Special Specification 5056
Impermeable Liner

1. DESCRIPTION

Furnish and install impermeable geomembrane liner shown on the plans. The geomembrane shall be high-density polyethylene (HDPE) membrane. HDPE membrane shall be used as a detention pond liner to prevent stormwater from penetrating the soil in unwanted locations.

2. MATERIALS

Furnish new materials in accordance with this item and the details shown on the plans.

2.1 **Geomembrane.**

The geomembrane liner shall be new and comprised of HDPE material manufactured of first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures. The nominal thickness of the HDPE membrane shall be 30 mils and be ultraviolet resistant.

The contractor shall, at the time of award, submit to the Engineer, a certification from the manufacturer of the sheeting, stating that the sheeting meets physical property requirements for the intended application.

The geomembrane shall be textured on both sides. The surface of the geomembrane shall not have striation, pinholes or bubbles and shall be so produced to be free of holes, blisters, undispersed raw materials, or any contamination of foreign matter. Any defects shall be reported to the Engineer immediately after discovery and replaced or repaired under the direction of the Engineer at the Contractor's expense. If repair is required, extrusion fusion welding technique shall be performed in accordance with the manufacturer's recommendations.

The geomembrane shall be manufactured in a minimum of 22-feet seamless widths. Labels on the roll shall identify the thickness, length, width and manufacturer's batch and roll number. There shall be no factory seams.

The geomembrane rolls shall meet the minimum values as shown in the following chart:

Geomembrane Specifications*

Property	Value	Test Method
Nominal Thk	30 mils	
Density (Min)	0.033 oz/cc	ASTM D1505
Melt Flow Index (Max)	0.014 oz/10 min	ASTM D1238
		Condition E(374 F, 4.76 lb)
Tensile Properties (Typical)		ASTM D 638 Type IV Dumb-bell at 2.0 in/min
Tensile Strength at Break	240 lb/in width	
Tensile Strength at Yield	140 lb/in width	
Elongation at Break	700%	
Elongation at Yield	13%	
Tear Resistance Initiation (Typ)	45.0 lbs	ASTM D1004 Die C
Low Temperature Brittleness (Typ)	-112 F	ASTM D746 Procedure B
Dimensional Stability	+/- 2%	ASTM D1204 212 F, 1 hr

Change Each Direction (Max)		
Environmental Stress Crack. (Min)	2,000 hours	ASTM D1693 (10% Igepal, 60 C)
Puncture Resistance (Typical)	80 lbs	FTMS 101 Method 2065
Coefficient of Linear Thermal Expansion (Typical)	0.00008 in/in F	ASTM D696
Thermal Stability Oxidative Induction	2,000 mins Time (OIT)	ASTM D3895 266 F 800.03 PSI Oxygen (Min)
Carbon Black	2-3%	

* Note: Minimum values, unless otherwise specified, are average roll values as reported by the specific test methods.

2.2 **Manufactured Roll Goods.** Samples of the production run shall be taken and tested according to ASTM D638 to ensure the tensile strength at yield and break, and elongation at yield and break meet the minimum specifications. A quality control certificate shall be issued with the material.

All welding material shall be of a type recommended by the manufacturer.

2.3 **Liner System.** The liner method system shall consist of a layer of 30 mil HDPE geomembrane. A nonwoven geotextile fabric shall be placed on the top and bottom of the geomembrane for puncture protection. The liner shall be covered with a minimum of 12" of compacted top soil.

The geotextile fabric shall meet the specifications in the table below.

Property	Value	Test Method
Unit weight	8 oz/sy	
Filtration Rate	0.08 in/sec	
Puncture Strength	125 lb	ASTM D-751
Mullen Burst Strength	4000 psi	ASTM D-751
Tensile Strength	200 lb	ASTM D-1682
Equiv. Opening Size	No. 80	US Standard Sieve

The contractor shall, at the time of award, submit to the Engineer, a certification from the manufacturer of the sheeting, stating that the sheeting meets physical property requirements for the intended application.

2.4 **Material Compliance.** Engineer reserves the right to inspect the manufacturer's or the fabricator's facilities to ensure compliance with these specifications.

3. CONSTRUCTION

Use construction methods in accordance with this specification and as shown in the plans.

3.1 **Area Subgrade Preparation**. Surfaces to be lined shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind and shall be approved by the Engineer prior to liner installation. A 2" layer of flowable backfill shall be placed on the subgrade prior to installing the HDPE geomembrane. The surface shall provide a firm, unyielding foundation for the geomembrane with no sudden, sharp or abrupt changes or break in grade, except as shown on the plans. Bends indicated on the plans shall be field fabricated using Manufacturer's recommendation and approved by the Engineer. No standing water or excessive moisture shall be allowed. The Contractor shall certify in writing that the surface on which the geomembrane is to be installed is acceptable before commencing work.

3.2 **Weather Conditions.** Geomembrane deployment shall proceed between ambient temperatures of 32°F and 105°F. Placement can proceed below 32°F only after it has been verified by the Engineer that the material can be seamed according to the specification. Geomembrane placement shall not be done during any

precipitation, in the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the Engineer.

3.3 **Methods of Placement.** The liner shall not be installed with any equipment or tools that can damage the liner materials by handling, trafficking, or other means. The method used to unroll the liner panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil or flowable backfill. Panels of geomembrane shall be placed using a method that shall minimize wrinkles.

3.4 **Field Seams.** Individual panels of geomembrane shall be laid out and overlapped by a maximum of 4-inches for an extrusion weld prior to welding or 5-inches for a hot wedge weld prior to welding. Extreme care shall be taken in the preparation of the areas to be welded. The area to be welded shall be cleaned and prepared according to the procedures of the material manufacturer. All sheeting shall be welded together using the hot wedge welding system.

The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the lining material to ensure that changes in environmental conditions will not affect the integrity of the weld.

No “fish mouths” shall be allowed within the seam area. Where “fish mouths” occur, the material shall be cut, overlapped, and an overlap extrusion weld shall be applied.

3.5 **Field Seam Testing/Quality Control.** The Contractor shall employ on-site physical non-destructive testing on 100 percent of all welds.

A quality-control technician furnished by the Contractor shall inspect each seam. The ECM shall be notified of all tests in order to be present to observe the testing. Any area showing a defect shall be marked and repaired in accordance with HDPE repair procedures.

A test weld one 3-feet long from each welding machine shall be run each day prior to liner welding and under the same conditions as exist for the liner welding. The test weld shall be marked with the date, ambient temperature, and welding machine number. Samples of weld ½-inch to ¾-inch wide shall be cut from the test weld and pulled by hand peel. The weld shall not peel. Seams shall exhibit a film tear bond. The weld sample shall be kept for subsequent testing on laboratory tensometer equipment in accordance with the applicable ASTM standards. Random weld samples may be removed from the installed welded sheeting at a frequency to be approved by the Engineer.

4. MEASUREMENT

This Item will be measured by the square yard.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Impermeable Liner” of the type shown. This price is full compensation for furnishing all labor, materials, welding materials, excavation for toe and top anchor trenching, freight, tools, equipment, testing, and incidentals, and for all work involved in placement of the liner, complete in place.