipping geomembrane to the site, the Contractor shall notify the Owner's Representative of the date of shipping.

C. Prior to shipping the geomembrane to the site, the Contractor shall submit the following Product Data.

1. Resin data

a) Statement of production date or dates

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b) Certification stating that the resin meets the specification requirements

c) Certification stating that all resin is from the same manufacturer

d) Copy of quality control certificates issued by the manufacturer

e) Test reports from the manufacturer

2. Geomembrane roll data:

a) Statement of production date or dates

b) Laboratory test results and certification stating that the geomembrane meets the product requirements

c) Certification stating that all geomembrane rolls are furnished by one supplier and that all rolls are manufactured from one resin type obtained from one resin supplier

d) Copy of quality control certificates indicating compliance with requirements of this Specification

e) Test reports from the manufacturer

f) Statement listing percentages/total of processing aids, antioxidants, and other additives other than carbon black added to or in the resin

g) Manufacturer's recommended geomembrane delivery, storage, and handling instructions

h) Manufacturer's recommended geomembrane installation instructions

D. After shipping the geomembrane to the site, the Contractor shall submit three samples of the HDPE geomembrane to be supplied for the Work. Each sample shall be one piece at least 12 inches wide and 48 inches long. Label each sample with brand name and furnish documentation of the lot and roll number from which the sample was obtained.

E. Prior to the commencement of geomembrane installation on any given day, the Contractor shall:

1. Submit all quality control documentation from the previous working day's geomembrane installation.

2. Submit a subgrade acceptance certificate signed by the installation supervisor for each area to be covered by the geomembrane.

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F. Prior to the installation, submit proposed installation layout drawings showing the panel layouts for the geomembrane. Include both fabricated (if applicable) and field seams, the locations of all anchor trenches meeting the maximum spacing requirements, pipe penetration boots, and details that are specific to the installation requirements of the technical specifications. Draw proposed layout drawings to scale and suitable for use as construction As-Built Drawings; include information such as dimensions, panel numbering, sequence, and installation details.

1.06 QUALITY ASSURANCE AND QUALITY CONTROL

A. The Engineer and/or Owner will engage the services of a CQA laboratory for monitoring the quality and installation of the geomembrane unless otherwise specified.

B. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control. The Contractor shall accommodate and provide support for CQA activities.

C. The Owner's Representative will be responsible for CQA. The Owner's Representative will be responsible for observing and documenting periodic verification, checking, or testing for confirming that the quality of the geomembrane is in accordance with the Contract Documents. The Owner's Representative will determine the location for destructive sampling.

D. Contractor's responsibilities

1. The Contractor shall be responsible for CQC required in this section. The Contractor shall engage and pay for the services of a qualified subcontractor to perform CQC for monitoring, sampling, testing, and documenting the quality of the geomembrane in accordance with the Contract Documents.

2. The subcontractor performing CQC shall have appropriate education and prior experience in conducting the specific quality control activities.

3. The Contractor shall accommodate and provide support for quality assurance activities.

E. The Contractor shall complete CQC inspection, sampling, testing, or any other action considered necessary by the Contractor to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, determination of whether the Work is in compliance with the Contract Documents will be made by the Owner's Representative.

F. Repair and Protection: The Contractor shall:

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1. Upon completion of observation, testing, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

2. Protect construction exposed by or for quality control and quality assurance activities and protect repaired construction.

3. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for observation, testing, or similar services.

G. The installer shall complete CQC inspection, sampling, testing, or any other action as considered necessary by the installer to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Installer's CQC program, determination of whether the Work is in compliance with the Contract Documents will be made by the Owner's Representative.

H. Any Work that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Specification or as approved by the Owner's Representative at the sole expense of the Contractor.

I. The Contractor and installer shall agree to participate in and conform with all items and requirements of CQA and CQC programs as outlined in this Section.

1.07 QUALIFICATIONS

A. Manufacturer qualifications

1. Manufacturer shall be a commercial entity normally engaged in manufacture of geomembranes for waste containment applications.

2. Manufacturer shall have at least 5 years' continuous experience in the manufacturing of geomembrane rolls of the type specified.

3. Manufacturer shall satisfy all appropriate trade certifications.

B. Installer qualifications

1. Installer: Must have at least 5 years' continuous experience in the installation of the specified geomembrane and must have successfully installed a minimum of 10,000,000 square feet of welded polyethylene geomembrane with documented references.

2. Master Welder: Must have completed a minimum of 5,000,000 square feet of polyethylene geomembrane seaming work using the type of seaming apparatus proposed for use on the Project.

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3. Other Seamers: Must have seamed a minimum of 1,000,000 square feet of HDPE geomembrane.

4. Any deviations from the installer qualifications must be communicated to the Engineer and Owner in the Contractor's bid, including rationale and extent of experience. The Engineer and Owner may waive the installer qualification requirements based on the information provided.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage and handling of the geomembrane shall conform to ASTM D4873 and the manufacturer's recommendations.

B. The Contractor shall be responsible for coordination and payment of shipping, delivery, unloading, storing, handling, and installing the geomembrane.

C. Each roll shall be labeled with the lot number, roll number, and other information necessary to identify it for inventory and CQC and CQA testing.

D. Delivery

1. Deliver materials to the site only after the Owner's Representative accepts required submittals.

2. Damaged rolls, as determined by the Owner's Representative, shall be removed from the site.

3. Deliver in rolls; do not fold.

E. Upon delivery at the site, the Contractor and the Owner's Representative will inspect the surfaces of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected.

1. The Owner's Representative will determine:

a) Rolls, or portions thereof, that should be rejected and removed from the site because they have significant flaws.

b) Rolls or factory panels that include repairable flaws.

c) Rolls that are not properly labeled. No unlabeled rolls shall be used for any application. Unlabeled rolls shall be removed from the site and replaced at the Contractor's expense.

d) Rolls whose lots do not match the lots included in the conformance testing shall be rejected.

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F. Immediately repair any damaged protective covering. Preserve the integrity and legibility of geomembrane roll labels.

G. On-site storage

1. Store geomembrane rolls to protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, exposure to ultraviolet radiation, or any other deleterious conditions.

2. Store geomembrane rolls on prepared surface.

3. Do not stack geomembrane more than three rolls high.

4. The Contractor is responsible for offloading, storing, and transporting material from the storage area to the area of installation.

H. Handling on site:

1. Use appropriate handling equipment to load, move, or deploy geomembrane rolls. Appropriate handling equipment includes cloth chokers, spreader bars, and roll bars.

2. Dragging panels on ground surface will not be permitted.

3. Do not fold geomembrane material. Folded geomembrane will be rejected.

1.09 WARRANTY

A. In addition to the 1-year warranty applicable to all the Work, as specified in Section 00 72 00 – General Conditions, certain elements of the project are to be warranted for an extended period following the completion of the initial 1-year warranty.

B. Provide manufacturer's warranty for geomembrane material in compliance with provisions of the conditions of the Contract. Provide a minimum 5-year pro rata warranty for the material against deterioration due to exposure to the elements, whether exposed or buried. The warranty for material must cover costs of material replacement and installation.

C. Provide an installation warranty for geomembrane material in compliance with the conditions of the Contract. Provide a minimum of 2-year non-pro rata warranty for the installation against defects.

D. Warranty period shall commence on the date of Substantial Completion.

E. The warranties shall be provided to the Owner as purchaser and shall be signed by authorized representatives of the geomembrane manufacturer and installer.

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F. The manufacturer's warranty must be received as a condition of Liner Material approval; the Installer's warranty must be received as a condition for payment for liner installed.

G. See Section 01 77 00 – Closeout Procedures for documentation requirements.

PART 2 SEE SECTION 00 72 00 – GENERAL CONDITIONS FOR ADDITIONAL DETAILS ON WARRANTIES.PRODUCTS

2.01 HDPE GEOMEMBRANE

A. Shall meet the requirements of GRI Test Method GM13; based on WA NRCS 521A (2013) and MS-594.

2.02 HDPE GEOMEMBRANE RESIN

A. Resin shall be new HDPE of first quality, compounded, and manufactured specifically for producing HDPE geomembrane.

B. Do not mix resin types during manufacturing.

C. Resin shall meet the requirements in Table 1.

Table 1. Geomembrane Resin Requirements

Physical Characteristic	Test Method	Value
Density (min.) gram/cm^3	ASTM D1505	0.932
Melt Index gram/10 min	ASTM D1238	$\leq$ 1.0

2.03 EXTRUDATE ROD OR BEAD

A. Extrudate rod or bead shall:

1. Meet the manufacturer's requirements.

2. Be made from same resin as the geomembrane.

3. Have thoroughly dispersed additives throughout rod or bead.

4. Contain 2% to 3% carbon black.

5. Be free of contamination by moisture or any other foreign matter.

2.04 EQUIPMENT

A. The Contractor shall provide extrusion welding equipment that is equipped with gauges showing temperatures in the extruder apparatus and at the nozzle (temperature at the nozzle may be measured by external temperature gauge).

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B. The Contractor shall provide fusion welding equipment that is an automated variable-speed vehicular-mounted apparatus equipped with devices adjusting and giving temperatures at wedge. The pressure shall be controlled by a spring, pneumatic control, or other system that allows for variation in sheet thickness. Rigid frame fixed-position equipment is not acceptable.

C. Seam welding accessories shall meet the following requirements:

1. The Contractor shall maintain sufficient operational seaming equipment to continue work without delay.

2. Only apparatus that the Owner's Representative has specifically approved by make and model shall be used.

3. Equipment shall be powered by an electric generator (or generators) capable of providing constant voltage under the maximum anticipated combined load.

4. Electric generators shall not be placed on the geomembrane, unless specifically approved by Owner's Representative. If the Owner's Representative approves placement of electric generators on the geomembrane, a protective lining and double containment fuel tank with an additional splash pad large enough to catch spilled fuel shall be provided by the Contractor.

D. Equipment used for seaming shall not damage the geomembrane nor the geosynthetic clay liner (GCL).

2.05 MANUFACTURER SOURCE QUALITY CONTROL

A. The manufacturer shall perform source quality control testing on the geomembrane at the manufacturing plant as indicated in GRI Test Method GM13.

PART 3 EXECUTION

3.01 GEOMEMBRANE SUBGRADE

A. Prepare areas in which geomembrane is to be placed to the lines and grades shown on the Construction Drawings. The surface shall be prepared in accordance with Section 31 00 00 – Earthwork and the following requirements.

B. In general, the geomembrane will be installed on any combination of the following:

1. An approved geocomposite venting material

2. An approved GCL

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C. The surface on which the geomembrane is to be installed shall be smooth and free of any debris, angular gravel, rocks, sharp objects, grade stakes or hubs, or any other protrusions or deleterious material larger than 3/8 inch that may damage the geomembrane.

D. The Contractor shall be solely responsible for protection of the geomembrane subgrade surface, including the intrusion of surface water beneath the geomembrane. Any damage to the geomembrane subgrade, including damage caused by geomembrane installation, shall be repaired at the Contractor's sole expense. Repair of damaged subgrade shall be completed prior to deployment of geomembrane in that area.

E. Edges of anchor trenches, other excavations, and grade changes shall be rounded to a minimum 6-inch radius, chamfered to an angle of no less than 135 degrees, or, with the prior written approval of the Owner's Representative, cushioned using a geotextile cushion.

F. Geomembrane shall not be placed in an area which has been softened as a result of precipitation.

G. The liner shall not be placed until the subgrade has been approved by the Owner's Representative.

3.02 PREPARATION

A. Placement conditions: Geomembrane placement shall not proceed at an ambient temperature below 40 °F or above 100 °F as measured 6 inches above the geomembrane surface unless otherwise authorized by the Owner's Representative. Geomembrane shall not be placed during any precipitation, in the presence of excessive moisture (e.g., fog or dew), in an area of ponded water, or in the presence of excessive winds. Placement methods shall prevent damage to underlying materials.

B. The installer shall perform and test trial welds on samples of geomembrane to verify the performance of welding equipment, seaming methods, and conditions.

C. No seaming equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial welds.

3.03 ANCHOR TRENCH

A. The anchor trench provides permanent anchoring for the liner and shall be constructed in accordance with the Construction Drawings. The trench corners shall be slightly rounded to prevent sharp bends in the liner.

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B. If sloughing of the trench occurs, the sloughed soils shall be removed and necessary repairs shall be made to provide a smooth trench wall. Standing water, mud, and snow shall be removed prior to liner placement and trench backfill.

C. Soil material used for backfilling the trench shall meet the requirements specified in Article 3.02 and Section 31 23 33 – Trenching and Backfilling. The trench shall be backfilled in two equal lifts and compacted by rolling with rubber-tired equipment or manually directed compaction equipment.

3.04 INSTALLATION

A. Installation each day shall not begin until the Contractor has submitted to the Owner's Representative the previous working day's quality control documentation.

B. Wherever possible, the Contractor shall complete deployment, trench backfill, and welding at the same temperature or within as narrow a temperature range as practical. The Contractor shall avoid completing these activities during extreme hot or cold conditions.

C. The liner shall be installed with a minimum of handling by using a spreader bar assembly attached to a front-end loader, track-hoe bucket, or by other methods recommended by the geomembrane manufacturer. The liner shall be placed parallel to the direction of maximum slope. During installation, the liner shall be secured with sandbags to protect it from wind uplift forces. The liner shall be seamed and secured by the end of each workday.

D. Do not allow any vehicular traffic directly on geomembrane. If the geomembrane is covered with less than 2-foot thickness of soil, no equipment with a ground pressure of greater than 5 psi shall operate within 2 feet (vertical) of the area underlain by the geomembrane.

E. Deployment

1. The Contractor shall give careful consideration to the timing and temperature during deployment. The Contractor shall focus on verifying that:

   a) There is no bridging or excessive stress in the geomembrane.

   b) There are no wrinkles in the geomembrane that will fold over when covered with soil material and no wrinkles that exceed 4 inches in height.

2. Panel identification: Assign an identifying code number to each panel that is consistent with the Contractor's panel layout drawing. The coding shall be coordinated with the Owner's Representative.

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3. Panels shall be oriented perpendicular to the line of the slope crest (i.e., down and not across the slope). Each panel shall be laid out and positioned to minimize the number and length of liner seams and in accordance with the manufacturer's recommendations.

4. Do not damage geomembrane by handling, equipment trafficking, hydrocarbon leakage, or any other means.

5. The liner shall be loosely laid over the subgrade with sufficient slack to accommodate thermal expansion and contraction.

6. Unroll geomembrane panels using methods that will not damage, stretch, or crimp the geomembrane.

7. Use deployment methods that minimize wrinkles and differential wrinkles between adjacent panels. The methods used to place panels shall minimize wrinkles, especially along field seams.

8. When recommended by the manufacturer, a geosynthetic rub sheet shall be used under the liner when dragging or moving the panels.

9. Visually inspect the geomembrane for imperfections. Mark faulty or suspect areas for repair.

10. Sufficient geomembrane shall be installed to account for shrinkage and contraction while avoiding wrinkles. Installed geomembrane shall be stress-free with no bridging before it is covered.

11. Before wrinkles fold over, attempt to push them out. Wrinkles that cannot be pushed out shall be cut out and the cuts repaired prior to burial.

12. Remove wrinkled or folded material.

13. Personnel walking on the geomembrane shall not engage in activities or wear types of shoes that could damage the geomembrane.

14. The geomembrane surface shall not be used as a work area or for preparing patches, storing tools and supplies, or other uses.

15. Protect the geomembrane in areas of heavy traffic by placing a protective cover that is compatible with and shall not damage the geomembrane.

F. Seam layout

1. Liner panels shall have a minimum seam overlap 4 inches for extrusion welding and 4 inches for double-fusion welding.

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2. Seams shall be oriented perpendicular to the line of the slope crest (i.e., down and not across the slope).

3. Minimize the number of field seams in corners, odd-shaped geometric locations, and exterior corners.

4. Use a seam numbering system that is compatible with the panel numbering system. Coordinate the seam numbering system with the Owner's Representative.

5. Panels shall be shingled on all slopes such that the upper panel is overlapped above the lower panel.

G. General welding procedures

1. Do not commence welding with welding apparatus until a trial weld test sample made by that apparatus passes the trial weld test.

2. During all welding operations, at least one master welder shall be present and shall provide supervision over other welders.

3. Clean the geomembrane surface of grease, moisture, dust, dirt, debris, or other foreign material.

4. Overlap panels a minimum 4 inches for extrusion welding and 4 inches for double-fusion welding.

5. Solvents or adhesives shall not be used unless the product is approved, in writing, by the Owner's Representative.

6. If required, provide a firm substrate by using a flat board, a conveyor belt, or similar hard surface directly under the weld overlap to achieve firm support.

7. The primary method of seaming shall be hot wedge fusion welding. Fillet extrusion welding shall be used for repairs, T-seams, and detail work.

H. Extrusion welding

1. Extrusion welding shall be used only for repairs (e.g., patches or caps) and areas not accessible to fusion welding equipment.

2. Extrusion welding equipment and accessories shall be in accordance with the liner manufacturer's recommendations.

3. The extrusion welder shall be calibrated at least once per day at the beginning of each seaming period.

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4. To ensure proper bonding of the extrusion weld, edges of the patch material and the adjacent liner shall be properly abraded by a light grinding a maximum of 1/4 inch beyond the weld bead area. This operation shall be done no more than 15 minutes before the welding operation. The abrasion process shall remove no more than 10% of the material thickness.

5. Adjacent panels shall be tack bonded together using procedures that do not damage the geomembrane, allow the required tests to be performed, and are not detrimental to final seaming. Tack welded panels shall not be left overnight.

6. Welding apparatus shall be free of heat-degraded extrudate before welding. Purge extruder prior to beginning seam until all heat-degraded extrudate has been removed from barrel.

7. The edge of the top sheet of geomembrane shall be beveled to a minimum of 45 degrees and to the full thickness of geomembrane before extrusion welding.

8. The ends of all seams that are more than 5 minutes old shall be grinded when restarting the weld.

9. Grind across, not parallel to, welds.

10. Change grinding discs frequently. Do not use clogged discs.

11. Maintain one spare operable extrusion welding apparatus on site at all times.

I. Hot wedge welding

1. Hot wedge welding shall be accomplished by a double-wedge fusion welder that produces a double track weld.

2. Welding equipment and accessories shall be in accordance with the liner manufacturer's recommendations.

3. The welder shall be calibrated at least once per day at the beginning of each seaming period.

J. Trial welds shall be performed at the following minimum frequency:

1. At least two per day per welder and machine, with one prior to the start of work and one at mid-shift, as well as when directed by the Owner's Representative.

2. Every 2 hours when using a fusion welder to weld across seams.

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3. At least one per weld per shift.

4. Whenever the ambient temperature changes more than 20 ˚F since the previous trial weld.

K. Trial welds shall be performed in the same surroundings and environmental conditions as the production welds (e.g., in contact with the geomembrane subgrade and similar ambient conditions).

L. All trial welds shall be tested as follows:

1. Five 1-inch-wide test strips shall be cut from the trial weld.

2. Each of the five specimens shall be quantitatively tested in the field using a tensiometer. The specimens shall be tested first for peel and then for shear in accordance with ASTM D6392.

3. The remaining sample shall be retained by the Contractor for future testing. The remaining sample shall be marked with the seamer's initials, date, time, and seaming machine identification.

4. A trial weld specimen shall pass when the results for both peel and shear tests exceed the requirements of this Section. For double-wedge fusion welding, both welds shall be individually tested, and both welds shall be required to pass in peel.

M. If a trial weld fails, neither the seaming apparatus nor seamer shall be accepted and neither shall not be used for seaming until deficiencies are corrected and two passing full-trial weld samples and tests are achieved consecutively. The physical properties of the type of resin used in extrusion welding shall be the same as those of the resin used in the geomembrane.

N. HDPE geomembrane seams shall conform to the requirements in Table 2.

Table 2. Minimum HDPE to HDPE Geomembrane Seam Properties

Physical Characteristic	Unit	Test Method	Requirement	
			40 mil	60 mil
Shear Strength (at yield point)	Pounds per Inch	ASTM D6392	80 and FTB[1]	120 and FTB[1]
Peel Strength (extrusion)	Pounds per Inch	ASTM D6392	52 and FTB[1]	78 and FTB[1]

Notes:
1. Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the other sheet at the weld interface area (i.e., the sheet fails before the weld fails).
mil: thousandth of an inch

O. Inspection

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1. Examine all welds and non-weld areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of the examination.

P. Repair and nondestructively test each suspect location both in weld and non-weld areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.05 GAS VENTING

A. When specified, gas vent flaps or vent pipes shall be installed in accordance with the Construction Drawings to provide adequate venting for the liner system. See specification Section 33 31 19 – Agricultural Waste Utility Piping.

3.06 QUALITY CONTROL

A. General

1. The Contractor and all subcontractors, including the manufacturer and the installer, shall participate in and conform with all terms and requirements of the quality control specified herein.

B. Nondestructive testing

1. Field seams shall be nondestructively tested over their full length. Seam testing shall be performed as the work progresses.

2. Nondestructive testing, as specified herein, shall be completed by the Contractor as part of its CQC. The Contractor may undertake nondestructive testing in addition to that specified.

3. The Contractor shall pressure test all fusion-welded seams. Fusion-welded seams that, in the opinion of the Owner's Representative, cannot be pressure tested shall be vacuum tested.

4. The Contractor shall vacuum test all extrusion-welded seams and those fusion-welded seams that, in the opinion of the Owner's Representative, cannot be pressure tested.

5. Both pressure testing and vacuum testing shall be completed as specified over the full length of the seam.

6. All testing shall be performed as the seaming progresses and not at the completion of all the field seaming. Complete all required repairs in accordance with this Section.

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7. Pressure testing shall be completed according to ASTM D5820, the liner manufacturer's recommendations, and the following procedure:

   a) Seal both ends of the seam to be tested.

   b) Insert needle or other approved pressure-feed device into one end of the channel created by the double-wedge weld.

   c) Energize the air pump to a pressure between 25 and 30 pounds per square inch.

   d) Close the valve and maintain test pressure for a minimum of 5 minutes.

   e) If pressure loss exceeds 3 pounds per square inch in 3 minutes or does not stabilize in Step D, locate the faulty area, mark the location, and repair in accordance with this Section. Repeat the pressure testing procedure on both sides of the repair.

   f) If the pressure was sustained, puncture the opposite end of the seam to release the air pressure. If the pressure is relieved from the puncture, the seam can be accepted.

   g) If the pressure does not release, there is a blockage present. Locate the blockage and repeat the testing procedure on both sides of blockage.

   h) Remove needle or other approved pressure-feed device and seal penetration holes by extrusion welding.

C. Vacuum box tests shall be performed in accordance with ASTM D5641 on all seams and repairs made by extrusion. The location of all defective seams shall be marked and repaired.

D. Seams that the Owner's Representative agrees cannot be nondestructively tested shall be treated by the Contractor as follows:

   1. If the weld is accessible to testing equipment prior to final installation, nondestructively test the weld prior to final installation.

   2. If the weld cannot be tested prior to final installation, a cap strip shall be provided over the weld. The welding and cap-stripping operations shall be observed by both the Owner's Representative and the Contractor's CQC representative to ensure uniformity and for completeness.

E. Destructive testing

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1. Destructive testing, as specified herein, shall be completed by a designated independent laboratory as part of CQA.

2. Samples for destructive testing shall be collected by the Contractor, at locations specified by the Owner's Representative, at no more than one sample per 500 feet of seam length. All destructive seam samples shall be tested in shear and peel modes in accordance with ASTM D6392 to verify seams meet the requirements of Table 2, based on NRCS MS-594.

3. The Owner's Representative will specify test locations based on the minimum frequency or suspicion of excess crystallinity, contamination, offset welds, or suspected defect. The Owner's Representative may increase the test frequency based on marginal results in accordance with GRI GM17.

4. Sampling procedures

    a) The Contractor shall cut samples at locations designated by the Owner's Representative as the welding progresses.

    b) The sample shall be a minimum of 12 inches wide by 44 inches long with the seam centered lengthwise.

    c) The Owner's Representative will provide a unique number for each sample. The Contractor shall mark the sample number and location, including dimensions, on the panel layout drawing.

5. The Contractor shall immediately repair all holes in the geomembrane resulting from destructive test sampling. Repair in accordance with repair procedures described in this Section. Test the continuity of the repair in accordance with the nondestructive testing requirements of this Section.

6. The Contractor shall divide the sample into four parts as follows:

    a) Cut a 1-inch-wide strip from each end of the sample.

    b) Cut one 12-by-12-inch portion to be retained by the Contractor.

    c) Cut one 12-by-18-inch portion to be submitted for testing.

    d) Cut one 12-by-12-inch portion to be retained by the Owner's Representative on behalf of the Owner for archive storage.

7. The Contractor shall field test the two 1-inch-wide strips specified above as follows:

    a) Both samples shall be tested using a tensiometer for peel and shear.

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b) Both test strips shall meet the peel and shear requirements for welded seams as per this Section.

c) If any field test sample fails, follow failed test procedures as per this Section.

8. The designated independent laboratory will perform, at a minimum, the following tests to determine the geomembrane weld compliance with these Specifications:

a) Seam strength: ASTM D6392.

b) Peel Adhesion: ASTM D6392.

c) At least five specimens shall be tested for each test method. All specimens shall meet minimum requirements.

d) None of the peel specimens may peel 100%, or the entire sample shall be considered as failing.

e) All tests shall exhibit a Film Tearing Bond type of separation in which the geomembrane material tears before the weld.

f) If any test samples fail to achieve the minimum requirements of this Section, follow the failed test procedures as per this Section.

9. The Contractor shall allow 2 working days from delivery of the destructive test sample to the designated independent laboratory before the placement of any material over the geomembrane.

10. If the Contractor chooses to place material over the geomembrane prior to 2 working days from delivery of the sample to the designated independent laboratory, and any of the above tests fail to achieve the requirements of this Section, the Contractor shall, at its sole expense, remove the overlying material and follow the failed test procedures as per this Section.

F. Failed weld procedures

1. The Contractor shall follow these procedures when there is a destructive test failure. The procedures shall apply to test failures determined by both the Owner's Representative, based on laboratory test results, and the Contractor, based on field tensiometer results.

2. Whenever a sample fails, the Contractor shall provide additional testing for seams that were welded by the same welder and welding apparatus or welded during the same time shift.

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3. With respect to the seam from which the failed sample was taken, the Contractor shall follow one of the following two options:

4. Option 1

   a) Reconstruct the seam between any two passing test locations. The weld flap shall not be extrusion welded.

   b) Reconstruction methods shall include cap stripping of the seam or replacing the seam with a new 1-foot-wide panel and welding in place.

5. Option 2

   a) Trace the weld for a minimum of at least 10 feet in both directions from the location of the failed test, or to the end of the weld.

   b) Obtain a small sample at both locations for an additional field test.

   c) If these additional test samples pass field tests, then take laboratory samples.

   d) If the laboratory samples pass, then reconstruct the weld or cap between the two test sample locations that bracket the failed test location.

   e) If any sample fails, then repeat the process to establish the zone in which the weld must be reconstructed.

G. The Owner's Representative will accept welded seams only as follows:

1. Seams that have passed nondestructive testing and that are bracketed by two locations from which samples have passed destructive tests.

H. For reconstructed seams exceeding 50 feet, a sample taken from within the reconstructed weld shall pass destructive testing.

3.07 REPAIR PROCEDURES

A. All defective liner areas and failed seams shall be repaired and retested.

B. The Contractor shall remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be repaired to the satisfaction of the Owner's Representative.

C. Repair, removal, and replacement shall be at the Contractor's sole expense if the damage results from the Contractor or any of the Contractor's subcontractor activities.

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D. The Contractor shall repair any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test.

E. Patching is used to repair tears, punctures, material defects, and holes larger than 1/2 inch in diameter. Surfaces of the liner to be patched shall be cleaned before the repair. All patches shall be of the same liner material and extend a minimum of 6 inches beyond the edges of the defect area. All patches shall have rounded corners with a radius of at least 4 inches and shall be seamed to the liner.

F. Holes smaller than 1/2 inch in diameter shall be repaired by a bead of extrudent.

G. Failed seams shall be repaired by installing a cap strip over the entire length of failed seam. The cap strip shall be of the same liner material and shall extend beyond the failed seam a minimum of 6 inches in all directions. Alternatively, the upper flap may be extrusion welded to the liner along the entire length of the failed seam.

H. Repairs shall satisfy the following requirements as indicated:

1. For repairs incorporating extrusion welding, abrade the geomembrane surfaces to be repaired no more than 15 minutes prior to the repair.

2. For all repairs, clean and dry all surfaces at the time of repair.

3. All repair procedures, materials, and techniques shall be accepted in advance of the specific repair by the Owner's Representative.

4. Unless otherwise instructed by Owner's Representative, cut the geomembrane below large caps to avoid water or gas collection between the sheets.

I. Verification of repair

1. The Contractor shall number, mark, and log each patch repair. Repair numbering shall be coordinated with the Owner's Representative.

2. The Contractor shall nondestructively test each repair using methods specified in this Section.

3. The Contractor shall complete destructive tests at the discretion of the Owner's Representative.

J. Repairs shall be reconstructed until nondestructive and destructive (where required) test results achieve the requirements of this Section.

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3.08 APPURTENANCES

A. The liner shall be mechanically attached to pipe, concrete, or steel structures as shown in the Construction Drawings and according to the liner manufacturer's recommendations.

B. Pipe boots: Pipe boots fabricated in the field shall be from the same material as the liner. The boots shall be welded to pipes of the same material as the liner. See specification Section 33 31 19 – Agricultural Waste Utility Piping.

3.09 GEOMEMBRANE ACCEPTANCE

A. The installer shall retain Ownership and responsibility of the geomembrane until the Owner's Representative accepts it.

B. The Owner's Representative will accept the geomembrane installation after:

1. All required documentation from the manufacturer and installer has been received and accepted.

2. Test reports verifying material properties have been received and accepted by the Owner's Representative.

3. The Owner's Representative has completed final inspection and confirms that all noted defects have been repaired.

4. Contractor has supplied the Owner's Representative a set of panel layout drawings.

END OF SECTION 31 05 19.16

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SECTION 31 05 19.23
GEOSYNTHETIC CLAY LINER

PART 1 GENERAL

1.01 SUMMARY

A. Manufacture, storage, delivery, and installation of a geosynthetic clay liner (GCL) for the construction of the double-liner system as shown on the Construction Drawings.

B. This Work is included as part of, but not limited to:

1. Bid Item Number 7: Procure and Install Secondary Geosynthetic Clay Liner

1.02 RELATED SECTIONS

A. The Work of the following Sections is related to the Work of this Section. It is the Contractor's responsibility to perform all Work required by the Contract Documents. Other Sections not referenced below may also be related to the proper performance of this Work.

1. Section 31 00 00 – Earthwork
2. Section 31 05 19.13 – Geotextiles for Earthwork
3. Section 31 05 19.16 – Geomembranes for Earthwork
4. Section 31 05 19.26 – Geocomposites
5. Section 31 23 33 – Trenching and Backfilling

1.03 REFERENCES

A. The publications listed herein form a part of this Section to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

B. ASTM International:

1. D5887, Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Using Flexible Wall Permeameter.
2. D5888, Identification, Storage, and Handling of Geosynthetic Clay Liners.

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3. D5890, Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

4. D5891, Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

5. D5993, Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners.

C. Washington Natural Resources Conservation Service (WA NRCS):

1. WA NRCS Code 521A

2. NRCS MS-595 Geosynthetic Clay Liner

3. WA NRCS MS-223 Geosynthetic Clay Liner

D. Construction Quality Assurance Plan (CQAP)

1.04 DEFINITIONS

A. Bentonite: Clay soils comprised primarily of sodium montmorillonite, characterized by high swelling potential and low hydraulic conductivity.

B. Construction Quality Assurance (CQA) inspector: The professional representative of the CQA monitoring firm shall be responsible for implementation of the CQAP.

C. Geomembrane: An essentially impermeable HDPE membrane; see Section 31 05 19.16 – Geomembranes for Earthwork for further details.

D. Geosynthetic Clay Liner (GCL): Manufactured liner material consisting of a layer of high shrink-swell sodium bentonite encapsulated by two geosynthetics.

E. Installer: Party responsible for GCL handling, transporting, storing, deploying, protecting, sampling, patching (damaged GCL), and temporary restraining (against wind and thermal/solar expansion) at the construction site.

F. Lot: Group of consecutively numbered rolls from the same manufacturing line.

G. Manufacturer: The party responsible for the production and quality of the GCL panels.

H. Minimum Average Roll Value (MARV): The minimum average value of a particular physical property of a material.

I. Owner's Representative: Personnel employed by the Owner to conduct construction management services during construction.

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J. Overlap: The width of material of a GCL panel in contact with an adjacent GCL panel. The distance measures perpendicular from the overlying edge of one panel to the underlying edge of the other.

K. Construction Quality Control (CQC): Refer to Section 01 43 00 – Quality Assurance and Control.

L. CQA: Refer to Section 01 43 00 – Quality Assurance and Control.

1.05 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00 – Submittal Procedures.

B. At least 10 working days prior to shipping GCL to the site, the Contractor shall notify the Owner's Representative of the date of shipping.

1. GCL:

a) Certification stating that the GCL meets the product requirements in Article 2.05.

b) Copy of quality control tests performed by manufacturer.

C. Installer qualifications:

1. Submit the name of installer, resume of installation supervisor/field engineer to be assigned to the project, and list of projects completed by installer that involved geomembranes and GCLs.

D. Submit Quality Control Plan and manufacturer installation procedures 3 weeks prior to installation, including:

1. Copy of manufacturer's quality control plan, including a list of quality control tests performed and typical testing frequencies.

2. Recommended installation procedures.

E. Granular (loose) Bentonite product data and manufacturer certification: submit written certification that granular (loose) bentonite meets the requirements of the bentonite included in the GCL.

F. Prior to the installation, submit proposed installation layout drawings showing the panel layouts for the GCL. Include both fabricated (if applicable) and field seams, the locations of all anchor trenches meeting the maximum spacing requirements, pipe penetration boots, and details that are specific to the installation requirements of the technical specifications. Draw proposed layout drawings to scale and

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suitable for use as construction As-Built Drawings; include information such as dimensions, panel numbering, sequence, and installation details.

1.06 QUALITY ASSURANCE AND QUALITY CONTROL

A. The Engineer and/or Owner will engage the services of a CQA field inspector and a CQA laboratory for monitoring the quality and installation of the GCL unless otherwise specified.

B. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control. The Contractor shall accommodate and provide support for CQA activities.

C. The Owner's Representative will be responsible for CQA. The Owner's Representative will be responsible for observing and documenting periodic verification, checking, or testing for confirming that the quality of the geosynthetics is in accordance with the Contract Documents.

D. Contractor's responsibilities:

1. Contractor shall be responsible for CQC required in this section. Contractor shall engage and pay for the services of a qualified subcontractor to perform CQC for monitoring, sampling, testing, and documenting the quality of the GCL in accordance with the Contract Documents.

2. The subcontractor performing CQC shall have appropriate education and prior experience in conducting the specific quality control activities.

E. The Contractor shall accommodate and provide support for quality assurance activities. The Contractor shall complete CQC inspection, sampling, testing, or any other action as considered necessary by the Contractor to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, determination of whether the Work is in compliance with the Contract Documents will be made by the Owner's Representative.

F. Repair and Protection: The Contractor shall:

1. Upon completion of observation, testing, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

2. Protect construction exposed by or for quality control and quality assurance activities and protect repaired construction.

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3. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for observation, testing, or similar services.

G. The installer shall complete CQC inspection, sampling, testing, or any other action as considered necessary by the installer to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Installer's CQC program, determination of whether the Work is in compliance with the Contract Documents will be made by the Owner's Representative.

H. Any Work that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Specification or as approved by the Owner's Representative at the sole expense of the Contractor.

I. The Contractor and installer shall agree to participate in and conform with all items and requirements of CQA and CQC programs as outlined in this Section.

1.07 QUALIFICATIONS

A. Manufacturer qualifications:

1. Manufacturer shall be a commercial entity normally engaged in the manufacture of GCL for waste containment applications.

2. Manufacturer shall have at least 5 years' continuous experience in the manufacture of GCL rolls of the type specified.

3. Manufacturer shall satisfy all appropriate trade certifications.

B. Installer qualifications:

1. Have experience in constructing lining/closure projects using GCL products.

2. Have experience installing GCLs on at least five projects and have installed a minimum of 2,000,000 square feet of GCL materials.

3. Installer shall have at least 5 years' continuous experience in the installation of the specified GCL.

4. Any deviations from the installer qualifications must be communicated to the Engineer and Owner in the Contractor's bid, including rationale and extent of experience. The Engineer and Owner may waive the installer qualification requirements based on the information provided.

C. The Contractor and installer shall agree to participate in and conform with all items and requirements of CQA and CQC programs as outlined in this Section.

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1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling of the GCL shall conform to the manufacturer's recommendations, NRCS MS-595 – Geosynthetic Clay Liner, and ASTM D5888 unless otherwise specified. In the event of a conflict, the most stringent requirement shall govern.

B. The Contractor (and/or installer) shall be responsible for coordination and payment of shipping, delivery, unloading, storing, handling, and installing the GCL.

C. Each roll shall be labeled with the lot number, roll number, and other information necessary to identify it for inventory and CQC and CQA testing.

D. Delivery:

1. Deliver material to the site only after the Owner's Representative accepts required submittals.

2. Material shall be covered with a waterproof, tightly fitting, plastic covering resistant to ultraviolet degradation.

3. Ship less than 1 month prior to scheduled installation.

4. Each roll shall be marked with the following information:

a) Manufacturer's name.

b) Product identification.

c) Lot or batch number.

d) Roll number.

e) Roll dimensions.

E. Upon delivery at the site, the Contractor and the Owner's Representative will inspect the surfaces of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected.

1. The Owner's Representative will determine:

a) Rolls, or portions thereof, that should be rejected and removed from the site because they have significant flaws.

b) Rolls or factory panels that include repairable flaws.

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c) Rolls that are not properly labeled. No unlabeled rolls shall be used for any application. Unlabeled rolls shall be removed from the site and replaced at the Contractor's expense.

d) Rolls whose lots do not match the lots included in the conformance testing shall be rejected.

F. Immediately repair any damaged protective covering. Preserve the integrity and legibility of roll labels.

G. Storage on site:

1. Store rolls in space allocated on the Construction Drawings or specified by the Owner's Representative. Space should be at high ground level or elevated above ground surface.

2. Store rolls to protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or any other deleterious condition. GCL needs to be kept dry and away from potential flooding or high storm runoff.

3. Storage methods shall include storing the rolls tarped on pallets, under a roof in a clean, dry protected area, and storing the rolls on a flat, dry, stable surface suitably covered with protective waterproof tarps.

4. Stack no more than three rolls high.

5. Stored rolls should be tarped and remain in their original, unopened plastic shipping sleeves to prevent damage and undue pre-hydration prior to installation.

6. Preserve integrity and readability of roll labels.

H. Handling on site:

1. Use appropriate handling equipment to (manufacturer's recommendations) to load, move, or deploy rolls. Appropriate handling equipment includes cloth chokers, spreader bars, and roll bars.

2. Handling of rolls shall be done in a competent manner such that damage does not occur to the product or to its protective wrapping. Follow handling procedures outlined in ASTM D5888.

3. Damage to protective covering due to mishandling or sampling must be repaired immediately. Repairs shall be such that the GCL roll is protected from moisture or other deleterious conditions.

4. Dragging panels on ground surface will not be permitted.

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5. Do not fold GCL material. Folded GCL will be rejected.

PART 2 PRODUCTS

2.01 MATERIAL

A. As a single, standalone unit, the GCL is composed of a layer of high shrink-swell sodium bentonite sandwiched between a layer of nonwoven polypropylene geotextile and a layer of woven geotextile. The GCL material shall be manufactured by one of the following processes:

1. Needle punched process by which the bentonite is encapsulated between the geotextile layers by a mechanical bonding process without the use of any chemical binders or adhesive.

2. Lock stitched to provide internal shear strength and the integrity and consistency to the thickness and unit weight of the material.

B. See the Testing and Quality Control requirements in Article 2.05.

2.02 PACKAGING AND LABELING

A. All material shall be packaged in individual rolls of a minimum of 3.65 meters wide and with at least 30.5 meters in length on the roll. All rolls shall be labeled and in a wrapping that is resistant to ultraviolet deterioration.

B. The labels on each roll shall marked or tagged with the following information:

1. Manufacturer's name.

2. Product identification.

3. Lot or batch number.

4. Roll number.

5. Roll dimensions.

2.03 TRANSPORATION

A. Transportation of the GCL to the site shall be the responsibility of the manufacturer. The manufacturer shall be liable for all damages to the materials incurred prior to and during transportation to the site.

2.04 MANUFACTURING QUALITY CONTROL

A. The GCL shall be subject to quality control and conformance testing to assure that the materials provided meet the minimum performance requirements. In most

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cases, sampling can be carried out on a sacrificial portion of the material. Consequently, repair of sampled locations should not be required.

1. Quality control tests:

   a) Manufacturer shall verify the proper mass per unit area of bentonite has been added to the product.

   b) All materials shall be tested in accordance with the manufacturer's quality control program. The manufacturer shall perform testing. Samples not satisfying the manufacturer's specifications shall result in the rejection of the applicable rolls. At the manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify the noncomplying rolls and/or to qualify individual rolls.

   c) The manufacturer shall certify the quality of the rolls. The quality control certificate shall include:

      1) Roll number and identification.

      2) Sampling procedures.

      3) Results of all quality control tests, including a description of test methods used.

2.05 TESTING AND QUALITY CONTROL

A. The following tests shall be performed and the results certified by the manufacturer and submitted to the Owner's Representative.

Property	Test Method	Test Frequency	Value
Bentonite Swell Index	ASTM D5890	100,000 lb	24 mL/2 g (min)
Bentonite Fluid Loss	ASTM D5891	100,000 lb	18 mL (max)
Bentonite moisture content	ASTM D2216	100,000 lb	40%, dry weight basis
Bentonite Mass/Unit Area, finished GCL	ASTM D5993	40,000 sf	0.75 lb/sf (min)
Tensile strength, finished GCL	ASTM D6768	40,000 sf	30 lb/inch
Internal shear strength, finished GCL	ASTM D6243	Periodically	500 psf
Index Flux, finished GCL	ASTM D5887	Weekly	$1x10^{-8}$ m^2/m^2-s (max)
Hydraulic Conductivity, finished GCL	ASTM D5887	Weekly	$5x10^{-9}$ cm/sec (max)

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Property	Test Method	Test Frequency	Value
Mass/Unit Area, Geotextile Cap Nonwoven (WA-NRCS)	ASTM D3776	200,000 sf	6.0 oz/SY
Mass/Unit Area, Geotextile Carrier woven (WA-NRCS)	ASTM D3776	200,000 sf	3.2 oz/SY

PART 3 EXECUTION

3.01 GENERAL

A. No liner material shall be accepted for placement in the permanent works that has not been certified by the manufacturer as meeting all specified requirements with the required submittals.

B. No liner material shall be accepted that exhibits any visible defects.

C. The liner material shall be subject to quality assurance testing at any time before and during installation.

3.02 SUBGRADE PREPARATION

A. Prepare areas in which GCL is to be placed to the lines and grades shown on the Construction Drawings. The surface shall be prepared in accordance with Section 31 00 00 – Earthwork and the following requirements.

B. In general, the GCL will be installed on any combination of the following:

1. A suitable subgrade.

2. An approved geotextile.

3. An approved geomembrane bridging the geocomposite venting material.

C. The surface on which the GCL is to be installed shall be smooth and free of any debris, angular gravel, rocks, sharp objects, grade stakes or hubs, or any other protrusions or deleterious material larger than 3/8 inch that may damage the geomembrane.

D. At a minimum, the site shall be smooth-rolled to the specified compaction requirements set forth in Section 31 00 00 – Earthwork.

E. The Contractor shall be solely responsible for protection of the GCL subgrade surface. Any damage to the GCL subgrade, including damage caused by GCL installation, shall be repaired at the Contractor's sole expense. Repair of damaged subgrade shall be completed prior to deployment of GCL in that area.

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F. Edges of anchor trenches, other excavations, and grade changes shall be rounded to a minimum 6-inch radius, chamfered to an angle of no less than 135 degrees, or, with the prior written approval of the Owner's Representative, cushioned using a geotextile cushion.

G. GCL shall not be placed in an area which has been softened as a result of precipitation.

3.03 INSTALLATION

A. Installation each day shall not begin until the Contractor has submitted to the Owner's Representative the previous working day's quality control documentation.

B. The contractor shall confine the Work to an area that can be completely installed and covered by the end of the normal working day in a manner that will prevent the occurrence of hydration prior to being covered with the specified cover soils or geomembrane. Daily completion shall be defined as the full installation of the liner, covering around appurtenances, and placement of the specified cover soils and/or geomembrane.

C. The rolls shall be carefully rolled down the slope and not allowed to unroll freely and out of control. When it is necessary to drag liner panels, a geosynthetic subgrade covering known as a rub sheet shall be used to reduce friction and protect the GCL during placement.

D. The rolls shall be placed with the woven geotextile or geomembrane side against the subgrade. The GCL panels shall be placed so that the long axis of the panels is oriented up and down the slope. This panel orientation shall apply to all covered slopes including corner slopes. All seams shall be overlapped a minimum of 6 inches. End-of-roll seams shall not be located on slopes. Seams at the base of the slope shall be a minimum of 5 feet from the toe.

E. Seams at the ends of panels should be constructed such that they are shingled in the direction of the grade to prevent flow from entering the overlap zone. The end of roll overlap shall be a minimum of 24 inches. All seam areas or runs shall be augmented with granular bentonite. Granular bentonite shall be dispersed evenly to cover the entire lapped area from the panel edge to the lap line at a minimum rate of 1 pound per 2 square feet of area covered. Seams shall remain closed during the backfill operation in order to prevent contamination of the bond surface and to ensure the panels remain in intimate contact, where jointed, at all times.

F. Minimize the number of field seams in corners, odd-shaped geometric locations, and exterior corners.

G. Use a seam numbering system that is compatible with the panel numbering system. Coordinate the seam numbering system with the Owner's Representative.

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H. The GCL shall be anchored at the top of the slope as shown on the Construction Drawings. The GCL shall be placed in the anchor trench so that it covers the entire trench bottom and only one trench wall.

I. The GCL shall be placed so that seams are parallel to the direction of the slope. End-of-roll seams shall be a minimum of 3 feet from the toe or crest of the slope.

J. The GCL shall not be placed in the rain, at times of impending precipitation, or in ponded water.

K. As rolls are selected for deployment, the labels should be removed and recorded by the installer, along with any other pertinent information.

L. Rolls shall be aligned next to the adjacent product sheet prior to unrolling. The installation equipment then begins unrolling the panel as the equipment moves in the direction of material deployment.

M. Assign an identifying code number to each panel that is consistent with the Contractor's panel layout drawing. The coding shall be coordinated with the Owner's Representative.

N. Use deployment methods that minimize wrinkles and differential wrinkles between adjacent panels.

O. Before wrinkles fold over, attempt to push them out. Wrinkles that cannot be pushed out shall be cut out and the cuts repaired prior to burial. Remove wrinkled or folded material.

P. Personnel walking on the GCL shall not engage in activities or wear types of shoes that could damage the GCL.

Q. The GCL surface shall not be used as a Work area or for preparing patches, storing tools and supplies, or other uses.

R. For final material alignment, the installer should manually move the panels to the proper position with the required overlap distance. Care should be taken not to dislodge the sodium bentonite during installation.

S. Examine all areas of the GCL for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the GCL shall be clean at the time of the examination. Mark faulty or suspect areas for repair.

T. Equipment used to deploy the GCL must be track or rubber tired with 40 pounds per square inch maximum ground pressure; equipment is subject to approval by the Owner's Representative. Equipment shall not cause rutting of the subgrade surface, make sharp turns, or be driven over the GCL. Any damage to the

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subgrade or the GCL shall be the responsibility of the Contractor to replace or put back to the pre-installation conditions.

U. During windy conditions, the GCL edges shall be weighted down, as necessary, with a sufficient number of filled sandbags or underlying soil material to prevent damage to the GCL.

V. The GCL material shall be cut with a sharp utility knife with a hook blade or another approved device. Do not damage adjacent or underlying materials while cutting the GCL.

3.04 DETAIL WORK

A. The GCL shall be sealed around any penetrations and embedded structures in accordance with the Construction Drawings, Section 33 31 19 – Agricultural Waste Utility Piping, and the GCL Manufacturers' recommendations.

3.05 GAS VENTING

A. Where specified, cut a hole in the GCL for the gas vent pipes in accordance with the Construction Drawings to provide adequate venting for the liner system. See specification Section 33 31 19 – Agricultural Waste Utility Piping.

3.06 REPAIR PROCEDURES

A. GCL that has begun to hydrate before being covered with soil or geomembrane shall be removed and replaced with dry GCL.

B. All damaged or flawed material shall be repaired as follows:

1. Completely expose the affected area.

2. Remove all soil or other foreign objects.

3. Place a GCL patch over the exposed area with a minimum overlap of 12 inches on all edges.

4. Place granulated bentonite between overlap at the rate of 1 pound per 2 square feet of area covered and spread to a minimum width of 6 inches.

5. On a sloping surface, fasten augment the bentonite-enhanced seam with construction adhesive.

C. Repair, removal, and replacement shall be at the Contractor's sole expense if the damage results from the Contractor or any of the Contractor's subcontractor activities.

D. The Contractor shall repair any portion of the GCL exhibiting a flaw.

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E. The Contractor shall number and log each patch repair. Repair numbering shall be coordinated with the Owner's Representative.

F. Do not cover GCL at locations that have been repaired until the Owner's Representative has reviewed the repair.

3.07 GCL ACCEPTANCE

A. The installer shall retain Ownership and responsibility of the GCL until the Owner's Representative accepts it.

B. The Owner's Representative will accept the GCL installation after:

1. All required documentation from the manufacturer and installer has been received and accepted.

2. Test reports verifying material properties have been received and accepted by the Owner's Representative.

3. The Owner's Representative has completed final inspection and confirms that all noted defects have been repaired.

END OF SECTION 31 05 19.23

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SECTION 31 05 19.26
GEOCOMPOSITES

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the technical requirements for the manufacturing and installation of the geocomposite strips for gas venting underneath the liner system at the locations shown on the Construction Drawings. All materials shall meet or exceed the requirements of this Section, and all Work will be performed in accordance with the procedures provided in these Technical Specifications.

B. This Work is included as part of, but not limited to:

1. Bid Item Number 6: Procure and Install Geocomposite Venting System

1.02 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

B. Section 31 05 19.13 – Geotextiles for Earthwork

C. Section 31 05 19.16 – Geomembranes for Earthwork

D. Section 31 05 19.23 – Geosynthetic Clay Liners

E. Section 33 31 19 – Agricultural Waste Utility Piping

1.03 REFERENCES

A. The publications listed herein form a part of this Section to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

B. ASTM International

1. D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

2. D1505-98 Standard Test Method for Density of Plastics by the Density-Gradient Technique

3. D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace

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Technique D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics

4. D4491-99 Standard Test Method for Water Permeability of Geocomposites by Permittivity

5. D4533 Standard Test Method for Trapezoid Tearing Strength of Geocomposites.

6. D4716 Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

7. D4751-99 Standard Test Method for Determining Apparent Opening Size of a Geocomposite.

8. D6241 Standard Test Method for the Static Puncture Strength of Geocomposites and Geocomposite- Related Products Using a 50-mm Probe D 4833-88 (1996) Standard Test Method for Index Puncture Resistance of Geocomposites, Geomembranes and Related Products.

9. D5261-92 (1996) Standard Test Method for Measuring the Mass Per Unit Area of Geocomposites.

10. D7005-03 Determining the Bond Strength (Ply-Adhesion) of Geocomposites.

C. Relevant publications from Geosynthetic Research Institute (GRI)

1. GRI Standard GC8, Standard Specification for Determination of the Allowable Flow Rate of a Drainage Geocomposite.

D. Relevant publications from the Environmental Protection Agency (EPA) Washington National Resource Conservation Service (WA NRCS)

1. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

E. Construction Quality Assurance Plan (CQAP)

1.04 DEFINITIONS

A. Definitions shall be in accordance with ASTM D4439, unless otherwise indicated.

B. Construction Quality Assurance (CQA): Refer to Section 01 43 00 – Quality Assurance and Control.

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C. Construction Quality Control (CQC): Refer to Section 01 43 00 – Quality Assurance and Control.

D. Installer: The party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining (against wind), and installation of the geocomposites. The installer may also be referred to as the geocomposite subcontractor.

E. Manufacturer: The party, also referred to as the geocomposite manufacturer or fabricator, responsible for the production of the geocomposite.

F. Minimum Average Roll Value (MARV): Minimum of a series of average roll values representative of geocomposite furnished.

G. Owner's Representative: Personnel employed by the Owner to conduct construction management services during construction.

H. Overlap: Distance measured perpendicular from overlying edge of one sheet to underlying edge of adjacent sheet.

1.05 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00 – Submittal Procedures.

B. At least 10 working days prior to shipping geocomposite to the site, the Contractor shall notify the Owner's Representative of the date of shipping.

C. Prior to shipping geocomposite to the site, the Contractor shall submit the following:

1. Written procedures for storing, handling, installing, repairing, and seaming geocomposites.

2. Manufacturer's material specifications, product literature, and product sample for all materials.

3. Manufacturer certifications for all geocomposites to be used, verifying that furnished products have specified property values. Certified property values shall be MARV for geocomposites furnished.

4. Manufacturer's source quality control testing results as required by this Section.

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D. Samples

1. Geocomposite: Sample for material conformance testing per Article 3.06, this Section. Label each with brand name, furnish documentation of lot, and roll number from which each sample was obtained.

1.06 QUALITY CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control. These Technical Specifications apply to quality control and not to quality assurance.

B. The Contractor shall be responsible for CQC. The Contractor shall engage and pay for the services of qualified staff to perform CQC for monitoring and documenting the quality of the geocomposite in accordance with the Contract Documents.

C. Unless otherwise specified, the Contractor shall complete CQC inspection, sampling, testing, or any other action as considered necessary by the Contractor to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, compliance of the Work with the Contract Documents shall be defined by the results of the Owner's Representative's CQA program.

D. Any work that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Contract Documents or as approved by the Owner's Representative at the sole expense of the Contractor.

1.07 DELIVERY, STORAGE AND HANDLING

A. Follow Shipment and Storage requirements in GRI GT12(a).

B. Delivery, storage, and handling of the geocomposite shall conform to ASTM D4873.

C. Ship the geocomposite in an enclosed trailer. Ship and store geocomposite with suitable wrapping for protection against moisture and ultraviolet exposure.

D. Deliver each roll with sufficient information attached to identify it for inventory and CQC and CQA.

E. Handle products in a manner that maintains undamaged condition.

F. Immediately restore any damaged protective covering.

G. Do not store products directly on the ground. Protect the geocomposite from ultraviolet light exposure, precipitation, inundation, mud, dirt, dust, puncture, cutting, and other damaging or deleterious condition.

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PART 2 PRODUCTS

2.01 GENERAL

A. The geocomposite will be used as a part of a subgrade gas venting system and shall consist of a minimum 200-thousandth of an inch (mil)-thick geonet heat-laminated to a single 6-ounce nonwoven geotextile. Double-sided composite is acceptable, but not necessary. The geotextile side of the geocomposite shall be placed down on the final grade.

B. All products shall be made primarily from virgin materials. No more than 5 percent by weight of clean recycled polymer shall be allowed.

C. Geocomposites shall be furnished in complete rolls as manufactured.

D. Properties

1. A geocomposite shall be manufactured by extruding two crossing strands to form a biplanar drainage net structure with a nonwoven geotextile bonded to a single side.

2. The geocomposite specified shall have properties that meet or exceed the values listed in Tables 1 and 2.

E. The product cannot be heat burnished.

F. The product must be resistant to soil chemicals.

G. The product must be new product made from virgin materials.

H. The product must meet the following properties for the 200-mil section of the geocomposite:

Table 1. 200-mil Geocomposite

Property	Test Method	Frequency	Value
Geonet			
Thickness, mil (mm)	ASTM D5199	50,000 sf	200 (5.1)
Peak Tensile Strength MD, lbs/in (N/mm)	ASTM D5035/7179	50,000 sf	45 (7.9)
Density, g/cm^3	ASTM D792, B	50,000 sf	0.94
Carbon Black Content (%)	ASTM D4218	50,000 sf	2 - 3
Transmissivity, gal/min/ft (m^2/sec)	ASTM D4716	500,000 sf	9.6 ($2x10^{-3}$)
Geotextile			
Mass per Unit Area, oz/yd^2	ASTM D5261-92	100,000 sf	6.0
Grab Tensile Strength, lb.	ASTM D4632	100,000 sf	160

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Property	Test Method	Frequency	Value
Grab Elongation (%)	ASTM D4632	100,000 sf	50
Trapezoidal Tear Strength, lb.	ASTM D4533	100,000 sf	65
CBR Puncture Strength, lb.	ASTM D6241	500,000 sf	435
Permittivity, sec^{-1}	ASTM D4491=99	500,000 sf	1.5
Water Flow Rate, gpm/ft^2	ASTM D4491-99	500,000 sf	110
AOS, U.S. Sieve Max (mm)	ASTM D4751	500,000 sf	70 (0.212)
Geocomposite - Single Sided w/6-oz			
Ply Adhesion, lbs/in (g/cm)	ASTM D7005-03	50,000 sf	1 (178)
Transmissivity, m^2/sec (gal/min/ft)	ASTM D4716	500,000 sf	$1x10^{-3}$ (4.8)
Typical Role Dimensions			
Roll Length, ft			300
Roll Width, ft			14.75
Roll Area, sf			4,425

I. Resin

1. Resin shall be new, first-quality, compounded polyethylene resin.

2. Natural resin (without carbon black) shall meet the following additional minimum requirements:

Table 2. Resin

Property	Test Method	Value
Density (g/cm^3)	ASTM D1505-98	≥ 0.94
Melt Flow Index (g/10 min)	ASTM D1238	≤ 1.0

2.02 LABELING

A. Mark or tag all geocomposite rolls with the following information:

1. Manufacturer's or supplier's name

2. Product identification

3. Lot number

4. Roll number

5. Roll dimensions

B. Mark special handling requirements on rolls.

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2.03 SOURCE QUALITY CONTROL

A. Perform quality control tests of geocomposite in accordance with Table 1.

B. Reject rolls for which quality control requirements are not met.

C. Certify the quality of the rolls of geocomposite.

D. Provide quality control certificates for each lot and each shift's production. The quality control certificates shall include:

1. Roll numbers and identification.

2. Sampling procedures.

3. Results of quality control tests, including a description of test methods used.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare areas in which geocomposite is to be placed to the lines and grades shown on the Construction Drawings. The surface shall be prepared in accordance with Section 31 23 00 – Earthwork.

B. Prior to installation of the geocomposite, examine underlying surface for conformance with Contract Documents and for anything that may damage the geocomposite; remove objectionable materials.

3.02 INSTALLATION

A. The installer shall place geocomposite at the locations shown on the Construction Drawings.

B. Geocomposite shall be placed in accordance with the manufacturer's recommendations, standards, and guidelines and the requirements of this Section.

C. At the time of installation, geocomposite shall be rejected if it has defects, ribs, holes, flaws, presence of needles or needle fragments, deterioration, or damage incurred during manufacture, transportation, storage, or placement. Visual review of the geocomposite shall be performed once the geocomposite has been placed and prior to placement of any overlying materials.

D. The geocomposite shall be placed with the machine direction (long dimension) downslope, unless otherwise approved by the Owner's Representative. The placed geocomposite shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

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E. Adjacent strips shall be laid smooth and provide a minimum width of 12 inches of overlap for each joint. Overlap joints and seams shall be measured as a single layer.

F. Cut geocomposite using approved cutter only. Take care to protect other in-place geosynthetic materials when cutting geocomposite.

G. Securing pins or other methods that may damage the geomembrane shall not be permitted. Sandbags or other methods approved by the Owner's Representative shall be used to secure the geocomposite during installation and remain until replaced with cover material.

H. The geocomposite shall be protected at all times during construction from contamination by surface water runoff or any other means. Do not entrap in geocomposite excessive dust, stones, or moisture that could damage or clog drains or filters or hamper subsequent seaming. Any geocomposite so contaminated shall be removed and replaced with uncontaminated material, at the Contractor's sole expense.

I. After deployment, all geocomposite shall be covered within 4 weeks to prevent exposure to ultraviolet radiation.

3.03 SEAMS AND OVERLAPS

A. Each component of the geocomposite will be secured or seamed to the like component at overlaps.

B. Geonet components

1. Adjacent ends of the geonet along the length of the geocomposite strip shall be placed with the ends of each geonet butted against each other. Ends shall be joined by tying the geonet structure with plastic cable ties. These ties shall be at each edge and spaced between the edges every 2 feet. The geotextile at adjacent ends shall overlap at least 6 inches in length. Overlapping geotextile may be heat seamed using a Leister Gun.

2. Overlapping of geocomposites is not allowed.

3.04 PROTECTION OF GEOCOMPOSITE

A. When placing cover materials over geocomposite, the Contractor shall ensure that:

1. The geocomposite is not damaged through puncture, tear, or any other mechanism.

2. There is no slippage of the geocomposite on underlying layers.

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3. No excessive tensile stresses are generated in the geocomposite.

4. Any damage to the geocomposite shall be repaired at the Contractor's sole expense.

B. Do not operate machinery directly on the geocomposite. If the geocomposite is covered with less than a 2-foot thickness of soil, no equipment with a ground pressure greater than 5 pounds per square inch shall operate within 2 feet of the area underlain by the geocomposite.

3.05 REPAIRS

A. Prior to covering the deployed geocomposite, each strip shall be inspected for damage resulting from construction.

B. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50% of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be joined in accordance with Article 3.03.

3.06 FIELD QUALITY ASSURANCE

A. The Owner's Representative will collect samples of geocomposite delivered to the site for conformance testing and perform tests to determine product compliance with specified values.

B. Samples will be taken across the entire width, excluding the first 3 feet of the roll, unless otherwise approved. Sample size will be 3 feet long by the roll width.

3.07 ACCEPTANCE

A. Contractor retains all Ownership and responsibility for geocomposite until acceptance by Owner's Representative.

B. The Owner's Representative accepts geocomposite when:

1. Conformance tests verify product requirements and are accepted by the Owner's Representative.

2. The installation is complete – the geocomposite vent strips are installed, tied, and secured to the geomembrane cover strips.

3. Written certification documents have been received by the Owner's Representative.

END OF SECTION 31 05 19.26

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SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes general requirements for trenching, which includes excavation and backfilling of trenches (including bedding and compaction requirements). This Section includes, but is not limited to, the conveyance piping, anchor trenches.

B. This Work is included as parts of, but not limited to:

1. Bid Item Number 5: Grading and Testing
2. Bid Item Number 6: Procure and Install Geotextile Vesting System
3. Bid Item Number 9: Anchor Trench Construction
4. Bid Item Number 11: Install and Seal Pipe Penetration(s) to Liner System
5. Bid Item Number 12: Procure and Install Gate Valve(s)

C. Installation of the leak detection system electrical components shall be done by Others. Contractor is responsible for supporting the installation by:

1. Locating, trenching, deploying trench safety system, and stockpiling soils in preparation for the installation and testing of the system by Others.
2. Following installation and testing by Others, Contractor's surveyor shall collect and record electrode locations prior to backfilling trenches.
3. Backfilling, compacting, and grading the trenches to match finish grades.

1.02 RELATED SECTIONS

A. The Work of the following Sections is related to the Work of this Section. It is the Contractor's responsibility to perform all Work required by the Contract Documents. Other Sections not referenced below may also be related to the proper performance of this Work.

1. Section 01 20 00 – Price and Payment Procedures
2. Section 31 00 00 – Earthwork
3. Section 33 31 19 – Agricultural Waste Utility Piping

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1.03 REFERENCES

A. The referenced publications form a part of this Section. The publications are referenced in the text by basic designation only. The version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

B. ASTM International

1. D422 Standard Test Method for Particle-Size Analysis of Soils

2. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

3. D1586 Standard Test Method for Penetration Test and Split Barrel Sampling of Soils

4. D2166 Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

5. D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

6. D2487 Standard Practice Classification of Soils for Engineering Purposes (Unified Soil Classification System)

7. D2573 Standard Test Method for Field Vane Shear Test in Cohesive Soil

8. D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

C. Construction Quality Assurance Plan (CQAP)

D. Washington Department of Transportation (WSDOT) Standard Specifications 2016

1.04 DEFINITIONS

A. Backfill material: The material placed above the bedding zone to the existing or proposed subgrade.

B. Bedding material: Where classified as such on the Construction Drawings, the material placed in contact with (and immediately adjacent to) the pipe for the purpose of providing structural support to the pipe and a porous region for transfer of gas/fluids into the piping system. Bedding material is classified into three zones of placement as follows:

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1. Bedding: The material placed from the bottom of the bedding zone to the bottom of the pipe itself.

2. Haunching: The material placed from the bottom of the pipe to the springline of the pipe.

3. Initial backfill: The material placed from the springline of the pipe to the top of the bedding zone.

C. Compaction: The application of controlled forces to soils placed in lifts, using mobilized equipment, to achieve a prescribed soil density in accordance with established standards.

D. Construction Quality Control (CQC): Refer to Section 01 43 00 – Quality Assurance and Control.

E. Construction Quality Assurance (CQA): Refer to Section 01 43 00 – Quality Assurance and Control.

F. Excavation: Includes removal, loading, hauling, placing, compacting, and stockpiling as required to place the excavated materials in intermediate and ultimate destinations.

G. Imported fill material: Material obtained by the Contractor from sources off site.

H. On-site fill material: Material excavated on the site or taken from borrow areas designated on the Construction Drawings.

I. Owner-designated staging/stockpiling area: Stockpile areas containing material from on-site excavations as shown on the Construction Drawings.

J. Optimum moisture content: The moisture content for a given soil that will result in the maximum dry unit weight when compacted in accordance with ASTM D1557.

K. Percent compaction: The percent compaction in-place shall be conducted by a nuclear density gauge (ASTM D6938) and shall be calculated as the ratio (in percent) of the in-place dry density to the estimated maximum dry density, in accordance with ASTM D1557, of the representative material at the location of the in-place density test.

L. Prepared subgrade: The ground surface after clearing, grubbing, stripping, grading, excavation, smoothing, and compaction to meet the requirements for placement of the next overlying layer of earthen or geosynthetic material.

M. Shoring: Temporary excavation support needed if excavations extend below 4 feet below ground surface (bgs).

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N. Site: The property owned by the Owner within the boundaries shown on the Construction Drawings, easements and rights-of-way for roads, drainage facilities, and pipelines, and the Contractor's working and storage areas adjacent to the facilities.

O. Stable subgrade: Subgrade is considered stable:

1. For cohesive soils, if the shear strength as measured in accordance with ASTM D2166 or ASTM D2573 is not less than 500 pounds per square feet.

2. For sands, if the penetration resistance as determined in accordance with ASTM D1586 is not less than 8 blows per foot.

P. Stockpiles: Soil temporarily placed in piles at locations designated by the Construction Drawings or the Owner's Representative for future use by the Owner or the Contractor.

Q. Suitable material: Material imported or excavated from the cut areas, which is suitable for use as fill.

R. Track out: Material, including soil and organic waste, that is dropped onto roads from haul vehicles travelling throughout the site. Track out caused by the Contractor shall be cleaned up and managed by the Contractor at no additional cost to the Owner.

S. Unstable trench bottom: A condition that does not provide adequate support and stable containment of the bedding material. Unstable conditions include a soft trench bottom that does not provide an adequate working platform or walls that readily slough. Unstable conditions also include materials with high organic content, fine-grained soils saturated with water in excess of their liquid limit, low-density fine sands or silts, and expansive soils such as "fat" clays and certain shales that exhibit a large change in volume with change in moisture content.

T. Unsuitable material: Screenings generated during material processing or material from excavations which, in the opinion of the Owner's Representative, is not suitable for use as on-site fill material. Should the Owner's Representative deem screenings unsuitable, the Contractor shall stockpile unsuitable screenings at the location designated by the Owner's Representative.

1.05 SUBMITTALS

A. Submit in accordance with provisions of Section 01 33 00 – Submittal Procedures.

B. Trenching and Backfilling Plan, as part of the Construction Workplan as described in Section 31 00 00 – Earthwork and other Sections. Include a

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description of the trenching and backfill approach to construct the geomembrane anchor trench, conveyance piping, and the trenching and backfill methods for the leak detection electrode system (installed by Others).

C. Shoring Plan, as part of the Construction Workplan described in Section 31 00 00 – Earthwork and other Sections. The Shoring Plan should include the following:

1. Shop drawings that include plans, elevations, sections, and details that describe the systems to be installed. Dimensions, spacing of members, and egress points shall be clearly demarcated.

2. Design computations of the shoring system showing that the system shall meet the required loads. This design shall be stamped by a Professional Engineer in the State of Washington.

3. Product data for materials and equipment.

1.06 CONSTRUCTION QUALITY ASSURANCE AND QUALITY CONTROL

A. The Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control.

B. CQA will be performed by the Owner's Representative in accordance with the CQAP.

C. Any Work that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Contract Documents or as approved by the Owner's Representative or Engineer at the sole expense of the Contractor.

D. Imported fill material (if necessary based on the quality of the on-site fill material) source quality assurance testing will be performed by the Contractor to verify suitability for use as imported fill material and will be approved by the Owner's Representative prior to use or delivery to the site. Tests will be conducted when there is a noticeable change in material type. A minimum of three tests per borrow material type will be conducted. The following tests will be conducted:

1. Soil Classification; ASTM D2487; perform a minimum of one test per 2,000 cubic yards of material.

2. Moisture Density Relationship; ASTM D1557; perform a minimum of one test per 2,000 cubic yards of material.

3. Particle Size Analysis; ASTM D422; perform a minimum of one test per 2,0000 cubic yards of material.

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E. The Contractor shall procure a CQC testing firm to confirm that the Contractor is meeting the compaction requirements. Further information is provided in Article 3.05.

F. All Contractor's quality control testing and results shall be as provided herein for the specific material and/or application.

1.07 PROTECTION

A. Protect persons, both on and off site, from injury. Barricade temporary open trenches occurring as part of the Work with suitable fences and barriers. Equip barriers with warning lights as necessary.

B. Trenches deeper than 4 feet in depth require temporary shoring to protect collapse.

C. Protect existing structures, fences, roads, utilities, and other features that are to remain as part of the completed site.

D. Protect off-site property from damage caused by the Contractor's construction operations. Exercise particular care in preventing any disturbed soils, debris, refuse, or other potential pollutants from entering any watercourse or adjoining property. Do not bring or use explosives on the site.

E. Immediately repair at the Contractor's cost all damage caused by construction Work.

F. Existing utilities

1. Known existing utilities are indicated on the Construction Drawings. Hand excavate all excavations within 3 feet of areas where existing utilities are indicated, unless directed otherwise by the Owner's Representative.

2. Verify the actual locations of all existing utilities within the excavation area through the use of a qualified utility location services firm and/or by hand-excavation.

3. After the actual locations, routing, lines, and grades of the existing utilities and lining have been found to be accurately determinable through this hand-excavation and after approval from the Owner's Representative, excavation may begin using machinery in a manner acceptable to the Owner's Representative.

4. After trenching has begun, the Contractor is fully responsible for all utilities found through the location services, by hand-excavation, and/or that were indicated on the Construction Drawings.

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5. The Contractor shall be responsible for protection and support of existing utilities at crossing locations (if any). Responsibilities shall include, but not be limited to, design, fabrication, installation, and maintenance of support systems.

6. Any existing utility indicated on the Construction Drawings that is damaged shall be immediately repaired in a manner acceptable to the Owner's Representative and at no additional cost to the Owner.

7. If trench or other Work will be within 10 feet of any existing electrical utility, either aboveground or belowground, lockout/tagout is required. Provide 24-hour's prior notice to the Owner's Representative of planned excavations of this type. Coordinate with the Owner and the applicable utility companies to arrange for and perform this lockout/tagout.

8. Notify the Owner's Representative immediately if any existing utilities that were not indicated on the Construction Drawings are encountered during excavation.

9. Equipment and methods shall be utilized to protect the integrity of all liner/cover materials. The Owner's Representative may inspect for damage at any time. Repair damage as directed by the Owner's Representative and modify construction methods to prevent further damage. Damage to liner/cover systems, in the opinion of the Owner's Representative, caused by the Contractor's excavation over or adjacent to liner/cover shall be repaired at the Contractor's expense.

PART 2 PRODUCTS

2.01 MATERIALS

A. On-site fill material: Material shall be free from unsuitable material.

B. Imported fill material: Material shall be free from unsuitable material and:

1. Maximum particle size shall be 6 inches in any direction. Larger-sized particles may be removed through screening or segregation during excavation.

2. Imported fill material shall meet the Washington Department of Transportation (WSDOT) standard specifications for Common Borrow (WSDOT 2016 Standard Specification 9-03.14(3)).

C. Pipe bedding material: Pipe bedding material shall meet the WSDOT standard specifications of Gravel Backfill for Pipe Zone Bedding (WSDOT 2016 Standard Specification 9-03.12(3)).

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D. Water: water shall be of potable water quality, free of debris, contaminants, and other objectionable matter. Water containers shall be clean and free of debris, contaminants, and other objectionable matter. See Article 3.06.

2.02 SOURCE QUALITY CONTROL

A. Imported fill material is subject to the following requirements:

1. All tests necessary for the Contractor to locate an acceptable source of imported fill material shall be made by the Contractor and submittals provided as stated above.

2. No materials shall be delivered to the site until the proposed materials have been accepted in writing by the Owner's Representative.

3. Final acceptance shall be based on tests made on samples of material taken from the completed and compacted course. All testing for final acceptance shall be approved by the Owner's Representative.

4. If additional testing conducted by the Owner's Representative (as part of the CQA) indicate that the material does not meet Specification requirements, material placement shall be terminated until corrective measures are taken. Material not conforming to the Specification requirements that is placed on site shall be removed and replaced at the Contractor's sole expense. Sampling and testing performed by the Owner's Representative due to failure of the materials to meet these Technical Specifications shall be done at the Contractor's sole expense.

B. Preconstruction material quality evaluations shall be performed by the Contractor. The Owner's Representative will be provided the opportunity to review all of the Contractor's preconstruction test results for acceptance and to classify the materials prior to incorporation in the Work.

PART 3 EXECUTION

3.01 GENERAL

A. Equipment

1. All equipment and tools used in the performance of this Work are subject to the approval of the Owner's Representative before Work is started.

2. Provide compaction equipment appropriate for the material types to obtain the densities specified.

3. Provide hand-operated compaction equipment in areas closer than 2 feet to structures to obtain the compaction densities specified.

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4. Operate compaction equipment in accordance with the manufacturer's instructions and recommendations. If inadequate densities are obtained, provide larger and/or different types of equipment at no additional cost to the Owner.

5. Provide equipment for applying water of a type and quantity adequate for the Work, free of leaks and equipped with a distributor bar or other approved device to ensure uniform application.

6. Provide equipment for mixing and drying out material, such as blades, discs, or other approved equipment.

7. Provide equipment to control track out. Any track out noted by the Contractor, Owner's Representative, or Owner shall be cleaned by the Contractor.

8. Where compaction is required for materials directly over geomembrane (such as in the geomembrane anchor trench), a layer of geotextile shall be in place prior to filling. Compaction shall be achieved using a nonvibratory roller.

B. Verification of conditions

1. Verify all lines, limits, and grades prior to beginning construction activities. Adjust as necessary to accommodate settlement that may have occurred between the design survey and construction.

2. Verify that the survey control system is installed and properly protected from construction operations prior to earthwork.

3.02 TRENCHING

A. For excavations related to embankments and pond subgrade, see Section 31 00 00 – Earthwork.

B. Protect bottoms of all trenches from freestanding water and frost. All soils in trenches or where fills will be placed shall be protected from movement or other damage due to frost penetration. Soil backfill, insulation, heat, or other methods acceptable to the Owner's Representative shall be used to protect soils during periods of the year in which frost penetration is possible.

C. Limits of trenches

1. Excavate to lines, grades, and dimensions shown on the Construction Drawings.

2. Minimize excavation beyond limits shown on the Construction Drawings.

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D. Trenches shall not be left open after the Contractor has stopped Work for the day. Trenches shall be secured with the use of steel plates, fencing, barriers, or a combination thereof.

E. In trenches, proper provisions shall be made for pipe installation inspection and any other Work required in the excavation (such as compaction testing). Bottoms of trenches shall be level, clean, and clear of loose materials, trash, and debris.

F. Walls of trenches below the elevation of the crown of the pipe shall be maintained as vertically as possible. Where the trench excavation exceeds a depth of 4 feet, the trench walls shall be sloped or structurally retained with trench boxes or sheeting, shoring, and bracing systems.

G. Hand-trim excavation. Remove loose matter; water-softened subgrade, lumped subsoil, boulders, and rocks.

H. Excavated material meeting the requirements for on-site fill material may be placed as backfill material. Excavated material unsuitable for reuse shall be hauled off site and properly disposed of.

I. Limits of excavation

1. Excavate to lines, grades, and dimensions shown on the Construction Drawings.

2. Minimize excavation beyond limits shown on the Construction Drawings.

3.03 OVER-EXCAVATION AND REPLACEMENT OF UNSUITABLE MATERIAL

A. If during the excavation for elements of the Work, unsuitable material is encountered at the base of the trench, over-excavation may be required.

B. Any Work associated with the over-excavation and replacement of unsuitable materials shall only be performed on the written approval of the Owner's Representative.

C. When approved, over-excavations for replacement of unsuitable material shall be completed in 1-foot-vertical increments. Notwithstanding other factors, this excavation shall be completed in accordance with Article 3.02 of this Section.

D. The Contractor shall be responsible for the stability of the trench during over-excavation, which may include additional shoring.

E. Over-excavation shall be replaced using imported fill material or on-site fill material, unless otherwise directed by the Owner's Representative, and compacted as required in this Section.

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F. If the over-excavation is a result of the Contractor's means and methods or due to the Contractor's negligence, the Contractor shall correct all unauthorized over-excavated areas at their sole expense.

G. This Work shall be tracked and paid for under the Schedule 1 or Schedule 2 Additive Bid Items. Quantities of unsuitable material replaced shall be maintained by the Contractor for submission upon the request of the Owner's Representative.

3.04 STOCKPILING

A. Stockpile materials in a manner that segregates different material types in different stockpiles as directed by the Owner's Representative. The Contractor shall identify those stockpiles that are to be sorted, crushed, or screened.

B. Materials shall only be stockpiled in the Owner-designated staging/stockpiling area shown on the Construction Drawings. Any stockpiles outside of the Owner-designated staging/stockpiling area must be approved by the Owner's Representative.

C. Before stockpiling any materials, the surface below the stockpile shall be cleared of vegetation, rocks, or other debris.

D. Care shall be taken to prevent the contamination or deterioration of all stockpiled materials during construction, storage, and handling.

E. Protect Owner-designated staging/stockpiling area.

1. All stockpiles shall have erosion control best management practices in place prior to any stockpiling.

2. Direct surface water away from the stockpile sites so as to prevent erosion or deterioration of materials.

3. The stockpiles must not be allowed to become contaminated with mud or other material.

4. If the surrounding ground is wet and soft, or for any reason contaminants are carried into the stockpile, the Contractor shall provide and place granular material on the haul routes at no additional cost to the Owner and provide means of keeping the equipment tires clean.

5. All costs for storing, protecting, re-handling, and placing stockpiled material shall be considered incidental to the construction.

6. If the stockpiled material becomes too wet, contaminated, or otherwise unusable during stockpiling, removal, handling, and/or placement, the Contractor shall dispose of it and replace with an equal amount of material acceptable to the Owner's Representative.

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7. All costs for replacement of contaminated or unusable materials due to the Contractor's actions or inaction, as determined by the Owner's Representative, will be borne solely by the Contractor.

F. Stockpiles shall be made such that maximum long-term slope ratio is 3 horizontal to 1 vertical.

G. The Contractor shall maintain Owner-designated staging/stockpiling area during the Contract period in a neat and free-draining condition that prevents stormwater sediment transport.

H. Upon completion of the Work, the Contractor shall inventory all Contractor-imported materials remaining on site and coordinate with the Owner's Representative and Owner if any of these materials may be utilized in other portions of the Owner's property. If they are unable to be reused, the Contractor shall bear all costs for removing any remaining Contractor imported materials from the site. Payment shall not be made for materials that have not been incorporated in the Work unless they are otherwise specified or called for in the Construction Drawings. Leave -designated staging/stockpiling area in clean and neat condition after materials are removed. Grade site surface to prevent freestanding surface water.

I. Any materials deemed unsuitable for the Work and not used shall remain the responsibility of the Contractor during the duration of the Work. The Contractor shall off-haul, dispose of properly, and clean the areas used for stockpiling at the conclusion of the Work at no additional costs to Owner.

3.05 PLACING AND COMPACTION OF MATERIALS

A. Pipe bedding:

1. The minimum thickness for pipe bedding under the conveyance pipe shall be 6 inches, unless otherwise shown on the Construction Drawings. Hand-grade and compact each lift of bedding material to provide a firm, unyielding surface. Check grade and correct irregularities in bedding material. Loosen the top 1 to 2 inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe.

2. Excavate in bedding at each pipe connection to permit proper assembly and inspection of connection and to provide uniform bearing along the barrel of the pipe. Install to form a continuous and uniform support.

3. Restrain the pipe as necessary to prevent movement of the pipe during backfill operations. The thickness of the pipe zone above the pipe crown is 6 inches, unless otherwise shown on the Construction Drawings.

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4. Place bedding material simultaneously in lifts on both sides of the pipe and, if applicable, between pipes installed in a common trench. Haunching shall be placed in loose layers no greater than 8 inches or 3/4 of the pipe diameter, whichever is smaller. Handwork bedding material under the barrel of the pipe or conduit without displacing the pipe. Material shall be placed by hand-tamping to ensure the material is well consolidated on both sides of the pipe.

5. Thoroughly tamp each lift, including the area under haunches, with handheld tamping bars supplemented by "walking in" and slicing material under the haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.

6. After the full depth of the material has been placed as specified, compact the material by a minimum of three passes with a handheld vibratory plate compactor over the area between the sides of the pipe and the trench walls.

7. Pipe joining and placement shall be per Section 33 31 19 – Agricultural Waste Utility Piping.

B. Trench backfilling

1. Do not place fill materials until preparation of the underlying surface has been completed and has been accepted by the Owner's Representative.

2. Place fill materials to the lines and grades shown on the Construction Drawings.

3. Fill materials shall not be placed over wet, frozen, or unstable subgrade surfaces.

4. Stop fill placement temporarily during unsuitable weather conditions, or as approved by the Owner's Representative. Fill materials that do not meet specified moisture content shall not be placed, spread, or compacted. When Work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate the moisture content is within the specified tolerances. Moisture content ranges indicated in this Section represent the moisture content required at the time the material is undergoing compaction.

5. If, in the opinion of the Owner's Representative, the underlying surface is not suitable for subsequent fill placement, the underlying surface shall be corrected. Additional Work shall include, but not be limited to, the following:

   a) If the underlying surface of any layer of the fill is too dry and/or too smooth to bond properly with the layer of material to be placed

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thereon, moisten and/or scarify to provide a satisfactory bonding surface before the next layer of fill material is placed.

b) If the underlying surface of any layer of the fill is too wet, remove and allow drying and/or scarifying in place to reduce the moisture content to the required amount in accordance with the requirements in the Contract Documents. Recompact before the next layer of fill is placed.

6. Do not allow backfill to freefall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of the pipe.

7. Do not use power-driven impact-type compactors for compaction until at least 3 feet of backfill is placed over the top of the pipe.

C. Compaction

1. Each layer of the trench backfill (inclusive of both pipe bedding and on-site or import fill material) shall be compacted to 92% of the maximum density as determined by ASTM D1557 (Modified Proctor). Horizontal layers shall not exceed 6 inches in depth before compaction. In the top 2 feet, horizontal layers shall not exceed 4 inches in depth before compaction. No layer below the top 2 feet shall exceed 8 inches in depth before compaction.

2. The Contractor shall procure a CQC testing firm to confirm that the Contractor is meeting the compaction requirements. This testing shall be completed using a nuclear density gauge (ASTM D6938) at the minimum testing frequency of once per 100 linear feet of trench. The results of this testing shall be included in the Contractor's Daily Construction Report (Section 01 32 00 – Construction Progress Documentation).

3. If the Contractor cannot attain the specified densities with the maximum lift thicknesses specified, the lift thickness shall be reduced and/or heavier compaction equipment shall be provided. Adjustments to achieve compaction shall be at no additional cost to the Owner.

D. Surface restoration

1. Finished grades shall be within plus or minus 0.1 foot from required elevations unless otherwise noted.

2. After each section of the trench is completed, the surface shall be restored to its original condition or finished as otherwise required for additional Work.

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3. Gravel roadway surfaces disturbed during construction shall be restored with crushed surfacing material.

3.06 NOT USED

3.07 ACCEPTANCE

A. The Contractor shall cooperate with the Owner's Representative in the performance of compaction and gradation testing performed for quality acceptance purposes.

B. The Contractor retains all Ownership and responsibility for the earthwork until written acceptance by the Owner's Representative.

C. The Owner's Representative shall accept earthwork when:

1. Conformance test results meet the requirements of the Contract Documents.

2. Required documentation from the field and laboratory testing laboratories has been received and accepted.

3. All repairs have been completed to the Owner's Representative's satisfaction.

4. Written Certification Documents have been received by the Owner's Representative.

5. All required documentation from the material supplier and Contractor has been received and accepted.

6. The material installation and compaction are complete.

7. The Contractor has submitted to the Owner's Representative all written Certification Documents and reports required by this Section.

END OF SECTION 31 23 33

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SECTION 33 31 19
AGRICULTURAL WASTE UTILITY PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes Work to:

1. Construct the under-liner gas vent system piping improvements and connect the piping to the new lagoon liner system.

2. Connect conveyance piping to the new lagoon liner system.

3. Install conveyance piping appurtenances.

B. Gas vent pipe shall be constructed using High Density Polyethylene (HDPE) pipe and fittings.

C. This work is included as parts of, but not limited to:

1. Bid Item Number 6: Procure and Install Geocomposite Venting System.

2. Bid Item Number 11: Install and Seal Pipe Penetration(s) to Liner System.

3. Bid Item Number 12: Procure and Install Gate Valve(s).

1.02 RELATED SECTIONS

A. The work of the following sections is related to the work of this section. It is the Contractor's responsibility to perform all work required by the Contract Documents. Other sections not referenced below may also be related to the proper performance of this work.

1. Section 31 00 00 – Earthwork

2. Section 31 05 19.16 – Geomembranes for Earthwork

3. Section 31 05 19.23 – Geosynthetic Clay Liners

4. Section 31 23 33 – Trenching and Backfilling

1.03 REFERENCES

A. The referenced publications form a part of this Section. The publications are referenced in the text by basic designation only. The version of the publication and test method in effect at the time of bidding shall be applicable in all cases.

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B. American National Standards Institute (ANSI):

1. B16.5 Standards for Pipe Flanges and Fittings

C. American Water Works Association (AWWA):

1. C219-01 Bolted, Sleeve-Type Couplings for Plain-End Pipe

D. ASTM International:

1. A36: Carbon Structural Steel
2. A760: Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
3. A762: Corrugated Steel Pipe, Polymer Pre-coated for Sewers and Drains
4. A849: Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
5. B418: Cast and Wrought Galvanic Zinc Anodes
6. B443: Concrete Pipe and Manholes, Using Rubber Gaskets
7. B745: Corrugated Aluminum Pipe for Sewers and Drains
8. D638: Standard Test Method for Tensile Properties of Plastics
9. D695: Standard Test Method for Compressive Properties of Rigid Plastics
10. D326: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for PE Plastic Pipe and Tubing
11. D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
12. F714: Standard Specification for Polyethylene Plastic Pipe (SDR-PR) Based on Outside Diameter
13. F1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled PE Pipe and Tubing

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. Prior to shipping any material to the site, submit the following:

1. Manufacturer's product data including pipe, pipe accessories, valves, and appurtenances. Provide manufacturer's certificates for materials that meet

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or exceed the Specifications. Certifications shall be submitted to the Owner's Representative by the Contractor prior to pipe installation.

C. Prior to fabrication of pipe components, submit the following:

1. Shop Drawings for fabricated fittings or assemblies.

2. Pipe fabricator's qualifications and certifications with applicable standards.

D. Prior to installation of any components, submit the following:

1. Pipe installer's qualifications for fusion welding of HDPE pipe.

2. Plan(s) showing pipe installation sequence and schedule.

1.05 OWNER'S REPRESENTATIVEQUALITY CONTROL

A. Contractor shall perform the Work in accordance with Section 01 43 00 – Quality Assurance and Control. The Specifications apply to quality control and not to quality assurance.

B. Contractor shall be responsible for Construction Quality Control (CQC). Contractor shall engage and pay for the services of qualified staff or a qualified subcontractor to perform CQC for monitoring and documenting the quality of the HDPE pipe and fittings in accordance with the Contract Documents.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Labeling: The following information shall be continuously marked on the pipe and spaced at intervals not to exceed 5 feet:

1. Name and/or trademark of the pipe manufacturer.

2. Nominal pipe size.

3. Standard dimensional ratio (SDR)/Schedule.

4. Material classification.

5. Manufacturing standard reference.

6. A production code from which the date and place of manufacture can be determined.

B. Transportation of any pipe not already on site is the responsibility of the Contractor, who shall be liable for all damages prior to and during transportation to site.

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C. During shipment and storage, pipe shall be wrapped in relatively impermeable and opaque protective covers.

D. Inspect materials delivered to the site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective coverings. Store pipe and fittings in a flat, horizontal position and under cover out of direct sunlight. Do not sort materials directly on the ground. Keep the inside of piping free of dirt and debris.

E. Handling, storage, and care on site are the responsibility of the Contractor prior to, during, and after installation. Handle pipes, fittings, and other accessories in a manner that ensures delivery to the point of installation in sound, undamaged condition. Do not drop pipe. Carry, do not drag, pipe to the point of installation.

1.07 QUALIFICATIONS

A. The pipe installer shall be qualified by experience in installation of HDPE pipe.

B. Contractors are considered qualified by installing a minimum combined total of 1,000 feet of HDPE pipe using thermal fusion joining on at least three separate projects.

C. The person/persons performing pipe joining by butt-fusion welding shall be certified as capable of conducting butt-fusion welding by the pipe manufacturer or manufacturer's authorized representative.

PART 2 PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE MATERIAL

A. HDPE pipe and fittings shall be extruded from an extra-high molecular weight, high-density polyethylene (HDPE) compound conforming to ASTM D3350 for a PE4710 material with a cell classification as shown in Table 1 or better. This material shall have a compressive yield strength of 1,600 pounds per square inch (psi) when tested and analyzed by ASTM D695 and a tensile yield strength of 3,200 psi when tested and analyzed by ASTM D638.

Table 1. Material Specifications

System	Nominal Diameter	Standard Dimensional Ratio	ASTM D3350 Cell Classification
HDPE	All Diameters	32.5	445574C

B. The HDPE compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by pre-compounding in a concentration of not less than 2%.

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C. The manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe and fittings for this project.

D. HDPE products shall contain no recycled compounds except those generated in the manufacturer's own plant from resin of the same specifications from the same raw material supplier.

2.02 HIGH DENSITY POLYETHYLENE PIPE

A. HDPE pipe meeting the requirements of this Section shall be used for conveyance piping as shown on the Construction Drawings.

B. Pipe and fittings shall be of the nominal diameter shown on the Construction Drawings. All pipe sizes, either solid or perforated, shall conform to ASTM F714.

C. The HDPE pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other injurious defects. Any pipe with nicks, scrapes, or gouges deeper than 5% of the nominal wall thickness shall be rejected. The pipe shall be uniform in color, opacity, density, and other physical properties.

D. Joints and pipe connections shall be joined thermal butt-fusion. No mechanical couplings shall be used unless shown on the Construction Drawings or approved by the Owner's Representative.

2.03 HIGH DENSITY POLYETHYLENE FITTINGS

A. HDPE fittings shall be molded or fabricated from HDPE pipe having the same SDR as the pipe connecting to the fitting. HDPE fittings shall be molded, for sizes 6 inches and smaller, if manufactured as a standard item. All other HDPE fittings shall be fabricated from HDPE pipe by means of thermal butt-fusion unless otherwise noted. Fabricated and molded fittings shall have complete joining compatibility with the pipe it is to be connected to.

B. All molded HDPE fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest Specifications. All fabricated HDPE fittings shall have the same or higher pressure rating as the adjoining pipe when installed in accordance with the manufacturer's recommendations.

2.04 HDPE PIPE CONNECTIONS

A. HDPE pipe joints and connections shall be joined by thermal butt-fusion or electrofusion, except where shown on the Construction Drawings or approved by the Owner's Representative. Mechanical couplings shall not be used in below-grade applications, except where shown on the Construction Drawings or in permanent above-grade or temporary applications as approved by the Owner's Representative.

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2.05 GATE VALVES

A. See Construction Drawings for gate valve type, dimensions, and locations.

2.06 VALVE BOXES

A. Valve boxes shall conform to the Construction Drawings and be extendable to obtain the depth required. All gate valves shall be installed in valve box with a vandal-resistant lid as shown in the Construction Drawings.

2.07 FLEXIBLE COUPLINGS

A. See Construction Drawings for flexible coupling type, dimensions, and locations.

2.08 GAS VENT PIPES

A. Construct all gas vents from the materials equal to the primary geomembrane liner, as shown on the Construction Drawings and in accordance with Section 31 05 19.16 – Geomembranes for Earthwork.

2.09 PIPE BOOTS AND LINER PENETRATION SEALING SYSTEM

A. Construct all pipe penetrations from the same geomembrane material as the primary geomembrane liner as shown on the Construction Drawings and in accordance to Section 31 05 19.16 – Geomembranes for Earthwork.

2.10 ELECTROFUSION COUPLING

A. Electrofusion couplings shall be used where shown on the Construction Drawings, in situations where welding machine access is difficult or impossible, or as determined by the Owner's Representative.

B. Electrofusion couplings shall be a rigid straight coupler constructed from injection-molded HDPE with embedded heating coils. Electrofusion couplings shall be manufactured in accordance with ASTM F1055. Electrofusion couplers shall be Frialen Straight Couplers, as manufactured by Friatec, or an approved alternate.

PART 3 EXECUTION

3.01 CONFORMANCE TESTING

A. Samples of fusion welding, if required by the Owner's Representative, will be done by the Contractor at the direction of the Owner's Representative. The initial testing performed will be included in the bid price. In the case of material failures, retesting will be at the Contractor's expense until materials meet the Specifications.

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3.02 PIPE PLACEMENT

A. Install only that amount of pipe that can be backfilled in same day.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions and industry standards listed above.

C. Place pipe on prepared pipe bedding layer as shown on the Construction Drawings.

D. Buried pipe installation.

1. Buried piping shall be laid to the grades and alignment shown on the Construction Drawings, and all trenching, bedding, and backfilling shall conform to the applicable requirements of Section 31 21 33 – Trenching and Backfilling.

E. Pipes shall be free from burrs, nicks, gouges, surface cracks, or defects. Pipe shall be open, clean, and free-draining.

F. Where fittings are omitted from the Construction Drawings, they shall be the same size as the adjacent piping.

G. Open pipe ends shall be securely closed when the work is not in progress.

H. The piping shall be placed when trench and weather conditions are suitable, as determined by the Contractor and Owner's Representative.

I. The Contractor shall not backfill before the Owner's Representative has reviewed and approved all pipe in place as to line, grade, bedding, and proper joint construction.

J. The Contractor shall be responsible for preventing damage to or misalignment of the pipe.

K. Unless otherwise shown on the Construction Drawings, all buried piping shall have cover of at least 2.5 feet between the top of the pipe and the finished surface.

L. All changes of grade and alignment from the design shall require approval by the Owner's Representative.

M. No pipe shall be laid in water, and the Contractor shall provide for the diversion of drainage and dewatering of trenches during construction, including meeting all safety and environmental requirements.

N. The Contractor shall notify the Owner's Representative 10 days prior to scheduled tie-in to existing conveyance systems or structures.

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3.03 HDPE PIPE JOINING

A. HDPE pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations.

B. HDPE pipe and fitting connections shall be joined by thermal butt-fusion and be of the same type, grade, and class of HDPE compound and supplied from the same raw material supplier. Butt-fusion of pipes and fittings shall be performed in accordance with ASTM D3261 and the pipe manufacturer's recommendations.

C. Butt-fusion of HDPE pipe shall be done with equipment recommended by the pipe manufacturer. Butt-fusion equipment shall meet the pipe manufacturer's recommended fusion temperature, pressure, and alignment.

D. Butt-fusion joining shall be 100% efficient, offering a joint weld strength equal to or greater than the tensile strength of the pipe. Solid HDPE pipe shall have airtight joints.

E. Where used, electrofusion couplings shall be installed in accordance with the manufacturer's recommendations.

F. Prior to backfilling over all electrofusion coupling joints, the Contractor shall survey the location and elevation at top of pipe for as-built purposes. The survey point shall be labeled as "EFJ#" for Electro-Fusion Joint followed by the distinct number per joint.

G. The pipe ends to receive the couplings shall be finished to the outside diameter and surface finish required by the coupling manufacturer.

H. Provide secure connection of HDPE piping, using fittings or couplings as shown on the Construction Drawings.

3.04 GATE VALVE AND VALVE BOX INSTALLATION

A. Upon delivery at the work site, all valves shall be opened to prevent the collection of water in the valve. Valves shall have the interiors cleaned of all foreign matter and shall be inspected both in open and closed position prior to installation. Valves and valve boxes shall be set plumb and valve boxes shall be placed over the valve or valve operator in a manner that the valve box does not transmit shock or stress to the valve. Backfill shall be carefully tamped around the valve box to a distance of 3 feet on all sides or to the undisturbed face of the trench if it is closer. The valve box cover shall be set flush with finished surface.

3.05 GAS VENTING

A. Penetrate liner where gas venting is shown on the Construction Drawings, in accordance to Section 31 05 19.16 – Geomembranes for Earthwork.

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B. Piping shall be constructed of HDPE, in accordance to the dimensions shown on the Construction Drawings

C. Weld pre-fabricated or field fabricated assembly to the geomembrane as shown on the Construction Drawings to prevent leakage. Weld the pipe boot to the HDPE pipe, as shown in the Construction Drawings. Once complete, test the weld assembly via non-destructive testing (Section 31 05 19.16 – Geomembranes for Earthwork).

3.06 PIPE PENETRATION

A. The boots shall be welded along seams and to the primary geomembrane liner as shown in the Construction Drawings to provide a leak-free attachment.

B. Weld the prefabricated or field fabricated assembly to the geomembrane as shown on the Construction Drawings to prevent leakage. Once complete, test the weld assembly via non-destructive testing (Section 31 05 19.16 – Geomembranes for Earthwork).

3.07 FLEXIBLE COUPLINGS

A. Install flexible couplings to each pipe end in accordance with manufacturer instructions.

3.08 ALLOWANCE FOR THERMAL EXPANSION/CONTRACTION

A. HDPE has a coefficient of thermal expansion of 1.2 x 10-4 per °F; therefore, exposed pipe must be installed with the ability to expand and contract between anchored points.

3.09 CLEANING

A. All existing or new piping systems shall be cleaned and tested in accordance with the manufacturer's recommendation and as specified herein.

B. Prior to testing, solid pipelines shall be cleaned to remove shavings, welding slag, dirt, construction debris, and other foreign material and flushed with clean water at a minimum velocity of 3 feet per second.

C. Collect and manage flush water as necessary; do not discharge flush water into or within 50 feet of storm drainage systems.

3.10 SOLID PIPE LEAK TEST

A. Demonstrate, to the satisfaction of the Owner's Representative, that fusion welded piping and piping connected using flexible couplings are leak-proof. Tests shall generally occur after backfilling the piping.

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3.11 ACCEPTANCE

A. The Contractor retains all Ownership and responsibility for the installed pipe and fittings until written acceptance by the Owner's Representative.

B. The Owner's Representative will accept the pipe and fittings when:

1. Conformance test results meet the requirements of the Contract Documents.

2. All repairs have been completed to the Owner's Representative's satisfaction and at no cost to the Owner.

3. Written certification documents, including Construction Drawings indicating as-built conditions have been received by the Owner's Representative.

4. All required documentation from the material supplier and Contractor has been received and accepted.

5. Reports verifying completion of all quality control testing have been received in accordance with this Section.

6. The Contractor has submitted to the Owner's Representative all written certification documents and reports required by this Section.

END OF SECTION 33 35 10

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Appendix D
Construction Quality Assurance Plan

March 4, 2019
H&S Bosma Dairy Lagoon No. 6
Administrative Order on Consent Docket No. SDWA-10-2013-0080

ANCHOR QEA

H&S Bosma Dairy Lagoon No. 6 Construction Quality Assurance Plan

Prepared for Liberty/H&S Bosma Dairies

March 4, 2019
H&S Bosma Dairy Lagoon No. 6
Administrative Order on Consent Docket No. SDWA-10-2013-0080

H&S Bosma Dairy Lagoon No. 6 Construction Quality Assurance Plan

Prepared for
Liberty/H&S Bosma Dairies
4300 Beam Road
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Prepared by
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APPENDICES

Appendix A Construction Documentation Forms
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ABBREVIATIONS

ASTM	ASTM International
CHASP	Construction Health and Safety Plan
CQA	Construction Quality Assurance
CQAP	*Construction Quality Assurance Plan*
CQC	Construction Quality Control
CQC Plan	Construction Quality Control Plan
EPA	U.S. Environmental Protection Agency
GC	General Contractor
GCL	geosynthetic clay liner
HDPE	high-density polyethylene
mil	thousandth of an inch
OR	Owner's Representative
Owner	H&S Bosma Dairy
QA	quality assurance
QC	quality control

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1 Introduction

This *Construction Quality Assurance Plan* (CQAP) for the grading and lining of H&S Bosma Dairy Lagoon No. 6 was prepared by Anchor QEA, LLC, on behalf of Liberty/H&S Bosma Dairies as part of the 100% lagoon lining design.

1.1 Purpose

The purpose of this document is to provide construction quality assurance (CQA) during construction of the liner system to confirm that the liner it is installed in accordance with the *Construction Drawings* (Anchor QEA 2019a), *Technical Specifications* (Anchor QEA 2019b), and manufacturer recommendations. It also identifies the responsibilities during construction and performance monitoring of the construction activities in accordance with the 100% design documents through a quality assurance (QA) program. Furthermore, it delineates the QA methods and protocols for project personnel to confirm they have a complete understanding of monitoring, feedback, and adjustment mechanisms. Construction quality control (CQC) is the responsibility of the Contractor and will be conducted in accordance with the *Technical Specifications* and detailed in their Construction Quality Control Plan (CQC Plan), described in Section 4.1.2.1. Definitions of CQA and CQC are provided in Section 1.2.

1.2 Quality Control and Quality Assurance Defined

In the context of this document, CQC and CQA are not equivalent. Instead, CQC and CQA are defined as follows:

- CQA is a planned and systematic pattern of actions intended to yield confidence that the materials and procedures conform to the *Construction Drawings* and *Technical Specifications* and any applicable regulatory requirements. CQA will be provided by Anchor QEA on behalf of the Owner (Liberty Dairy). Because field conditions are variable and difficult to control, CQA is a critical component of an overall quality assurance program.
- CQC refers to actions taken by the Contractor (including parties charged with the manufacture, fabrication, delivery, and installation of the materials) to determine and sometimes quantify the characteristics of the product. The results of a quality control program are compared to the *Technical Specifications* or other contractual or regulatory requirements. During the handling of the materials, CQC is provided by the manufacturer, fabricator, supplier, and Contractor, as appropriate, to confirm that the materials and craftsmanship conform to the *Construction Drawings* and *Technical Specifications*. The Contractor will perform the work in accordance with Specification Section 01 43 00 – Quality Assurance and Control and will support CQA activities as described therein.

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1.3 Construction Components

A brief description of major work/construction activities that will occur during the project is presented below. This document is directed to the CQA of the various construction components of the project, as is described in the following paragraphs.

Lagoon No. 6 will be constructed within its current footprint, as shown in the *Construction Drawings*. Lagoon No. 6 will be lined with the following layers, from bottom to top:

- **Prepared subgrade** consists of compacted existing embankment or screened embankment meeting the requirements of the *Construction Drawings* and *Technical Specifications* if placed as fill. The work includes screening out oversized material larger than three-eighths of an inch, leveling, compacting, and smoothing the soil surface to remove protrusions prior to placement of the leak detection system, geocomposite gas venting, and geosynthetic clay liner (GCL).
- **Geocomposite gas venting** is a composite drainage material consisting of polymer drainage core protected by a geotextile. The geocomposite strips are located under the GCL and allows any gas buildup from the subgrade to be vented to the surface.
- **Geotextile** is a separation and protection layer placed above the prepared subgrade and below the GCL at the direction of the Project Engineer. Its use will be based on subgrade properties.
- **GCL** is a barrier layer consisting of a bentonite clay or other very low-permeability clay material, supported by geotextiles that are held together by needling, stitching, and/or chemical adhesives, located directly above the prepared subgrade.
- **Geomembrane** is a barrier layer consisting of a smooth 60-thousandth of an inch (mil) high-density polyethylene (HDPE), located directly above the GCL.
- **Anchor system** consists of a continuous compacted soil trench that will be constructed as part of the double liner system to terminate and secure the liners along the perimeter of the lagoon.
- **Piping** consists of HDPE pipe sealed to the primary liner for the lagoon inlets and outlets.

1.4 Plan Organization

The remainder of this CQAP is organized as follows:

- **Section 2 – Project Role and Responsibilities.** This section identifies the roles, responsibilities, and authorities of the parties involved in the construction and quality control (QC).
- **Section 3 – Quality Assurance Program.** This section describes the QA measures, inspection and verification activities, and contingency actions for each component of the liner system.

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- **Section 4 – Documentation, Meetings, and Reporting.** This section outlines documentation requirements for construction QA activities, including daily summary reports, as well as procedures, documentation, and reporting for project modifications and change orders.
- **Section 5 – References.** This section provides references for the materials cited in this report.

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2 Project Role and Responsibilities

2.1 Roles and Responsibilities of Key Parties

The roles and responsibilities of key parties are described in the following subsections.

2.1.1 Owner (H&S Bosma Dairy)

The Owner is the primary responsible party for construction. The Owner has ultimate responsibility for implementing and ensuring that the design criteria are met. The Owner, or their consultant, will be responsible for construction management and contract administration. The Owner will hire the General Contractor (GC) and, indirectly, its subcontractors specializing in the required construction activities. The Project Engineer and Owner's Representative (OR) will also be contracted by the Owner to fulfill the responsibilities identified in the following subsections.

2.1.2 Project Coordinator (Anchor QEA)

The Project Coordinator is responsible for administration of all actions by the Owner required by the Consent Order and has overall authority over the project team. The Project Coordinator will be responsible for ensuring that the construction is performed according to the approved *Construction Drawings* and *Technical Specifications*. In addition, the Project Coordinator will ensure that any changes to the approved *Construction Drawings* and *Technical Specifications* necessitated by field conditions are approved by the U.S. Environmental Protection Agency (EPA) prior to implementation in accordance with Consent Order Paragraph 45.

2.1.3 Project Engineer (Anchor QEA)

The Project Engineer is the project designer. Responsibilities include design engineering, design modifications, clarification of design intent, and field engineering. The Project Engineer will communicate with the Owner, OR, Contractor, and Project Coordinator and review submittals, Daily Field Reports, and meeting notes. The Project Engineer will do the following:

- Review the design, *Construction Drawings*, and *Technical Specifications* for the project, as well as any reports referenced in these documents.
- Review the CQAP for the project and confirm that any project-specific revisions are incorporated into the *Technical Specifications*.
- Administer the CQA Program, including the supervision of the on-site OR (and any other CQA personnel), weekly review of progress, review of all daily reports, review and interpretation of all laboratory test data, and engineering review of all aspects of the project during construction. The Project Engineer will provide periodic on-site support to the OR as needed, based on the activities being conducted.

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- Attend the Preconstruction Meeting, site progress meetings, and any other meetings as requested by either the Contractor or EPA.
- Review any changes to the design, *Construction Drawings*, or *Technical Specifications* necessitated by field conditions and report recommendations to the Owner and the Project Coordinator. After obtaining EPA approval, implement any changes to the design, *Construction Drawings*, or *Technical Specifications*.
- Review the As-Built Drawings prepared by the Contractor and confirm that all changes to the design made during construction have been properly applied.
- Oversee the generation of the Final Completion Report and certify the construction was completed in conformance with the *Construction Drawings*, *Technical Specifications*, Addenda, Work Change Directives, and this CQAP.

2.1.4 Owner's Representative

The OR will be on site full time and will be in direct charge of the CQA Program. The OR will be responsible for overseeing the implementation of the CQAP on site. In overseeing implementation of the CQAP, the OR is responsible for monitoring construction performance for compliance with construction performance standards and design requirements during implementation of the design; the OR is also responsible for overseeing the required inspection and verification activities. The OR will work closely with the Project Engineer, providing updates on the field activities and variances which require attention. The OR will do the following:

- Serve as the on-site CQA representative and supervises other on-site CQA personnel (such as the third-party materials laboratory checking compaction and the third-party liner CQA subcontractor), which may be brought in for inspections that require additional expertise.
- Review the quality of the materials and qualifications of personnel for conformance with the *Technical Specifications*.
- Review the CQAP, *Construction Drawings*, and *Technical Specifications* for the site and confirm that other CQA personnel are informed of the requirements of the work.
- Assign the daily responsibilities of CQA personnel to confirm that relevant activities of the Contractor are monitored and documented.
- Review daily reports by CQA personnel and prepare daily reports.
- Attend the Preconstruction Meeting and site Progress Meetings, in addition to any CQA-specific meetings necessary to review the installation and CQA activities.
- Collect and review documentation provided by the Contractor.
- Document and forward conformance samples to the laboratory, as appropriate, and review results for conformance and acceptability.
- Record on-site activities that could result in damage to the construction work.
- Prepare, with the Project Engineer, the Final Completion Report.

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In addition to the above, the OR regularly reports, on both a verbal basis and through periodic submittals of the daily and weekly reports, to the Project Engineer to confirm that any problems are identified on a timely basis and acted on to minimize any potential negative effects. Examples of forms that will be used by the OR are included in Appendix A. These forms may be modified as appropriate, based on the activity being reported on and through coordination with the Owner.

Additionally, subcontracted CQA field inspectors may be assigned to the project to confirm that the Contractor's activities are adequately monitored and documented (such as for compaction testing and inspection of the liner installation). The OR (and/or CQA field inspectors) will, at minimum, monitor the following activities and carry out the following duties within the scope of the overall CQA Program:

- Oversee materials logistics, including material handling, storage, and protection prior to deployment.
- Confirm that the materials received match the approved lot number and shipping papers provided by the Contractor.
- Examine soils (including on-site soils and soils delivered to the site) for use as components of the project and collect independent samples, if necessary, for laboratory testing to confirm conformance with the *Technical Specifications*.
- Monitor and document the liner installation.
- Monitor and document pipe installation and testing.
- Monitor deployment of all geosynthetic materials for damage or flaws, mark any such areas for repair, and document the location, size, time, and date of these activities.
- Monitor and document the seaming, joining, and overlap (as appropriate) of all geosynthetic materials.
- Perform a final walk-over of all completed areas before deployment of the overlying layer to confirm that, in the case of geosynthetics, all seams have been tested and flaws and damage have been identified, repaired, tested, and passed.
- Monitor and document all soils used in the lagoon lining system to confirm that the correct materials are used; specified thickness is maintained; and proper compaction is achieved with minimum material densities attained, as determined through in situ testing.
- Note and document on-site activities that could result in damage to the lining system and report to the Project Manager/OR so that corrective action can be expedited.
- Monitor and document the excavation, GCL and geosynthetics placement, backfilling, and compaction to meet specification requirements of all anchor trenches.

Appendix B includes a summary of the required construction inspection and verification activities and frequencies of inspections for each construction activity.

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2.1.5 General Contractor

The GC will be retained under direct contract with the Owner to perform the work described in the contract documents. The GC will do the following:

- Hold on-site responsibility for managing the construction and contract administration. The GC will have total authority and responsibility to deal with all contractual matters and to confirm that the work complies with the final *Construction Drawings* and *Technical Specification* requirements and provides all necessary QC information.
- Implement the design by either performing tasks or contracting with subcontractors. As part of the design implementation, the GC will be responsible for implementing the CQC Plan. Included with this responsibility is the implementation of the QC activities to confirm that project construction is conducted in accordance with the *Construction Drawings* and *Technical Specifications*.
- Provide all submittals discussed in the *Technical Specifications* for the approval of the Project Engineer and/or OR. The GC will be responsible for providing the submittals for approval with enough time as to not affect the project schedule (while awaiting approval). A list of submittals required by the GC is included in Appendix B.

The GC will use key personnel to help with the tasks described above, including an on-site superintendent, a CQC manager, and a health and safety manager.

The GC will either perform construction elements or contract with subcontractors to perform selected phases of the work for which they have special expertise. The subcontractors are responsible to the GC for the quality of their work, protection of the environment, and compliance with the GC-generated CQC Plan and Construction Health and Safety Plan (CHASP). The subcontractor's principals will designate a job foreman with responsibility to see that the work is conducted in accordance with the contract requirements.

2.2 Qualifications

Qualifications that will be required of the Project Engineer, OR, supporting CQA inspection personnel, and the GC firm and personnel are provided in Sections 2.2.1 and 2.2.2.

2.2.1 Project Engineer, Owner's Representative, and Supporting Construction Quality Assurance Inspector Qualifications

The Project Engineer and OR will be determined prior to start of work and will have experience managing synthetic liner construction projects with similar QA requirements. The OR will be required to have current federal and state health and safety training. Additionally, the Project Engineer and OR will be sufficiently familiar with the final design and the construction operations to recognize deviations from that design. Additional inspectors may be used to help the OR, and these inspectors

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will have experience inspecting construction activities for related projects and will have current federal and state health and safety training.

2.2.2 General Contractor Qualifications

The GC will employ, as part of its permanent organization, senior, knowledgeable, and experienced personnel to oversee the project. The journeyman operators, surveyors, and other GC personnel performing key jobs must also have the demonstrated ability and skills to satisfactorily perform their respective assignments.

The CQC manager and the GC must have documented qualifications and experience to perform independent checks on the GC's operations as necessary to determine compliance with the contract provisions. These documented qualifications will be submitted to the Owner for approval prior to identifying a CQC manager. Additionally, any subcontractors utilized in the work must have demonstrated to the Owner's satisfaction that they are qualified and have performed the type of work for which they will be engaged. However, responsibility for subcontractor performance rests with the GC.

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3 Quality Assurance Program

The QA program, which will be implemented during construction to confirm compliance with the approved design documents and *Technical Specifications*, is described in this section by construction component. Specific activities to be implemented during construction are described, along with specific performance objectives, performance criteria, QA measures, inspection and verification activities, and contingency actions. Major construction components include the following:

- Earthwork
- Leak detection system
- Geocomposite gas venting system
- Geotextiles
- GCL
- Geomembrane
- Pipes, fittings, and wall penetrations

During construction, the QA process will progress as follows:

- The GC will submit a CQC Plan as detailed in Section 4.
- The GC will provide documentation to the OR and Project Engineer to demonstrate that specific components of the final design have been properly implemented.
- The GC and the OR will conduct inspection and verification activities (i.e., testing and monitoring) to confirm compliance with the approved design documents.

3.1 Earthwork

This section discusses and outlines the CQA activities to be performed for earthwork activities at Lagoon No. 6. Earthwork activities include excavation, grading, subgrade preparation, fill placement and compaction, and anchor trench excavation and backfill. Prior to earthwork activities, the GC will submit a construction plan and schedule for each lagoon to the OR and Project Engineer for acceptance. This plan will include a description of the methods to be used for all material processing, excavation, backfilling, soil placement, compaction, and grading operations. The OR and Project Engineer will review this plan for conformance with the *Technical Specifications*.

3.1.1 Performance Objectives and Criteria

Performance objectives and criteria for earthwork tasks include the following:

- **Monitoring of Import Soil Material Quality.** Identify proposed sources of soil for fill and confirm that the proposed material meets the *Technical Specifications*.
- **Monitoring of Subgrade Preparation.** Confirm that the subgrade soil at each lagoon has been excavated, placed, graded, and compacted in a manner consistent with the *Construction Drawings* and *Technical Specifications*.

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- **Monitoring of Anchor Trench Construction.** Confirm that the anchor trench excavation at each lagoon for the geotextiles and backfill methods are consistent with the *Construction Drawings* and *Technical Specifications*.

3.1.2 Quality Assurance Measures, Inspection and Verification Activities, and Contingency Actions

QA measures described in this section will be implemented during earthwork activities at Lagoon No. 6 to confirm performance objectives are met and construction is completed per the *Construction Drawings* and *Technical Specifications*. Inspection and verification activities will be implemented and compared to criteria to determine if performance objectives have been achieved at Lagoon No. 6. If performance standards have not been achieved, the contingency actions will be implemented.

3.1.2.1 Monitoring of Import Fill Material Quality

If applicable after excavation activities, the Contractor will identify proposed sources of import fill material (if necessary) and submit test results to demonstrate that the proposed materials meet the *Technical Specifications*. The OR or the Project Engineer will review the soil material submittals and will determine if the material is in conformance with the *Technical Specifications* and either accept or reject the material. This review must be taken before any deliveries of the fill material to Lagoon No. 6.

Laboratory testing of the soil materials to be used will be carried out for the purpose of materials selection QA during construction operations. All testing will be done in accordance with the associated ASTM International (ASTM) standard or other procedures as listed in this CQA Plan and the *Technical Specifications*.

To confirm that the imported fill material meets the gradation listed in the *Technical Specifications*, the GC will collect samples for conformance testing from materials delivered to the site. The GC will be responsible for shipping samples to the laboratory responsible for conformance testing of soil materials. Additional testing may be performed by the OR (using a third-party materials laboratory) during construction for QA purposes. This testing confirms that the materials do not vary significantly or adversely during the work and that the materials consistently meet the *Technical Specifications*.

Table 1 summarizes the minimum frequency for collecting and testing imported fill material samples. Additionally, the OR will visually inspect import fill materials delivered to the site. If import fill materials do not meet requirements, the material may be rejected, and a different material will need to be obtained.

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Table 1
Import Fill Material Sampling and Testing Frequency

Test	Frequency
Unified Soil Classification System (Method ASTM D2487 or equivalent)	One per 2,000 cubic yards placed or three minimum for the project
Moisture Density Relationship (Method ASTM D2216 or equivalent)	One per 2,000 cubic yards placed or three minimum for the project
Particle Size (Method ASTM D422 or equivalent)	One per 2,000 cubic yards placed or three minimum for the project

3.1.2.2 Monitoring of Subgrade Preparation

During construction, the OR will monitor the subgrade excavation, soil placement, fine grading, and compaction at Lagoon No. 6 to confirm methods are consistent with the requirements specified in the *Technical Specifications* and *Construction Drawings*. The OR will monitor, at a minimum, that:

- Soft, organic, and otherwise undesirable material has been removed from Lagoon No. 6.
- The materials identified at Lagoon No. 6 for reuse as backfill are properly segregated and stockpiled.
- No soil particles greater than specified limits are exposed on the finished surface beneath any geosynthetic material (i.e., GCL or geotextile) at Lagoon No. 6.
- The subgrade surface of Lagoon No. 6 is smooth (free of clods, rocks, sticks, abrupt changes in grade, ruts, protrusions, standing water, sharp objects, and other conditions) and uniform by visually monitoring proof rolling activities and by the compaction testing conducted by the third-party CQA soils laboratory per the schedule presented in Table 2. The OR may elect to conduct their own compaction testing (using a third-party CQA soils laboratory).
- Prior to placement of any fill at Lagoon No. 6, it will be confirmed that the subgrade has been prepared (scarified, moisture-conditioned, and compacted, as appropriate) in accordance with Specification requirements.
- The subgrade soil and final grading at Lagoon No. 6 has been completed to the general lines and grades shown in the *Construction Drawings*.

Observations of the OR will be recorded on daily field monitoring report forms, including As-Built Drawings or photographs, as appropriate.

Regarding the placement of fill materials, the GC, OR, or third-party liner CQA subcontractor will be responsible for scheduling a third-party CQA soils laboratory, which will be responsible for providing in situ testing of the prepared subgrade after fill placement and compaction at Lagoon No. 6 to determine as-compacted properties and to confirm conformance with the *Technical Specifications* (through use of a nuclear moisture density gauge and the results of previously conducted proctor

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compaction tests). In situ testing frequency will be in accordance with Table 2. Regarding undisturbed in situ soils within the subgrade, the Contractor will proof-roll those areas; the OR will monitor the soils for yielding surfaces.

Table 2
In Situ Testing Frequency

Test	Material	Frequency
In-place density/moisture content (ASTM D6938 or equivalent)	Prepared subgrade surface using on-site fill material or import fill material	1 per 10,000 square feet per lift
Proof-rolling using heavy equipment (field call)	Excavated, undisturbed in situ soils as subgrade surface	All non-fill areas

Any deficiencies of the subgrade at Lagoon No. 6 found by the OR will be corrected by the GC prior to the placement of the GCL. If a Specification criterion cannot be met or unusual weather conditions hinder work, the OR will work with the Project Engineer to develop and present suggested solutions to the Owner and GC. Re-evaluations by the OR will continue until it is verified that defects have been corrected before the subgrade will be approved. Once the subgrade preparation has been completed to the satisfaction of the OR, the OR will obtain the liner installer's acceptance of the subgrade in writing.

3.1.3 Monitoring of Anchor Trench Construction

An anchor trench is required along the outer limits of the double liner system at Lagoon No. 6. The anchor trench will be utilized to effectively anchor the liner in place. During anchor trench construction, the OR will monitor the excavation and backfill methods (following placement of the liner) to confirm they are consistent with the requirements specified in the *Technical Specifications* and *Construction Drawings*. The OR will monitor, at a minimum, that:

- Each anchor trench is free of debris and other undesirable materials prior to the placement of the liner.
- Each anchor trench is constructed to the general lines and grades shown in the *Construction Drawings*.
- Compaction requirements are met, through visual observations, as specified in the *Technical Specifications*.

3.2 Geocomposite Vent Strips

This section presents information regarding the QA for the geocomposite vent strips at Lagoon No. 6. The geosynthetic will act as a gas venting system and will consist of a grid of geocomposite

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vent strips with spacing as shown in the *Construction Drawings* and outlined in the *Technical Specifications*. The vent strips installed at Lagoon No. 6 will convey gases that may potentially collect under the liner system to vent pipes located around the top perimeter of the lagoon. To minimize the potential for the bentonite from the GCL to enter the geocomposite, a geomembrane cover strip will be placed on top of the geocomposite strips.

3.2.1 Performance Objectives and Criteria

Performance objectives and criteria for the geocomposite vent strips installed at Lagoon No. 6 include the following:

- **Material Acceptance.** Confirm through conformance testing that the geocomposite vent strips meet the *Technical Specifications*.
- **Material Delivery, Unloading, and Storage.** Observe the handling and storage procedures of the geotextile used by the GC.
- **Monitoring of Installation.** Confirm the deployment procedures utilized to install the geocomposite.

3.2.2 Quality Assurance Measures, Inspection Activities, and Contingency Actions

QA measures described in this section will be implemented during geocomposite installation activities at Lagoon No. 6 to confirm performance objectives are met and construction is completed per the *Construction Drawings* and *Technical Specifications*. Inspection activities will be implemented and compared to criteria to determine if performance objectives have been achieved at each lagoon. If performance standards have not been achieved, the contingency actions will be implemented.

3.2.2.1 Material Acceptance

Prior to the installation of the geocomposite vent strips at Lagoon No. 6, certifications of the material properties will be obtained, and conformance testing will be conducted by the GC's third-party materials laboratory. The OR and Project Engineer will review all geocomposite vent strip manufacturer QC certificates and other submittals required by the *Technical Specifications* and provided by the GC for conformance with the *Technical Specifications* prior to material shipment to the site.

Once documentation is confirmed, the OR (third-party liner CQA subcontractor) will document that the materials on site correspond to the materials for which the manufacturing documentation has been prepared. Any discrepancies will be reported to the GC with details of the discrepancies and the nature of the materials on site. Conformance certifications will be included in the Final Completion Report.

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3.2.2.1.1 Conformance Testing

Conformance testing will be completed by a third-party materials laboratory selected and subcontracted by the OR and/or Project Engineer to confirm that the geocomposite vent strips shipped to the site have the required physical and mechanical properties required by the *Technical Specifications*.

Geocomposite vent strip conformance samples will be collected by the OR or third-party liner CQA subcontractor at a minimum rate of one per 100,000 square feet of geosynthetic supplied. Samples will only be collected from material delivered to the site. After sample collection, the OR or third-party liner CQA subcontractor shall forward the samples to the third-party materials laboratory for testing. Based on the results of the conformance testing, the Project Engineer (in consultation with the third-party CQA subcontractor) may provide corrective actions to the GC.

Conformance testing will be carried out by the third-party materials laboratory in accordance with the ASTM test methods shown in the Project Engineer/OR-approved product specifications. These conformance tests should include, at a minimum, those listed in Table 3.

Table 3
Conformance Tests for Geocomposite Vent Strips

Test	Test Designation
Geocomposite	
Transmissivity	ASTM D4716
Geonet	
Thickness, Minimum	ASTM D5199
Density	ASTM D1505
Tensile Strength	ASTM D7179
Carbon Black Content	ASTM D4218
Geotextile	
Thickness, Minimum	ASTM D1117
Mass per Unit Area	ASTM D5261
Grab Tensile Strength	ASTM D4632
Trapezoidal Tear Strength	ASTM D4533

3.2.2.1.2 Conformance Test Results

Conformance test results will be reported to the OR and third-party liner CQA subcontractor, who will review the results for conformance with the *Technical Specifications*. Conformance test results will be reported to the Project Engineer and the GC.

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Nonconformance test results may require the following corrective actions:

- If the GC has installed all or a portion of the geocomposite test strips, they will be required to uncover the strips for additional resampling and retesting.
- Geocomposite vent strips represented by nonconformance test results may not be deployed (if not deployed already) until conformance with the *Technical Specifications* has been demonstrated.
- If a second round of tests confirms nonconformance of the sample, the roll from which the sample was taken will be rejected, as well as any other rolls represented by that sample. The OR (or third-party liner CQA subcontractor) will determine which rolls are represented by the sample from a review of the geosynthetic material manufacturer's QC testing and certification.

Additional sampling and testing may be conducted on unsampled rolls represented by the nonconforming sample. Additional sampling and testing, as well as any additional labor or materials, will be conducted at the expense of the GC to determine conformance of those rolls with the *Technical Specifications*. If the GC elects to deploy the material prior to the receipt of the conformance testing results, all additional labor and materials to remove, replace, and reinstall the material shall be borne by the GC.

The OR will include the results of all conformance testing in the Final Completion Report.

3.2.2.2 Material Delivery, Unloading, and Storage Procedures

The OR (or third-party liner CQA subcontractor) will perform receiving inspection on all geocomposite vent strip material in compliance with procedures described in the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will also confirm that transportation, handling, and storage of geocomposite vent strips are performed in accordance with the *Technical Specifications* and will determine the condition of rolls of geocomposite upon delivery to Lagoon No. 6.

During delivery to Lagoon No. 6, the OR (or third-party liner CQA subcontractor) will monitor and document, at a minimum, the following:

- Inventory of all materials delivered to each lagoon
- Logging of roll numbers on inventory checklist
- Confirmation that the rolls delivered to Lagoon No. 6 match the lot numbers of those included in the conformance testing
- Cross-reference with the bill of lading supplied by the manufacturer
- Visual inspection of materials for damage; suspect rolls will be marked, recorded on inventory checklist, and set aside for further inspection

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3.2.2.3 Observation of Installation

The OR (or third-party liner CQA subcontractor) will monitor and document the deployment of the geocomposite vent strips at Lagoon No. 6 and confirm compliance with the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will document the time and location of material placement and make note of any damage to the materials. Weather and subgrade conditions will also be recorded by the OR to confirm conformance with the *Technical Specifications*.

For any damage to the materials, the GC's liner installer will prescribe the method of repair to be used (for the approval of the OR or third-party liner CQA subcontractor), based on the nature and size of the problem. All repairs will be performed in accordance with the *Technical Specifications*.

The OR (or third-party liner CQA subcontractor) will periodically monitor the geocomposite vent strip operations for proper overlap technique and overlap length. Upon completion, the third-party liner CQA subcontractor will confirm that all geotextiles have been properly overlapped in accordance with the *Technical Specifications*.

3.3 Geotextile

This section presents information regarding QA for geotextiles at Lagoon No. 6. This geosynthetic material will primarily act as a separation layer between the GCL and earthen subgrade and would only be installed at the discretion of the Project Engineer and Owner (based on the final subgrade surface).

3.3.1 Performance Objectives and Criteria

Performance objectives and criteria for the geotextile include the following:

- **Material Acceptance.** Confirm through conformance testing that the geotextile meets the *Technical Specifications*.
- **Material Delivery, Unloading, and Storage.** Observe the handling and storage procedures of the geotextile utilized by the GC at each lagoon.
- **Monitoring of Installation.** Confirm the deployment procedures used when installing the geotextile at each lagoon.

3.3.2 Quality Assurance Measures, Inspection Activities, and Contingency Actions

QA measures described in this section will be implemented during geotextile installation activities at Lagoon No. 6 to confirm performance objectives are met and construction is completed per the *Construction Drawings* and *Technical Specifications*. Inspection activities will be implemented and compared to performance criteria to determine if performance objectives have been achieved. If performance standards have not been achieved, the contingency actions will be implemented.

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3.3.2.1 Material Acceptance

Prior to the installation of the geotextile at Lagoon No. 6, certifications of the material properties will be provided by the GC. The OR/Project Engineer (or third-party liner CQA subcontractor) will review all geotextile manufacturer QC certificates and other submittals required by the *Technical Specifications* and provided by the Contractor for conformance with the *Technical Specifications* prior to material shipment to the site.

Once documentation is confirmed and the materials have arrived at the site, the OR (or third-party liner CQA subcontractor) will document that the materials on site correspond to the materials for which the manufacturing documentation has been prepared. Any discrepancies will be reported to the GC with details of the discrepancies and the nature of the materials on site. Material property certifications will be included in the Final Completion Report.

3.3.2.1.1 Conformance Testing

Conformance testing will be completed by a third-party materials laboratory selected and subcontracted by the OR and/or Project Engineer to confirm that the geocomposite vent strips shipped to the site have the required physical and mechanical properties required by the *Technical Specifications*.

Geotextile samples will be collected by the OR or third-party liner CQA subcontractor at a minimum rate of one per 100,000 square feet of geosynthetic supplied. Samples will only be collected from material delivered to the site. After sample collection, the OR or third-party liner CQA subcontractor shall forward the samples to the third-party materials laboratory for testing. Based on the results of the conformance testing, the Project Engineer (in consultation with the third-party CQA subcontractor) may provide corrective actions to the GC.

Conformance testing will be carried out by the third-party materials laboratory in accordance with the ASTM test methods shown in the Project Engineer/OR-approved product specifications. These conformance tests should include, at a minimum, those listed in Table 4.

Table 4
Conformance Tests for Geotextiles

Test	Test Designation
Thickness, Minimum	ASTM D1117
Mass per Unit Area	ASTM D5261
Grab Tensile Strength	ASTM D4632
Trapezoidal Tear Strength	ASTM D4533

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3.3.2.1.2 Conformance Test Results

Conformance test results will be reported to the OR and third-party liner CQA subcontractor, who will review the results for conformance with the *Technical Specifications*. Conformance test results will be reported to the Project Engineer and the GC.

Nonconformance test results may require the following corrective actions:

- If the GC has installed all or a portion of the geotextile, they will be required to uncover the material for additional resampling and retesting.
- Geotextile represented by nonconformance test results may not be deployed (if not deployed already) until conformance with the *Technical Specifications* has been demonstrated.
- If a second round of tests confirms nonconformance of the sample, the roll from which the sample was taken will be rejected, as well as any other rolls represented by that sample. The OR (or third-party liner CQA subcontractor) will determine which rolls are represented by the sample from a review of the geosynthetic material manufacturer's QC testing and certification.

Additional sampling and testing may be conducted on unsampled rolls represented by the nonconforming sample. Additional sampling and testing, as well as any additional labor or materials, will be conducted at the expense of the GC to determine conformance of those rolls with the *Technical Specifications*. If the GC elects to deploy the material prior to the receipt of the conformance testing results, all additional labor and materials to remove, replace, and reinstall the material shall be borne by the GC.

The OR will include the results of all conformance testing in the Final Completion Report.

3.3.2.2 Material Delivery, Unloading, and Storage

The OR (or third-party liner CQA subcontractor) will perform receiving inspection on all geocomposite vent strip material in compliance with procedures described in the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will also confirm that transportation, handling, and storage of geotextile are performed in accordance with the *Technical Specifications* and will determine the condition of rolls of geotextile upon delivery to Lagoon No. 6.

During delivery to Lagoon No. 6, the OR (or third-party liner CQA subcontractor) will monitor and document, at a minimum, the following:

- Inventory of all materials delivered to each lagoon
- Logging of roll numbers on inventory checklist
- Confirmation that the rolls delivered to Lagoon No. 6 match the lot numbers of those included in the conformance testing
- Cross-reference with the bill of lading supplied by the manufacturer

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- Visual inspection of materials for damage; suspect rolls will be marked, recorded on inventory checklist, and set aside for further inspection

3.3.2.3 Observation of Installation

The OR (or third-party liner CQA subcontractor) will monitor and document the deployment of the geotextile at Lagoon No. 6. Deployment of the geotextile will be in accordance with the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will document the time and location of material placement and make note of any damage to the materials. Weather and subgrade conditions will also be recorded by the OR to confirm conformance with the *Technical Specifications*.

For any damage to the materials, the GC's liner installer will prescribe the method of repair to be used (for the approval of the OR), based on the nature and size of the problem. All repairs will be performed in accordance with the *Technical Specifications*.

The OR will periodically monitor the geotextile operations for proper overlap technique and overlap length. Upon completion, CQA personnel will confirm that all geotextiles have been properly overlapped in accordance with the *Technical Specifications*. Heat-tacking the overlap will be acceptable; however, the OR should observe these activities to confirm that no damage is caused to the geotextile by this practice.

3.4 Geosynthetic Clay Liner

This section discusses and outlines the CQA activities to be performed for GCL installation at Lagoon No. 6; the GCL will act as the secondary liner. The GCL material, consisting of a bentonite clay or other very low-permeability clay material, is supported by geotextiles that are held together by needling, stitching, and/or chemical adhesives and delivered to the site in rolls. The OR (or third-party liner CQA subcontractor) will review the *Construction Drawings*, *Technical Specifications*, and any approved Addenda regarding this material.

3.4.1 Performance Objectives and Criteria

Performance objectives and criteria for GCL installation at Lagoon No. 6 includes the following:

- **Material Acceptance.** Confirm through conformance testing that the GCL meets the *Technical Specifications.*
- **Material Delivery, Unloading, and Storage.** Observe the handling and storage procedures of the GCL utilized by the GC at each lagoon.
- **Monitoring of GCL Installation.** Confirm that the GCL installation at each lagoon is carried out in accordance with the *Construction Drawings*, *Technical Specifications*, and manufacturer's recommendations.

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3.4.2 Quality Assurance Measures, Inspection Activities, and Contingency Actions

QA measures described in this section will be implemented during GCL installation at Lagoon No. 6 to confirm performance objectives are met and construction is completed according to the *Construction Drawings* and *Technical Specifications*. Inspection activities will be implemented at Lagoon No. 6 and compared to criteria to determine if performance objectives have been achieved. If performance standards have not been achieved, the contingency actions will be implemented.

3.4.2.1 Material Acceptance

Prior to the installation of the GCL at Lagoon No. 6, certifications of the material properties will be obtained, and conformance testing will be conducted by the GC's third-party materials laboratory. The OR and Project Engineer (or third-party liner CQA subcontractor) will review all GCL manufacturer QC certificates and other submittals required by the *Technical Specifications* and provided by the Contractor for conformance with the *Technical Specifications* prior to material shipment to the site.

Once documentation is confirmed and the materials have arrived at the site, the OR (or third-party liner CQA subcontractor) will document that the materials on site correspond to the materials for which the manufacturing documentation has been prepared. Any discrepancies will be reported to the Contractor with details of the discrepancies and the nature of the materials on site. Conformance certifications will be included in the Final Completion Report.

3.4.2.1.1 Conformance Testing

Conformance testing will be completed by a third-party materials laboratory selected and subcontracted by the OR and/or Project Engineer to confirm that the geocomposite vent strips shipped to the site have the required physical and mechanical properties required by the *Technical Specifications*.

GCL samples will be collected by the OR or third-party liner CQA subcontractor at a minimum rate of one per 100,000 square feet of GCL supplied. Samples will only be collected from material delivered to the site. After sample collection, the OR or third-party liner CQA subcontractor shall forward the samples to the third-party materials laboratory for testing. Based on the results of the conformance testing, the Project Engineer (in consultation with the third-party CQA subcontractor) may provide corrective actions to the GC.

Conformance testing will be carried out by the third-party materials laboratory in accordance with the ASTM test methods shown in the Project Engineer/OR-approved product specifications. These conformance tests should include, at a minimum, those listed in Table 5.

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Table 5
Conformance Tests for Geosynthetic Clay Liner

Test	Test Designation
Swell Index	ASTM D5890
Fluid Loss	ASTM D5891
Index Flux	ASTM D5887
Mass/Unit Area, Bentonite	ASTM D5993
Mass/Unit Area, Geotextile	ASTM D3776

3.4.2.1.2 Conformance Test Results

Conformance test results will be reported to the OR and third-party liner CQA subcontractor, who will review the results for conformance with the *Technical Specifications*. Conformance test results will be reported to the Project Engineer and the GC.

Nonconformance test results may require the following corrective actions:

- If the GC has installed all or a portion of the GCL, they will be required to uncover the material for additional resampling and retesting.
- GCL represented by nonconformance test results may not be deployed (if not deployed already) until conformance with the *Technical Specifications* has been demonstrated.
- If a second round of tests confirms nonconformance of the sample, the roll from which the sample was taken will be rejected, as well as any other rolls represented by that sample. The OR (or third-party liner CQA subcontractor) will determine which rolls are represented by the sample from a review of the geosynthetic material manufacturer's QC testing and certification.

Additional sampling and testing may be conducted on unsampled rolls represented by the nonconforming sample. Additional sampling and testing, as well as any additional labor or materials, will be conducted at the expense of the GC to determine conformance of those rolls with the *Technical Specifications*. If the GC elects to deploy the material prior to the receipt of the conformance testing results, all additional labor and materials to remove, replace, and reinstall the material shall be borne by the GC.

The OR will include the results of all conformance testing in the Final Completion Report.

3.4.2.2 Material Delivery, Unloading, and Storage

The OR (or third-party liner CQA subcontractor) will perform receiving inspection on all geocomposite vent strip material in compliance with procedures described in the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will also confirm that transportation,

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handling, and storage of GCL are performed in accordance with the *Technical Specifications* and will determine the condition of rolls of GCL upon delivery to Lagoon No. 6.

During delivery to Lagoon No. 6, the OR (or third-party liner CQA subcontractor) will monitor and document, at a minimum, the following:

- Inventory of all materials delivered to each lagoon
- Logging of roll numbers on inventory checklist
- Confirmation that the rolls delivered to Lagoon No. 6 match the lot numbers of those included in the conformance testing
- Cross-reference with the bill of lading supplied by the manufacturer
- Visual inspection of materials for damage; suspect rolls will be marked, recorded on inventory checklist, and set aside for further inspection

3.4.2.3 Observation of Geosynthetic Clay Liner Installation

The OR (or third-party liner CQA subcontractor) will document that GCL placement activities at Lagoon No. 6 are performed in accordance with the *Technical Specifications*, particularly confirming that required materials, methods, and testing procedures are employed. Requirements for GCL installation and testing are described in detail in the *Technical Specifications* and are summarized in the following subsections.

3.4.2.3.1 Deployment

The OR (or third-party liner CQA subcontractor) will monitor and document that the GCL is installed in accordance with the *Construction Drawings* and *Technical Specifications* at Lagoon No. 6. The GC's geosynthetics installer will provide the OR (or third-party liner CQA subcontractor) a certificate of subgrade acceptance prior to the installation of the GCL as outlined in the *Technical Specifications*. The GCL installation activities to be monitored and documented by the OR (or third-party liner CQA subcontractor) include the following:

- Monitoring that the GCL rolls are stored and handled in a manner which does not result in any damage to the GCL
- Monitoring that the GCL is not exposed to UV radiation for extended periods of time without prior approval
- Monitoring that the GCL is seamed in accordance with the *Technical Specifications* and the manufacturer's recommendations
- Monitoring and documenting that the GCL is installed on an approved subgrade free of debris, protrusions, or uneven surfaces at both lagoons
- Monitoring that the subgrade surface is moist to within a minimum of 1 inch from the subgrade surface
- Monitoring that any damage to the GCL is repaired as outlined in the *Technical Specifications*

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3.4.2.3.2 Field Seaming

This section details CQA procedures to document that seams are properly constructed and tested in accordance with the manufacturer's specifications and industry standards. The field seaming procedure of the GCL is expected to consist of overlapping, with the OR (or third-party liner CQA subcontractor) documentation at Lagoon No. 6 to include at a minimum:

- Numbering of the seams
- Field seaming process (overlapping or other method)
- Confirmation by the OR (or third-party liner CQA subcontractor) that the minimum overlap/seam is adhered to

3.4.2.3.3 Repairs

Any portion of the GCL with a flaw where a conformance test has left holes or cuts, or where the GCL has been damaged visually, must be repaired in accordance with the *Technical Specifications*. The GC's liner subcontractor and the OR (or third-party liner CQA subcontractor) must locate and record all repairs to be included in the As-Built Drawings. The OR (or third-party liner CQA subcontractor) will monitor and document all repairs by the GC's liner subcontractor to confirm that they are completed in accordance with the *Technical Specifications*.

3.5 Geomembrane

This section discusses and outlines the CQA activities to be performed for HDPE geomembrane installation at Lagoon No. 6; the HDPE geomembrane shall act as the primary liner. The geomembrane material, consisting of polyethylene resin, is manufactured in 60-mil-thick sheets that are smooth on both sides and delivered to the site in rolls. The OR (or third-party liner CQA subcontractor) will review the *Construction Drawings*, *Technical Specifications*, and any approved Addenda regarding this material.

3.5.1 Performance Objectives and Criteria

Performance objectives and criteria for geomembrane at Lagoon No. 6 include the following:

- **Material Acceptance.** Confirm material conformance through the review of the manufacturer's submittals for compliance with the *Technical Specifications* and conduct conformance testing of the rolls before the geomembrane is installed.
- **Material Delivery, Unloading, and Storage.** Document the delivery and proper storage of geomembrane rolls.
- **Monitoring of Installation.** Observe the geomembrane installation to confirm the installation is carried out in accordance with the *Construction Drawings*, *Technical Specifications*, and manufacturer's recommendations.

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3.5.2 Quality Assurance Measures, Inspection Activities, and Contingency Actions

QA measures described in this section will be implemented during geomembrane installation at Lagoon No. 6 to confirm performance objectives are met and construction is completed according to the *Construction Drawings* and *Technical Specifications*. If performance standards have not been achieved, the contingency actions will be implemented.

3.5.2.1 Material Acceptance

Prior to the installation of the geomembrane at Lagoon No. 6, certifications of the material properties will be obtained, and conformance testing will be conducted by the GC's third-party materials laboratory. The OR and Project Engineer (or third-party liner CQA subcontractor) will review all geomembrane manufacturer QC certificates and other submittals required by the *Technical Specifications* and provided by the GC for conformance with the *Technical Specifications* prior to material shipment to the site.

Once documentation is confirmed and the materials have arrived at the site, the OR (or third-party liner CQA subcontractor) will document that the materials on site correspond to the materials for which the manufacturing documentation has been prepared.

Any discrepancies will be reported to the GC with details of the discrepancies and the nature of the materials on site. Conformance certifications will be included in the Final Completion Report.

3.5.2.1.1 Conformance Testing

Conformance testing will be completed by a third-party materials laboratory selected and subcontracted by the OR and/or Project Engineer to confirm that the geomembrane shipped to the site have the required physical and mechanical properties required by the *Technical Specifications*.

Geomembrane conformance samples will be collected by the OR or third-party liner CQA subcontractor at a minimum rate of one per 100,000 square feet of geosynthetic supplied. Samples will only be collected from material delivered to the site. After sample collection, the OR or third-party liner CQA subcontractor shall forward the samples to the third-party materials laboratory for testing. Based on the results of the conformance testing, the Project Engineer (in consultation with the third-party CQA subcontractor) may provide corrective actions to the GC.

Conformance testing will be carried out by the third-party materials laboratory in accordance with the ASTM test methods shown in the Project Engineer/OR-approved product specifications. These conformance tests should include, at a minimum, those listed in Table 6.

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Table 6
Conformance Tests for HDPE Geomembrane

Test	Test Designation
Sheet Thickness	ASTM D5994
Density	ASTM D1505
Tensile Properties (Type IV at 2 inches per minute): Yield Stress Break Stress Yield Elongation Break Elongation	ASTM D638
Tear Resistance	ASTM D1004
Puncture Resistance	ASTM D4833
Carbon Black Content	ASTM D1603
Carbon Black Dispersion	ASTM D5596

3.5.2.1.2 Conformance Test Results

Conformance test results will be reported to the OR (or third-party liner CQA subcontractor), who will review the results for conformance with the *Technical Specifications*. Conformance test results will be reported to the Project Engineer and the Contractor.

Nonconformance test results may require the following corrective actions:

- If the GC has installed all or a portion of the GCL, they will be required to uncover the material for additional resampling and retesting.
- Geomembrane represented by nonconformance test results may not be deployed (if not deployed already) until conformance with the *Technical Specifications* has been demonstrated.
- If a second round of tests confirms nonconformance of the sample, the roll from which the sample was taken will be rejected, as well as any other rolls represented by that sample. The OR (or third-party liner CQA subcontractor) will determine which rolls are represented by the sample from a review of the geosynthetic material manufacturer's QC testing and certification.

Additional sampling and testing may be conducted on unsampled rolls represented by the nonconforming sample. Additional sampling and testing, as well as any additional labor or materials, will be conducted at the expense of the GC to determine conformance of those rolls with the *Technical Specifications*. If the GC elects to deploy the material prior to the receipt of the conformance testing results, all additional labor and materials to remove, replace, and reinstall the material shall be borne by the GC.

The OR will include the results of all conformance testing in the Final Completion Report.

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3.5.2.2 Material Delivery, Unloading, and Storage

The OR (or third-party liner CQA subcontractor) will perform receiving inspection on all geomembrane material for Lagoon No. 6 in compliance with procedures described in the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will also confirm that transportation, handling, and storage of geomembrane are performed in accordance with the *Technical Specifications* and will determine the condition of rolls of geomembrane upon delivery to the site.

During delivery, the OR (or third-party liner CQA subcontractor) will monitor and document, at a minimum, the following:

- Inventory of all materials delivered to the lagoons
- Logging of roll numbers on inventory checklist
- Confirmation that the rolls delivered match the lot numbers of those included in the conformance testing
- Cross-reference with the bill of lading supplied by the manufacturer
- Visual inspection of materials for damage; suspect rolls will be marked, recorded on inventory checklist, and set aside for further inspection

The QA Installation Manual will describe the packaging requirements from the manufacturer.

3.5.2.3 Observation of Geomembrane Installation

The OR (or third-party liner CQA subcontractor) will document that geomembrane placement and seaming activities are performed in accordance with the *Technical Specifications*, particularly confirming that required materials, methods, and testing procedures are employed. Seams or repaired areas that do not pass the tests will be repaired and retested, as described in the *Technical Specifications*, until a passing result is achieved. Requirements for geomembrane installation and testing are described in detail in the *Technical Specifications* and are summarized in the following subsections.

3.5.2.3.1 Deployment

The OR (or third-party liner CQA subcontractor) will monitor and document geomembrane deployment. Prior to deployment, the OR (or third-party liner CQA subcontractor) and installer will confirm that the surface upon which the geomembrane will be installed is suitably prepared and will not damage the geomembrane. Deployment will be in accordance with the *Technical Specifications* and the accepted seam and panel layout drawing submitted by the GC prior to construction. The OR (or third-party liner CQA subcontractor) will document the time and location of material placement and make note of any damage to the materials. The OR (or third-party liner CQA subcontractor) will record weather, ambient temperature, temperature of the geomembrane, and subgrade conditions to confirm conformance with the *Technical Specifications*.

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For any damage to the materials, the *Technical Specifications* define the repair method to be used, based on the nature and size of the damage. All repairs will be performed in accordance with the *Technical Specifications*.

3.5.2.3.2 Seaming/Welding

All field seaming will conform to the accepted seam and panel layout for each lagoon. Field seaming operations must be completely monitored and documented by the OR (or third-party liner CQA subcontractor) to confirm conformance with the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will do the following:

- Confirm that only seaming methods and equipment that have been previously accepted are used and that equipment and gages are in current calibration, as applicable. Obtain copies of calibration certificates for project files.
- Observe the trial seaming procedure and record test results. If questions arise concerning seam failure or other aspects of the trial seam, the OR (or third-party liner CQA subcontractor) will make the final determination as to whether the seam is acceptable.
- Monitor weather conditions, measure ambient temperature, and notify the installer if conditions are outside of the acceptable limits or if conditions have changed so that new trial seams are required.
- Prior to seaming, confirm that panels have been prepared in accordance with the *Technical Specifications* and are clean and dry.
- During seaming, monitor and record nozzle, preheat extrudate, wedge, or other temperatures, as appropriate for the particular apparatus. For automated apparatus, record seaming apparatus speed.

Documentation at Lagoon No. 6, at a minimum, will include the following:

- A record of the trial seams, including date, time, welder ID, machine ID and settings, and associated test results
- The seam number, based on a seam numbering system agreed to by the OR and Contractor
- The date, time, welder ID, machine ID, and settings for each seam
- The ambient temperature and temperature of the material

3.5.2.3.3 Seam Testing

For seam testing at Lagoon No. 6, the OR (or third-party liner CQA subcontractor) will perform the following activities:

- Confirm with the GC's geomembrane installer that test equipment is suitable and in working order and that gages are in current calibration, as applicable. Obtain copies of calibration certificates for project files.
- Continuously monitor and record the results of all nondestructive testing at both lagoons.

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- Determine locations for destructive test samples based on the required sampling frequency and seaming observations. Destructive samples will not be taken from places that would be hard to patch. The installer will not be informed in advance of the locations where the seam samples will be taken.
- Observe removal of destructive test samples. Assign a number to each sample and record the sample number and location in the geomembrane layout drawings.
- The OR or the third-party liner CQA subcontractor will send the destructive test sample to the third-party material testing laboratory. The results of the laboratory destructive testing will be made available to the Project Engineer and GC.
- The GC's liner subcontractor will conduct on-site destructive testing for QC purposes. The results of the QC destructive testing will be made available to the Project Engineer and OR.
- Observe all repair procedures and destructive testing of sample locations.
- Determine whether additional sampling and testing is required, such as in tie-in areas or when there is cause to suspect the presence of excess crystallinity, contamination, offset welds, or any other potential defect.
- Document all actions taken in conjunction with destructive test failures.

3.5.2.3.3.1 Nondestructive Seam Testing

The purpose of nondestructive testing is to detect discontinuities or holes that may exist in the seams and to indicate whether a seam is continuous or has non-welded sections. Nondestructive tests for geomembrane include vacuum testing and/or air pressure testing. Nondestructive testing at Lagoon No. 6 must be performed over the entire length of all seams in accordance with the *Technical Specifications*. The GC's liner subcontractor will perform nondestructive seam testing.

The OR (or third-party liner CQA subcontractor) will observe and document the testing to confirm conformance with the *Technical Specifications* and document any seam defects and necessary repairs. Documentation will include, at a minimum, the date, time, location, and pass or fail determination for each test. The GC's liner subcontractor and/or OR (or third-party liner CQA subcontractor) will identify the failed areas by marking the area with a waterproof marker compatible with the geomembrane, notify the GC of any required repairs, and record the repair needed.

3.5.2.3.3.2 Destructive Seam Testing

Destructive seam tests will be performed at Lagoon No. 6 at a minimum interval of at least one test per 500 linear feet for geomembrane seams. The OR (or third-party liner CQA subcontractor) may require additional tests if there are seams that do not appear to meet specification requirements. Reasons for selecting test locations may include, but are not limited to, the following:

- Wrinkling in seam area
- Excess crystallinity

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- Suspect seaming equipment or techniques
- Weld contamination
- Insufficient overlap
- Adverse weather conditions
- Possibility of moisture, dust, dirt, debris, or other foreign material in the seam
- Failing tests

The OR (or third-party liner CQA subcontractor) will select locations where seam samples will be cut for destructive testing as follows:

- The minimum testing frequency of one test per 500 feet of seam length is an average frequency for the entire installation. Individual samples may be taken at greater or lesser intervals.
- If the number of failed samples exceeds 5% of the tested samples, this frequency may be increased solely at the discretion of the OR. Samples taken as a result of failed tests do not count toward the total number of required tests.

The OR (or third-party liner CQA subcontractor) will not inform the GC in advance of destructive sample locations. The GC will collect samples in accordance with the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) will do the following:

- Observe the sample cutting operations.
- Mark each sample with an identifying number that contains the seam number, destructive test number, welder ID, machine ID, date, and time.
- Record the sample location and reason for taking the sample.

Destructive testing must be performed concurrently with seaming operations, not at the completion of the entire installation.

The GC's liner subcontractor will divide each sample into four parts, of which one part will be field tested by the GC in accordance with the *Technical Specifications*. The OR (or third-party liner CQA subcontractor) must observe the tests. A geomembrane seam sample passes when the break is a ductile, film-tearing bond. A film-tearing bond means the test strip must break at the edge or the outside of the seam, but not within the seam. In addition, the seam strength must meet the values listed in the *Technical Specifications*. If any field test sample fails, the GC will follow the failed-weld procedures outlined in the *Technical Specifications*.

Of the remaining three parts, the OR or third-party liner CQA subcontractor will submit one part of the sample to the third-party materials laboratory for testing (laboratory testing is discussed in Section 3.5.2.3.4). The GC will retain one part for their records, and the OR (or third-party liner CQA subcontractor) will retain one part on behalf of the Owner.

3.5.2.3.4 Laboratory Testing

The OR or third-party liner CQA subcontractor will forward one part of all samples for destructive testing to the third-party materials laboratory to confirm seam quality. Qualities tested include bonded seam strength (shear, ASTM D4437) and peel adhesion (peel, ASTM D4437). Both tests will be completed in accordance with the *Technical Specifications*. The purpose of peel and shear tests is to evaluate seam strength and to evaluate long-term performance. Shear strength measures the continuity of tensile strength through the seam and into the parent material. Peel strength addresses weld quality. At least five specimens from each sample must be tested in each method used. Minimum test values are presented in the *Technical Specifications*.

The OR (or third-party liner CQA subcontractor) must record the results of the laboratory testing on a destructive seam test form, the panel/seam log, and the panel layout drawing. If the laboratory test fails in either peel or shear, the GC's liner subcontractor will follow the failed weld procedures outlined in the *Technical Specifications*. This process will be repeated until passing tests bracket the failed seam section. All seams must be bounded by locations from which passing laboratory tests have been taken. Laboratory testing governs seam acceptance. In no case, can field testing of repaired seams be used for final acceptance.

3.5.2.3.5 Repairs

Any portion of the geomembrane with a flaw that fails a nondestructive or destructive test (where destructive tests were cut or where nondestructive tests left cuts or holes) must be repaired in accordance with the *Technical Specifications*. The GC's liner subcontractor and OR (or third-party liner CQA subcontractor) must locate and record all repairs to be included in the Record Drawings. The OR (or third-party liner CQA subcontractor) will monitor and document all repairs to ensure that they are completed in accordance with the *Technical Specifications*.

3.6 Pipes, Fittings, and Wall Penetrations

The Project includes solid HDPE pipe, fittings, couplings, and wall penetrations at Lagoon No. 6. CQA procedures for the selection, installation, and testing of these materials are presented in the following subsections. Wall penetrations require QA observation.

3.6.1 Performance Objectives and Criteria

Performance objectives and criteria for pipes and fittings at Lagoon No. 6 includes the following:

- **Material Acceptance.** Verify that the pipes and components meet the *Technical Specifications*.
- **Monitoring of Pipe Installation.** Monitor pipe installation at both lagoons, including all pipe joining and placement, to confirm the installation is in compliance with the *Technical Specifications*.

3.6.2 Quality Assurance Measures, Inspection Activities, and Contingency Actions

QA measures described in this section will be implemented during pipe installation activities to confirm performance objectives are met and construction is completed per the *Construction Drawings* and *Technical Specifications*. Inspection and verification activities will be implemented and compared to criteria to determine if performance objectives have been achieved. If performance standards have not been achieved, the contingency actions will be implemented.

3.6.2.1 Material Acceptance

The OR will inspect all pipe, equipment, and components when they are delivered to the site to confirm that they conform to the *Construction Drawings* and *Technical Specifications*. Specific activities performed by the OR will include the following:

- Review GC's submittals concerning joining methods, personnel qualifications, and testing procedures.
- Review manufacturer's QC data and certifications.
- When materials arrive at site, inspect all pipe components to confirm (from appearance, labels, and shipping documents) that they are constructed of materials as listed in the *Construction Drawings*, *Technical Specifications*, and procurement documents and that they are not damaged.
- Take periodic measurements to confirm that pipe is of the specified size and wall thickness and perforations are sized and spaced as specified.
- Confirm that non-HDPE piping systems are not damaged. Inspection will include visual observation of any corrosion-resistant coatings to document that they are present and without flaw.
- Inspect to confirm that all prefabricated materials, equipment, and parts are as specified in the design documents, including, but not limited to, pipe fittings, wall penetration appurtenances, and pipe sleeves.

3.6.2.2 Monitoring of Pipe Installation

The OR will monitor and inspect all pipe installation, including all pipe joining and placement, to confirm compliance with the *Technical Specifications*. CQA monitoring activities during construction of the inlet and outlet piping will include the following:

- Observe and measure to confirm that pipes are placed at the specified locations and configurations, and that all pipe grades are as specified. The GC will be required to maintain a complete and accurate As-Built Drawings of the piping systems.
- Visually observe that all pipes are joined together in accordance with the accepted procedures.

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- Observe acceptance testing by the GC and review acceptance test results of all piping prior to being buried.
- Observe that backfilling and compaction are completed as specified and that, in the process, the piping is not damaged.

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4 Documentation, Meetings, and Reporting

Documentation and reporting for construction QA activities will include pre-construction, construction, and post-construction documentation as detailed in this section. The GC, Project Engineer, and OR will work closely daily during construction to complete the project as specified in the final design and to collect the documentation required. The following subsections describe documentation, meetings, and reporting that will be required throughout construction.

4.1 Prior to Construction

4.1.1 Pre-construction Meeting

A pre-construction meeting for each lagoon will be held between the Owner, GC, Project Engineer, and OR before construction activities begin. The purpose of the pre-construction meeting will be to review the following information:

- Project layout, including *Construction Drawings* and *Technical Specifications*
- Project schedule and critical path items
- Project work areas, staging areas, and haul roads
- Roles, responsibilities, and lines of communication and authority
- Standards for QC procedures used for the geosynthetics in the context of the CQAP and approved CQC Plan, including review of the requirements for seaming, testing, monitoring, and documenting installation and repairs and the repair procedures that will be required for different types of flaws or damages
- Manufacturer material submittals required from the Contractor prior to items being shipped to the site
- Specific methods of deployment to be used for geosynthetic material and various pipe materials
- Review of GCL placement, and protection requirements.
- Confirmation of the timing and distribution of reports for the work schedule and CQA documentation

4.1.2 Pre-construction Submittals

4.1.2.1 Construction Quality Control Plan

The CQC Plan will present the system through which the GC confirms that construction activities are being implemented in compliance with the requirements of the contract. The CQC Plan will identify personnel, procedures, methods, instructions, inspections, records, and forms to be used in the CQC system. Specifically, the CQC Plan will include a description of procedures for maintaining and updating daily activity logs, procedures for reporting out-of-spec conditions, recordkeeping

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procedures for personnel, equipment maintenance and calibration, and daily and weekly reporting requirements.

4.1.2.2 Construction Health and Safety Plan

The GC will submit its CHASP presenting the minimum health and safety requirements for job site activities and the measures and procedures to be employed for protection of on-site personnel. The GC will employ a Certified Industrial Hygienist, whose proof of certification and resume will be submitted along with the CHASP, to produce this plan. The plan will cover the controls, work practices, personal protective equipment, and other health and safety requirements that will be implemented by the GC in connection with the remedial action construction activities.

4.1.2.3 Project Construction Schedule

A detailed project schedule will be submitted by the Contractor for each construction element prior to construction. Schedule updates will be submitted weekly by the Contractor following progress meetings.

4.2 Construction

During construction activities, the GC will be required to provide a variety of documentation to the OR, including testing results of materials received, survey results, and documentation of pay items completed. The GC will also maintain a corrective action log and a field report of daily activity. These records are described in more detail in the following sections and will be maintained in the project files.

4.2.1 Progress Meetings

An informal meeting will be held at the start of each day of work to discuss safety issues, potential problems and their resolution, applicable test data, personnel and equipment assignments, the previous day's accomplishments, and the status of the schedule. Minutes from each daily progress meeting will be generated by the GC and attached to the Contractor's Daily Field Report.

4.2.2 Weekly Meetings

Weekly meetings will be held at the site or by telephone conference with the Project Engineer, Owner, Contractor, and OR. Discussion topics at weekly meetings will include safety issues, potential problems and their resolutions, CQA, the resolution of nonconforming work, the Contractor's proposals, design revisions, the previous week's accomplishments, and the status of the schedule. Minutes from the weekly meetings will be documented by the OR or the Project Engineer and distributed to attendees.

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4.2.3 General Contractor's Daily Activity Report

During construction activities, the GC will prepare a Daily Activity Report and submit it to the OR on the day following the report date. The GC's Daily Activity Report will record at a minimum:

- ID of personnel on site, including visitors
- Weather
- Work hours
- Activities completed
- Any changes to best management practices or environmental controls
- Materials delivered or used
- Equipment used
- Debris material removed and disposed of off site
- Results of any QC inspections, tests, or other monitoring activities
- Problems encountered and resolution of problems
- Any EPA-authorized deviations from the final design

4.2.4 Owner's Representative Daily Report

The OR will maintain a daily field log to record observations, measurements, inspections completed, data received, communications with other members of the project team, additional environmental controls that were implemented, problems encountered, and resolutions. The daily field log will be supported by submittals received from the GC, such as survey results and weigh tickets, laboratory data received, inspection reports, and written communications from members of the project team or EPA.

4.3 Post Construction

When construction activities are complete, the Project Engineer will generate a Final Completion Report, which will include the following:

- Results of the final inspection and leak testing, including a brief description of any problems discovered during the final inspection and the resolution of those problems, as necessary
- A detailed description of all work conducted in accordance with the approved final *Construction Drawings* and *Technical Specifications* and certification by a Washington-registered Professional Engineer and the OR that the work was performed in accordance with all approved plans and *Technical Specifications*
- An explanation of any modifications to the approved plans and *Technical Specifications* and why these modifications were necessary
- Final As-Built Drawings, if different from final *Construction Drawings*
- Results of confirmation and verification sampling

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5 References

Anchor QEA (Anchor QEA, LLC), 2019a. *Construction Drawings*. 100% Design Submittal. Prepared for Liberty/H&S Bosma Dairies. March 2019.

Anchor QEA, 2019b. *Technical Specifications*. 100% Design Submittal. Prepared for Liberty/H&S Bosma Dairies. March 2019.

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Appendix A
Construction Documentation Forms

ANCHOR QEA

CHANGE ORDER NO. CO#

C.O. TITLE: **DATE:**

PROJECT NAME: H&S Bosma Dairy Lagoon No. 6

CONTRACTOR: **PROJECT NO:**

OWNER: Liberty/H&S Bosma Dairies

Change Order Description:

Summary of Changes:

Bid Item No.	Description	Est. Quantity	Unit	Unit Price	Amount
				Total Amount of Change	

The Contract is Modified as Follows:

Contractor is hereby directed to, upon receipt of an approved copy of this change order; execute the work as detailed herein. The work covered by the Change Order shall be performed under the same terms and conditions as those included in the original Contract, unless otherwise described herein. The payment and/or additional time specified and agreed to in this Change Order constitutes full adjustment for, and settlement of, all costs and time relating to the performance of the Work described herein.

Original Contract Amount:	$ 0,000,000.00
Current Contract Amount:	$ 0,000,000.00
Amount of this Change:	**$**
Revised Contract Amount:	$ 0,000,000.00

Contract time is: ☐ Unchanged ☐ **Increased** ☐ **Decreased** by +/- days ☐ Work Days ☐ Cal. Days

New Contract Duration: +/- days ☐ Work Days ☐ Calendar Days

Approved By *(Not valid until signed by Owner)*

Approval Recommended – Construction Manager

RE Name

(Print name) *Signature* *Date*

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Approved by Owner – H&S Bosma and Liberty Dairy

Owner Name		
(Print name)	*Signature*	*Date*

Contractor – TBD

Contractor Name		
(Print name)	*Signature*	*Date*

Justification of Change:

Changes to the Contract Documents: (Cite attachments, if any.)

Plans	
Sheet #	**Change:**
Contract Provisions / Project Manual	
Section #	**Change:**

Attachments:

Copies:

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ANCHOR QEA

CONSTRUCTION FIELD MEMO: XXX

PROJECT NAME: H&S Bosma Dairy Lagoon No. 6

CONTRACTOR: _____ **DATE:** _____

SUBJECT: _____

Message

(Print/Type Name)	*Signature*	*Date*
Construction Manager	*Anchor QEA*	
Title	*Company*	

Reply: By: _____ *Date* ☐ As Soon as Possible ☐ No Reply is Required

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ANCHOR QEA

INCIDENT REPORT

PROJECT NAME: H&S Bosma Dairy Lagoon No. 6
INITIATOR OF REPORT: _____ **DATE OF INCIDENT:** _____
LOCATION OF INCIDENT: _____ **TIME OF INCIDENT:** _____
CONTRACTOR: _____
CONTRACTOR REPRESENTATIVE: _____ **REVIEWED BY:** *(initials/date)* _____

Notification (see attached notification reports)

Notifying Party	Agency(ies) Notified	When Notified (time)

Description of Incident

☐ **Utility**
If a utility strike, was utility located? ☐ Yes ☐ No ☐ N/A Comment:
If "yes," were marks within 2 feet of actual location? ☐ Yes ☐ No

☐ **Property**

☐ **Personal**

☐ **Other**: *(specify)*

Were emergency services called to site? ☐ Yes (*If yes, describe in below*) ☐ No

Narrative *(Provide a chronological accounting of the incidents and events leading up to the incident, if applicable. Attach photos if necessary)*:

Recommendations

Attachments

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INSPECTOR'S DAILY REPORT (IDR)

CONTRACT NO.: _____
REPORT DATE: _____
REPORT NO.: _____

ANCHOR QEA FIELD REP.: _____
PROJECT NAME/LOCATION: H&S Bosma Dairy Lagoon No. 6

REPORT SUBMITTED TO	CONTRACTOR NAME AND CONTACT	WEATHER TEMP. AND PRECIPITATION	
Client: Henry Bosma	General:	AM:	
CC:	Subs:	PM:	
		TIME OF SITE VISIT/OBSERVATION	
		From:	To:

CONSTRUCTION ACTIVITY

CONSTRUCTION TASK	LOCATION OF WORK	COMMENT/NOTES

PERSONNEL ON SITE

NAME (or labor category)	PRIME/SUB/OTHER	NOTES (quantity, apprentice, training)

EQUIPMENT ON SITE

PRIME/SUB	EQUIP. ID	EQUIPMENT DESCRIPTION	HOURS			
			Oper.	Stdby.	Down	Idle

PHOTOS AND VIDEO

Were photos/video taken today? ☐Yes ☐No	Subject:

ACTIVITY LOG

TIME	DISCUSSION

UNIT PRICE WORK

Item	Description	Qty.	Location/Comment

LIMITATIONS: The Anchor QEA field representative is present on site solely to observe the field activities of the contractor identified and keep our client informed of the progress and quality of the work. The presence and activities of the Anchor QEA field representative and our acceptance of any non-conforming work does not relieve the contractor from complying with its contract documents. Any information provided by the Anchor QEA field representative is intended solely to advise the contractor of the technical requirements of the plans and specifications and/or design concept. The contractor is solely responsible for its means, methods, sequences, procedures, construction site safety, quality of the work, and adherence to the contract documents.

REVIEWED BY: *(PM initial/date)*

FIELD REP. SIGNATURE: _____ DATE: _____

(Rev. 5/17)

ANCHOR QEA

INSPECTOR'S DAILY REPORT (IDR)

CONTRACT NO.: _____

REPORT DATE: _____

REPORT NO.: _____

ANCHOR QEA FIELD REP.: _____

PROJECT NAME/LOCATION: H&S Bosma Dairy Lagoon No. 6

OTHER OBSERVATIONS

(Note any force account, changes, material testing, problems encountered, production rates, material delivery, etc.)

PHOTOS

Comment:	**Comment**:
Comment:	**Comment**:

LIMITATIONS: The Anchor QEA field representative is present on site solely to observe the field activities of the contractor identified and keep our client informed of the progress and quality of the work. The presence and activities of the Anchor QEA field representative and our acceptance of any non-conforming work does not relieve the contractor from complying with its contract documents. Any information provided by the Anchor QEA field representative is intended solely to advise the contractor of the technical requirements of the plans and specifications and/or design concept. The contractor is solely responsible for its means, methods, sequences, procedures, construction site safety, quality of the work, and adherence to the contract documents.		REVIEWED BY: *(PM initial/date)*
FIELD REP. SIGNATURE: _____	DATE: _____	Page 2 of 2

(Rev. 5/17)

MEETING NOTES

Type of Meeting:			
Project Name:	H&S Bosma Dairy Lagoon No. 6		
Meeting Location:		**AQEA #:**	
Call-In Number			

Date	Start	End	Meeting Led By:	
			Meeting Note-Taker:	

Attendees:

H&S Bosma Dairy	Agency Staff	Construction Management	Contractor
☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐

1. **Item 1**
2. **Item 2**

Follow-up Actions

Item #	Meeting # Ref.	Description	Action/ Responsible Party	Due Date

Next meeting:

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ANCHOR QEA

NONCONFORMANCE REPORT

Date Submitted:		**NCR No:**	
Project:	H&S Bosma Dairy Lagoon No. 6		
Contractor:		**Response Due Date:**	
Location:		**Project No:**	

Nonconformance Issue

Contract Requirement: Describe

Reference (*Spec or Drawing*): Reference

Description of Non-Conformance: Describe

Corrective Action Required: Describe

Attachments (*list as applicable*): Attachments

Nonconformance Noted by:

Name		
Construction Manager, Anchor QEA, LLC	*Signature*	*Date*
Name		
Project Engineer, Anchor QEA, LLC	*Signature*	*Date*

Contractor's Response

Corrective Action Proposed: Describe

Contractor's Response Provided by:

Name		
Contractor's Representative (Print/Type Name & Title)	*Signature*	*Date*

Resolution

Construction Manager's Response to Contractor's Proposed Action:

☐ **Accept** ☐ **Accept with Conditions** ☐ **Reject**

Conditions/Comments: Describe

Name		
Construction Manager (Print/Type Name)	*Signature*	*Date*

Verification of Corrective Action Taken

Name		
Owner's Representative (Print/Type Name & Title)	*Signature*	*Date*
Name		
Contractor's Representative (Print/Type Name & Title)	*Signature*	*Date*

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ANCHOR QEA

SUBMITTAL LOG

PROJECT NAME: H&S Bosma Dairy Lagoon No. 6

PROJECT NO:

CONTRACTOR:

CONTRACT NO:

OWNER: Henry Bosma

LAST UPDATED:

CODE KEY: AP = Approved NE = No Exceptions RJ = Rejected/Re-Submit RR = Revise & Re-Submit MC = Make Changes SI = Submit Specified Item

Submittal Info						Review Schedule				Response	
Submit. No.	Bid Item	Spec. Section	Submittal Category/Description	Submit. Type Req.	Man./ Supplier	Due to Cont.	Sent out for Rev.	Rev. Rec'd	Ret'd to Contr.	Code	Notes (Red Requires Action)

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ANCHOR QEA

SUBMITTAL LOG

CODE KEY: AP = Approved NE = No Exceptions RJ = Rejected/Re-Submit RR = Revise & Re-Submit MC = Make Changes SI = Submit Specified Item

Submittal Info						Review Schedule				Response	
Submit. No.	Bid Item	Spec. Section	Submittal Category/Description	Submit. Type Req.	Man./ Supplier	Due to Cont.	Sent out for Rev.	Rev. Rec'd	Ret'd to Contr.	Code	Notes (Red Requires Action)

ED_002369M_00000033-00312

ANCHOR QEA

SUBMITTAL REVIEW TRANSMITTAL

Contractor:		**Project Name:**	H&S Bosma Dairy Lagoon No. 6
		Project Number:	
Date:		**Transmittal Number:**	

Check:

☐Original Submittal ☐ Resubmittal ☐ Other

Item No.	Specification No.	Subsection	Description

Review action:

☐ No Exceptions Taken ☐ Rejected

☐ Revise and Resubmit ☐ Submit Specified Item

☐ Approved as Noted (Resubmittal Not Required)

Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications and does not relieve the contractor from compliance with contract requirements. Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

Comments:	
By:	Date:

Cc:

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ANCHOR QEA

TRANSMITTAL

To:	**From:**
	Date:
Re:	**Project:** H&S Bosma Dairy Lagoon No. 6

No. of Copies	Description

Comments:

Appendix B
Summary of Inspections and Submittals

Table B-1
Summary of Construction Inspections and Verification Activities

Construction Element*	Specification Section	Specification Reference	Monitoring, Testing, and Inspection Requirements	Monitoring Frequency
Heath and Safety	01 35 00	3.02	Supervise and enforce compliance with the site Health and Safety Plan	Daily
Construction Facilities and Temporary Controls	01 50 00	1.10	Progress cleaning and waste disposal	Daily
		1.10	Collect and remove trash	Weekly
		1.11	Maintain signs and supports	Throughout duration of project
		1.11	Remove signs, framing, supports, and foundations	At completion of project
		1.14	Environmental protection	Throughout duration of project
		1.15	Surface water control	Throughout duration of project
		1.16	Dust control measures	Throughout duration of project
Closeout Procedures	01 77 00	1.06	Punch List corrections	Prior to certification of Substantial Completion
Cast-in-Place Concrete	03 30 00	3.14	Field sampling and testing	During concrete placement
		3.17	Post-placement cleanup	Upon completion of work
Electrical General	26 00 00	2.03	Artificial Leak Test	Prior to final acceptance
		3.02	Punch List corrections	Prior to final acceptance
		3.09	Owner training	Prior to final acceptance
Earthwork	31 00 00	1.06	Quality control for earthwork	Throughout duration of project
		1.06	Verification of existing utilities and facilities	Prior to starting work in this section
		1.06	Inspection for additional utilities	Throughout duration of project
		1.06	Protection of placed soil layers	Throughout duration of project
		2.02	Pre-construction material quality evaluations	Prior to starting work in this section
		3.01	Verifications of conditions	Prior to starting work in this section
		3.01	Inspect stockpile best management practices	Daily
Geotextiles for Earthwork	31 05 19.13	1.06	Construction quality control inspection of geotextile	Throughout duration of project
		3.03	Protection of geotextile	Throughout duration of project
Geomembranes for Earthwork	31 05 19.16	1.06	Quality control of HDPE	Throughout duration of project
		1.07	Inspection surfaces of all rolls for defects and damage	Upon delivery of GCL
		3.01	Subgrade inspection	Prior to HDPE installation
		3.03	Inspection of installation and welds	During GCL installation
Geosynthetic Clay Liners	31 05 19.23	1.06	Quality control of GCL	Throughout duration of project
		1.07	Inspection surfaces of all rolls for defects and damage	Upon delivery of GCL
		3.01	Subgrade inspection	Prior to GCL installation
		3.02	Inspection of installation and welds	During GCL installation

Table B-1
Summary of Construction Inspections and Verification Activities

Construction Element*	Specification Section	Specification Reference	Monitoring, Testing, and Inspection Requirements	Monitoring Frequency
Trenching and Backfilling	31 21 33	3.01	Verifications of survey benchmarks and intended elevations	Prior to starting work in this section
		3.01	Verifications of the adequacy and accuracy of the control surveys and data	Prior to starting work in the section
		3.01	Verify the materials excavated and processed on site meet the specified requirements	Throughout duration of project
		3.02	Locate and lay out required lines, levels, contours, and data	Prior to starting work in the section
		3.02	Identify, flag, and protect known utilities	Prior to starting work in the section
		3.02	Protect benchmarks, existing structures, and fences from excavation equipment and vehicular traffic unless identified for removal	Throughout duration of project
		3.02	Protect above- and below-grade utilities that are to remain	Throughout duration of project
Agricultural Waste Utility Piping	33 31 19	1.05	Quality control for HDPE pipe and fittings	Throughout duration of project
		1.06	Inspect materials delivered to site	Prior to installation
		1.06	Handling, storage, and care of materials	Throughout duration of project
		3.07	Solid pipe leak test	After pipe installation
		3.08	Deflection testing on bell and spigot CPE pipes	No sooner than 30 days after completion

Notes:

* This table summarizes the divisions of the *Construction Specifications* (Anchor QEA 2017a) that are most relevant to the *Construction Quality Assurance Plan* (Anchor QEA 2018b).

GCL: geosynthetic clay liner

HDPE: high-density polyethylene

Table B-2
Summary of Contractor Submittals

Construction Element*	Specification Section	Specification Reference	Submittal**	Due Date
Construction Progress Documentation	01 32 10	1.03.B.1	Draft Construction Schedule	10 calendar days from Notice to Proceed
		1.05.B.2	Approved Construction Schedule	Following Owner approval of the draft schedule
		1.05.3.A	Draft Schedule of Values	Within 10 calendar days after Notice to Proceed
		1.05.C.1	Final Schedule of Values	Within 5 calendar days after Notice to Proceed
		1.05.C.3	Revised Construction Schedule	Once every 2 weeks
Health and Safety	01 35 00	3.02.A	Health and Safety Plan	Prior to commencing work or within 10 days after receiving Notice to Proceed
Quality Assurance and Control	01 43 00	1.05.A.	Construction Quality Control Plan	Within 5 calendar days of Notice to Proceed
			Contractor Daily Report	Submit by 9:00 a.m. the following day
Construction Facilities and Temporary Controls	01 50 00	1.11.A.4	Project identification sign drawings	Prior to manufacturing the sign
		1.16.A	Work Plan for any work that will generate dust	Prior to beginning work
		1.17.A	Temporary erosion and sedimentation controls	Prior to beginning work
Mobilization	01 71 13	1.04.B	Details on site layout including fencing, roads, parking, buildings, storage areas, drainage plans, temporary building layouts, and temporary utility locations	7 calendar days after Notice to Proceed
Closeout Procedures	01 77 00	1.08.E.1	Record Drawings on Bond	Prior to application for final payment
		1.08.E.2	Record Specifications	Prior to application for final payment
		1.09.B	Warranty for Geotextiles	10 days following the issuance of the Certificate of Substantial Completion
		1.09.C	Warranty for HDPE Geomembrane	10 days following the issuance of the Certificate of Substantial Completion
		1.10.B	Contract Closeout Documents	When directed by the Owner
		1.03.B.7	Concrete delivery truck tickets	At the end of the day of delivery
Electrical General	26 00 00	1.12.C.3	Sample submittal control wiring diagram	At the pre-submittal electrical conference
		1.12.C.10	Preliminary Electrical Schedule	At the pre-submittal electrical conference
		3.07.A	Electrical Equipment Transition Plan	At completion and time for transition of equipment
Earthwork	31 00 00	1.05.A	Earthwork Construction Plan	Within 5 calendar days of Notice to Proceed
		1.05.C	Moisture conditioning methodology	Prior to moisture conditioning work
		1.07.B	Notification of excavation within 10 feet of any existing electrical utility	1 working day prior to beginning work
		2.02.B	Preconstruction material	Prior to incorporation in the work

Table B-2
Summary of Contractor Submittals

Construction Element*	Specification Section	Specification Reference	Submittal**	Due Date
Geotextiles for Earthwork	31 05 19.13	1.05.B	Geotextile shipping date	At least 10 working days prior to shipping
		1.05.C.1	Work Plan for storing, handling, installing, repairing, and seaming geotextiles	At least 10 working days prior to shipping
		1.05.C.2	Manufacturer's material specifications, product literature, and product sample for all materials	At least 10 working days prior to shipping
		1.05.C.3	Manufacturer's certifications for all geotextiles used	At least 10 working days prior to shipping
		1.05.C.4	Manufacturer's source quality control testing results	At least 10 working days prior to shipping
		1.05.D.1	Geotextile sample for material conformance testing	At least 10 working days prior to shipping
		1.05.D.2	Geotextile field sewn seam	At least 10 working days prior to shipping
		3.05.A.6	Geotextile properties not subject to conformance testing required in Table 2.01-1	At least 10 working days prior to shipping
Geomembranes for Earthwork	31 05 19.16	1.04.N	Panel layout drawing	At least 10 calendar days prior to shipping
		1.05.B.1	Resin data	At least 10 calendar days prior to shipping
		1.05.B.2	Geomembrane roll data	At least 10 calendar days prior to shipping
		1.05.D	HDPE samples	At least 10 calendar days prior to shipping
		1.05.E.1	Quality control documentation from the previous day's geomembrane installation	Prior to commencement of geomembrane installation on any given day
		1.05.E.2	Subgrade acceptance certification	Prior to commencement of geomembrane installation on any given day
Geosynthetic Clay Liners	31 05 19.23	1.05.B.1.a	Certification stating that the geomembrane meets the product requirements	At least 10 working days prior to shipping
		1.05.B.1.b	Copy of quality control tests performed by geomembrane supplier (if different from manufacturer)	At least 10 working days prior to shipping
		1.05.B.1.c	Copy of quality control tests performed by manufacturer	At least 10 working days prior to shipping
		1.05.B.2.a	Certification stating that the GCL meets the product requirements	At least 10 working days prior to shipping
		1.05.B.2.b	Copy of quality control tests performed by manufacturer	At least 10 working days prior to shipping
		1.05.B.2.c	Permeability testing on typical product	At least 10 working days prior to shipping
		1.05.B.2.d	Laboratory test data on typical product for Free Swell	At least 10 working days prior to shipping
		1.05.C.1	Qualifications of the Installer	At least 10 working days prior to shipping
		1.05.D.1	Quality Control Plan and Installation Procedures	3 weeks prior to installation
		1.09.A	GCL installation warranty	With the standard general provisions of the contract
		3.02.A	Quality control documentation from the previous day's GCL installation	Prior to commencement of GCL installation on any given day

Table B-2
Summary of Contractor Submittals

Construction Element*	Specification Section	Specification Reference	Submittal**	Due Date
Agricultural Waste Utility Piping	33 31 19	1.04.B.1	Manufacturer's product data and manufacturer's certificates	Prior to shipping material to the site
		1.04.B.2	Sample for each solid and perforated pipe	Prior to shipping material to the site
		1.04.B.3	Pipe manufacturer's qualifications	Prior to shipping material to the site
		1.04.C.1	Shop drawings for any specialty fabricated fittings	Prior to fabrication of pipe components
		1.04.C.2	Pipe manufacturer's qualifications	Prior to fabrication of pipe components
		1.04.D.1	Pipe installer's qualifications	Prior to installation of any components
		1.04.D.2	Pipe installation sequence and schedule plan	Prior to installation of any components
		1.04.E	Pipe Testing Plan	Prior to installation of any components

Notes:

* This table summarizes the divisions of the *Construction Specifications* (Anchor QEA 2017a) that are most relevant to the *Construction Quality Assurance Plan* (Anchor QEA 2017b).

** These submittals constitute the submittals required of the General Contractor and will be approved by the Construction Manager/Project Engineer prior to the start of work.

GCL: geosynthetic clay liner

HDPE: high-density polyethylene

Appendix E
Operations, Maintenance, and Monitoring Plan

September 23, 2019
H&S Bosma Dairy Lagoon No. 6 and Consolidated Lagoon No. 10
Administrative Order on Consent Docket No. SDWA-10-2013-0080

ANCHOR QEA

H&S Bosma Dairy Lagoon No. 6 and Consolidated Lagoon No. 10 Operations, Maintenance, and Monitoring Plan

Prepared for Liberty/H&S Bosma Dairies

September 23, 2019
H&S Bosma Dairy Lagoon No. 6 and Consolidated Lagoon No. 10
Administrative Order on Consent Docket No. SDWA-10-2013-0080

H&S Bosma Dairy Lagoon No. 6 and Consolidated Lagoon No. 10 Operations, Maintenance, and Monitoring Plan

Prepared for
Liberty/H&S Bosma Dairies
4300 Beam Road
Zillah, Washington 98953

Prepared by
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720 Olive Way, Suite 1900
Seattle, Washington 98101

Project Number: 190996-01.01
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FIGURE

Figure 1 H&S Bosma Dairy Lagoon Map

APPENDIX

Appendix A Example Inspection Form

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ABBREVIATIONS

Dairy	H&S Bosma Dairy
EPA	U.S. Environmental Protection Agency
FML	flexible membrane liner
GCL	geosynthetic clay liner
H:V	horizontal to vertical (ratio)
HDPE	high-density polyethylene
mil	thousandth of an inch
OMMP	*Operations, Maintenance, and Monitoring Plan*

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1 Introduction

This *Operations, Maintenance, and Monitoring Plan* (OMMP) was prepared by Anchor QEA, LLC, on behalf of Liberty/H&S Bosma Dairies as required by the U.S. Environmental Protection Agency (EPA) Region 10 Administrative Order on Consent SDWA 10-2013-0080.

The OMMP describes the operations to be conducted at H&S Bosma Dairy's (herein referred to as the Dairy) Lagoon No. 6 and Consolidated Lagoon No. 10 (consolidated from existing Lagoon Nos. 10, 11, and 13) to safely operate the lagoons and maintain the integrity of the various lagoon components through inspection, maintenance, repair, monitoring, and reporting procedures.

The objectives of this OMMP are listed as follows:

- Describe the components of Lagoon No. 6 and Consolidated Lagoon No. 10 and their normal operating conditions.
- Provide a plan for operation of Lagoon No. 6 and Consolidated Lagoon No. 10 that minimizes the chance of damage to the liner systems.
- Provide a plan for Lagoon No. 6 and Consolidated Lagoon No. 10 that details long-term lagoon operation procedures that will maximize the life of the lagoon liner and reduce the chance for a release.
- Establish monitoring procedures for leak detection at Lagoon No. 6 and Consolidated Lagoon No. 10.
- Establish action levels that trigger various response procedures.
- Establish inspection and reporting schedules and required report components.

1.1 Lagoon Summary

Lagoon No. 6 is located approximately 1,100 feet to the southeast of the Dairy's office at 823 N Liberty Road in Granger, Washington. The approximate geographic coordinates of the lagoon are 46°23'30.03" N and 120°08'33.06" W. Consolidated Lagoon No. 10 is located approximately 790 feet to the southeast of the Dairy's office. The approximate geographic coordinates of the lagoon are 46°23'35.50" N and 120°08'32.91" W. Figure 1 shows the lagoon's location within the Dairy.

Primary inputs to the lagoons are liquid manure from the Dairy's operations.

On average, measuring from top of slope, Lagoon No. 6 is 215 feet long (as measured north to south) and 280 feet wide (as measured east to west), with interior side slopes that have a maximum horizontal-to-vertical ratio of 3:1 (3H:1V). The 10.2-foot maximum depth, which includes a freeboard depth of 2 feet, results in a maximum operational depth of 8.2 feet and an operational capacity of about 7.52 acre-feet or 2.45 million gallons, excluding the freeboard depth volume. The exterior side slopes do not exceed a 2H:1V inclination.

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The estimated maximum impounded volume for Lagoon No. 6 is 8.34 acre-feet, with a maximum lagoon impoundment depth of 8 feet. This impoundment depth is measured from the lowest point along the exterior of the berm to the top of the liner, which includes the freeboard depth of 2 feet. The impoundment depth does not include the 2 feet of lagoon depth below the lowest point on the exterior of the berm.

On average, measuring from top of slope, Consolidated Lagoon No. 10 is approximately 320 feet long (as measured north to south) and 165 feet wide (as measured from east to west), with interior side slopes that have a maximum horizontal-to-vertical ratio of 3H:1V. The 16-foot maximum depth, which includes a freeboard depth of 2 feet, results in a maximum operational depth of 14 feet and an operational capacity of approximately 7.89 acre-feet or 2.57 million gallons, excluding the freeboard depth volume. Existing exterior side slopes range between 1H:1V to 4H:1V.

The estimated maximum impounded volume for Consolidated Lagoon No. 10 is 9.23 acre-feet, with a maximum lagoon impoundment depth of 14 feet. This impoundment depth is measured from the lowest point along the exterior of the berm to the top of the liner, which includes the freeboard depth of 2 feet. The impoundment depth does not include the 2 feet of lagoon depth below the lowest point on the exterior of the berm.

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2 Operations

Lagoon No. 6 and Consolidated Lagoon No. 10 will both be lined with a primary flexible membrane liner (FML) over a secondary geosynthetic clay liner (GCL). The liner system and other key components of the lagoons related to operations, maintenance, and monitoring are discussed in the following subsections.

2.1 Liner Components

The components listed below comprise Lagoon No. 6 and Consolidated Lagoon No. 10's liner section. Listed from the bottom up, they are:

- A compacted and prepared soil base
- A grid of geocomposite gas vent strips
- A GCL secondary liner
- A 60-thousandth of an inch (mil) high-density polyethylene (HDPE) primary liner

The GCL will be placed over the geocomposite vent strips and compacted soil foundation with the HDPE geomembrane placed directly on top of the GCL.

The following measures will be taken to minimize the risk of the liner being punctured after installation:

- No vehicle traffic on liner: Following construction, vehicle traffic will not be allowed on the liner system.
- Perimeter protection: A fence or barrier will be installed along the perimeter of each lagoon to deter access to the lagoon by animals, personnel, and vehicles.
- Signage: Signs will be placed around the lagoons notifying individuals to stay off the liner. Foot traffic on the liner will be permitted on an as-needed basis for operational and maintenance needs only.
- HDPE rub sheets: Two rub sheets will be installed in locations on the lagoons designated for floating agitator pump ingress to and egress from the lagoons. These sheets will be installed on the primary liner from the edge of the anchor trench, downslope, and along the bottom of the lagoon. Rub sheets are anticipated to be made of smooth 40-mil HDPE liner and will be installed one on top of the other.
- Agitator tether lines: When in the lagoons, the floating agitator pumps will be secured in place with the use of tether lines anchored to designated points beyond the crest of each lagoon.

While in operation, Lagoon No. 6 and Consolidated Lagoon No. 10 will be tested for leaks using bare liner puddle surveys. For this survey method, a custom-made roller squeegee system (or "puddle probe") with sprayers is used to roll along the surface of the exposed liner to detect leaks. When a

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penetration, defect, or damage on the geomembrane is encountered, the water sprayed from the puddle probe completes a circuit. This connection (or anomaly) is translated through a high-frequency audible tone that notifies the technician. The technician will further investigate this targeted area to pinpoint the exact location of the anomaly.

2.2 Cleanout System

Lagoon No. 6 and Consolidated Lagoon No. 10 will be equipped with floating pontoon agitator pumps that will convey liquid and solids from the lagoons for use in field fertilizer application during the irrigation season. The pumps connect to an aboveground irrigation network that convey lagoon contents to various application fields, depending on the need. The pontoon system was selected to eliminate the need to deploy other pump systems by vehicles on the liner.

Each agitator pump is intended to be dedicated to Lagoon No. 6 and Consolidated Lagoon No. 10, respectively. HDPE rub sheets installed in designated areas of the lagoons from the edge of the anchor trench, downslope, and onto the bottom of the lagoons are used to protect the primary liner as the agitator enters and exits the lagoon or as the lagoon is emptied. Prior to emptying the lagoons, the agitators will be positioned directly above the rub sheets so the pontoons safely rest on the rub sheets when the lagoons are empty. The agitators will be tethered to the lagoon embankments per manufacturer specifications.

To confirm that the agitators are positioned along the rub sheets alignment for ingress to or egress from the lagoons, the rub sheets will be located between two vent system pipes along the lagoon perimeter at Lagoon No. 6 and Consolidated Lagoon No. 10; these pipes may be painted or otherwise marked to indicate the location of the rub sheet alignment. To ensure that the agitator is positioned above the rub sheet along the bottom of the lagoons, tethered lines of measured length from designated anchor points will be documented.

Any gate valves installed on an outlet pipe shall remain fully open during normal operating conditions and closed only temporarily if necessary to perform maintenance activities.

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3 Inspections, Leak Detection Monitoring, and Action Levels

3.1 Routine Visual Inspections

Routine inspections will be performed by Dairy personnel on a weekly basis. Weekly post-construction inspections will begin on the date the newly lined lagoon begins to receive liquid manure. Routine inspections will include visual inspections of the following:

- The liner for evidence of slumps, bulges, or whales
- Damage to the liner (e.g., holes, tears, or damaged seams)
- The perimeter of the lagoon, looking specifically for signs of access from animals or workers, damage to fencing/barrier, presence of trees or vegetation, wind damage, or rodent activity
- The embankments, looking for signs of erosion
- The protective fence or barrier and signage
- Inlet and outlet piping to check for obstructions or damage
- Accumulation of solids in the lagoon
- The agitation equipment to ensure that it is properly secured with the tethered lines and that the equipment is positioned away from the side slopes and bottom of the lagoon
- Gas venting piping to check for obstructions or damage

The Inspection Form in Appendix A will be completed and retained after each inspection at each lagoon. See Section 4 for maintenance requirements.

3.2 Liner Monitoring

3.2.1 *Construction Quality Assurance Monitoring*

During construction, liner seams will be tested to verify that they have been properly installed and have no leaks. Details on the construction quality assurance tests and action items that will be taken if the test fails are described in the *Construction Quality Assurance Plan* (Anchor QEA 2018a) and *Technical Specifications* (Anchor QEA 2018b). The lagoon liner installer will provide an installation warranty that warrants the liner at each lagoon for defects and leaks for the first 2 years of operation.

3.2.2 *Post-Installation Monitoring*

After installation and prior to commencing operations at Lagoon No. 6 and Consolidated Lagoon No. 10, a bare liner puddle survey will be conducted to confirm no leaks are present. For this survey method, a custom-made roller squeegee system (or puddle probe) with sprayers is used to roll along the surface of the exposed liner to detect leaks. When a penetration, defect, or damage on the geomembrane is encountered, the water sprayed from the puddle probe completes a circuit. This connection (or anomaly) is translated through a high-frequency audible tone that notifies the technician. The technician will further investigate this targeted area to pinpoint the exact location of

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the anomaly. If potential leaks are identified, they will be marked out for the liner installer to conduct repairs according the *Construction Quality Assurance Plan* (Anchor QEA 2018a) and *Technical Specifications* (Anchor QEA 2018b). Yearly Visual Bare Liner Inspection

Toward the end of each winter season, the lagoons will be drained of liquid and visually inspected by Dairy personnel to determine the integrity of liner. If any visual indications of liner tears are present, the Dairy will inform the liner installer for repair (if within the 2-year warranty) or contract out a qualified liner installer to conduct repairs.

3.2.3 *Liner Integrity Monitoring*

A bare liner puddle survey will be performed every 2 years to evaluate the integrity of the liner. This will consist of draining the lagoon of liquid, carefully removing any remaining solids, and conducting a bare liner puddle survey on the liner from the crest of the lagoon inwards. The Dairy will summarize leak detection results in a report after testing has occurred. If leaks are located, the Dairy will contract a qualified liner installer to conduct repairs.

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4 Post-Construction Maintenance

Periodic draining and cleanout to remove liquid and suspended solids from Lagoon No. 6 and Consolidated Lagoon No. 10 will occur for crop fertilization and as necessary for liner maintenance.

4.1 Regular Maintenance

To minimize issues (e.g., tearing and punctures) to the lagoon liners, appropriate operating procedures will be implemented. Operations and maintenance activities will include, but are not limited to:

- Maintain pumps, agitators, piping, valves, and other electrical and mechanical equipment in good operating condition by following the manufacturer's recommendations.
- Maintain wiring for all electrical equipment in good condition.
- Maintain fencing, barriers, and warning signs to deter access to Lagoon No. 6 and Consolidated Lagoon No. 10 by unauthorized personnel, vehicles, and animals.
- Repair damage to the lagoons, embankments surrounding the lagoons, or any appurtenances.
- Remove debris within the lagoons that may cause damage to equipment or the liner system.
- Eradicate or remove rodents or other burrowing animals that may damage the liner systems.
- Apply insect control measures per manufacturer's recommendations and precautions.

Weekly inspections, as described in Section 3.1, will include visual inspections of these items.

4.2 Liner Replacement

HDPE geomembrane and GCL manufacturers indicate that the products have a typical lifespan of 20 to 30 years, depending on exposure, slopes, operations, and construction. As the materials surpass this life expectancy, the liner system can be expected to require more frequent repairs and/or replacement. The need for liner replacement will be determined by the Dairy based on the manufacturer's specifications and criteria, the frequency of leaks as determined by puddle surveys, and/or the results of physical inspections of the liner system.

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5 Reporting

The Dairy will prepare an OMMP for Lagoon No. 6 and Consolidated Lagoon No. 10 after each calendar year of operations. The OMMP will include a section that summarizes the lagoon operations and maintenance activities that occurred during the year and a table for each dairy that lists the name of each lined lagoon and following components for each lined lagoon:

- Whether any anomalies were detected during the year that triggered repeat monitoring
- Results of the repeat monitoring
- Whether testing indicated a leak at any lagoon
- Descriptions of any actions that were taken to identify the location of or repair any identified leaks
- Descriptions of any relevant planned actions

The OMMP will be submitted to EPA with the Annual Report.

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6 References

Anchor QEA (Anchor QEA, LLC), 2018a. *Construction Quality Assurance Plan*. 90% Design Submittal. Prepared for Liberty/H&S Bosma Dairies. May 2018.

Anchor QEA, 2018b. *Technical Specifications*. 90% Design Submittal. Prepared for Liberty/H&S Bosma Dairies. May 2018.

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Figure

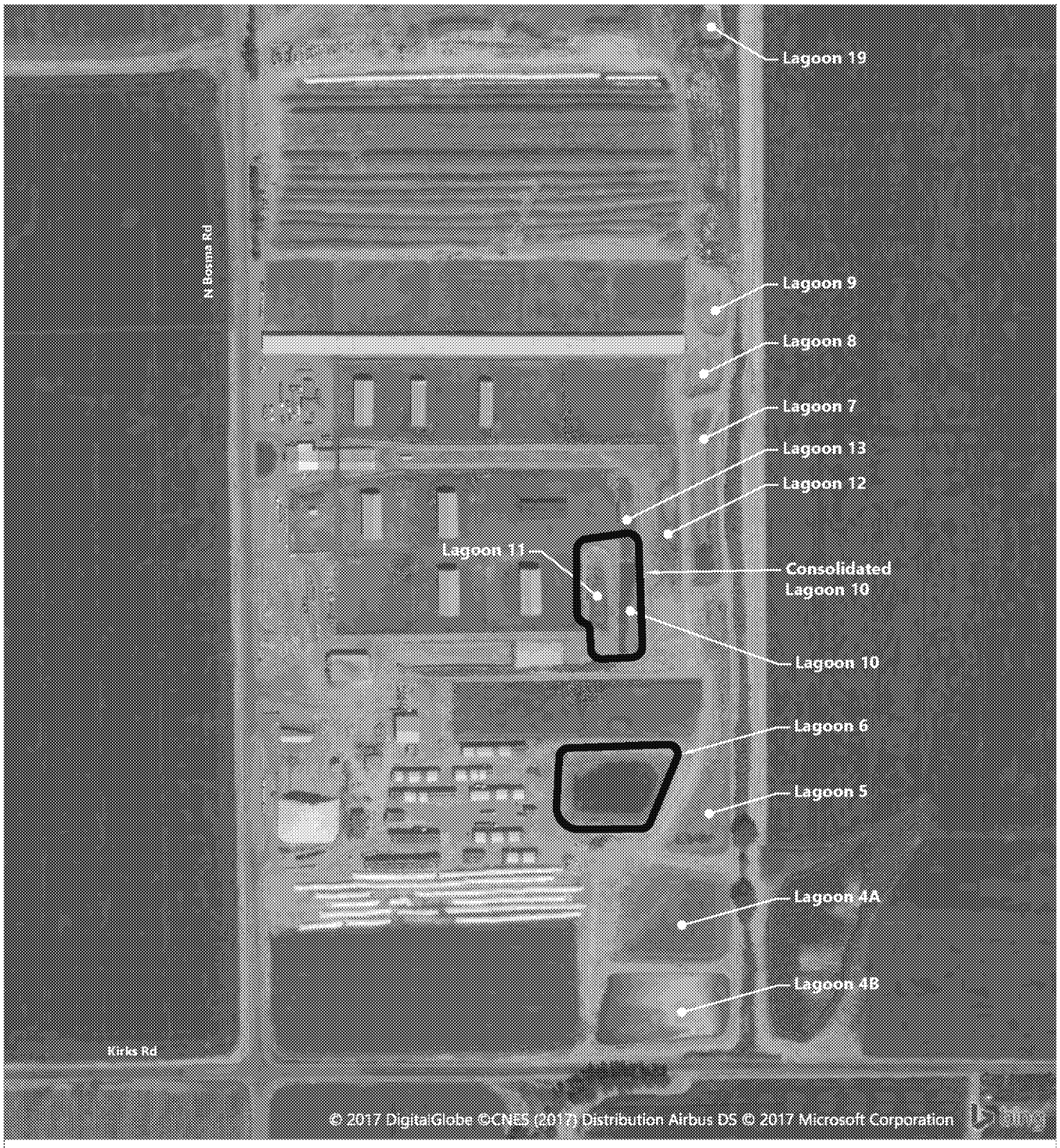

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Figure 1
H&S Bosma Dairy Lagoon Map

Operations, Maintenance, and Monitoring Plan
H&S Bosma Dairy Lagoon No. 6 and Consolidated Lagoon No. 10

Appendix A
Example Inspection Form

LIBERTY/H&S DAIRY LAGOON VISUAL INSPECTION FORM **DATE:** **NAME:**

Lagoon	Perimeter	Banks	Inlet and Outlet	Fence and Signs	Solids Inside	Liquid Level	Action Items
BOSMA LAGOON 1							
BOSMA LAGOON 2							
BOSMA LAGOON 3							
BOSMA LAGOON 4A							
BOSMA LAGOON 4B							
BOSMA LAGOON 5							
BOSMA LAGOON 6							
BOSMA LAGOON 7							
BOSMA LAGOON 8							
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