Long-term Integrity of Canals Lined with Geosynthetics

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Agenda

* Water in California
* Solano Irrigation District
* Putah South Canal
* Canal Liner Design Details
* The Putah Canal Today
* The Current Generation of Canals
Long Term Integrity of Canals Lined with Geosynthetics

WATER IN CALIFORNIA
(A CHALLENGING BALANCE)

SAN JOAQUIN VALLEY
“The Food Basket of the World”
~40 inches (100cm) Irrigation demand per year
(For the 0.26% of US land that supplies 12.8% of US agriculture)

LOS ANGELES AREA
13 million people
~80 inch (200cm)/year Demand
California Putah South Canal after 25 Years in Service

**PACIFIC OCEAN**
Ocean temperatures are cool
11-15°C (52-58°F, Crescent City) to
15-21°C (58-70°F, San Diego)

**CW CALIFORNIA & SIERRA NEVADA MOUNTAINS**
<120 in (<300 cm)/year

**SAN JOAQUIN VALLEY**
5-16 inches (12-40cm)/year

**LOS ANGELES AREA**
10-15 in (25-38cm) rain per year

**MOJAVE DESERT**
<5 in/year (<13 cm/year)

California Water Conveyance

California’s WATER BALANCE

10-25 in (28-64cm)/year
Water Deficit

<120 in (<300 cm)/year
Water Surplus

25-30 in (65-75cm)/year
Water Deficit

California Water Conveyance Facilities in California
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THE SOLANO PROJECT

The Solano Project

Lake Berryessa
Putah Creek
Putah South Canal
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PUTAH CANAL DESIGN DETAILS

CANAL DESIGN

PLAN VIEW

CROSS-SECTION VIEW
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**Installation**

* Installation of blown-film textured 80-mil (2.0mm HDPE) ca. 1993
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THE PUTAH CANAL TODAY

Present Day

Putah South Canal Today

Expansion Joint

Panoramic View
LESSONS LEARNED

1. HDPE encased in concrete has proven to be a cost-effective and lasting canal lining system;
2. A 2-inch (5cm) fiber-reinforced shotcrete
   a. Was applied directly to an HDPE geomembrane with blown-film texture on 1.5H:1V side slopes;
   b. Has withstood environmental exposure and canal flows;
3. ½-inch-wide x 1-inch deep (1cm x 2.5 cm) wet-formed expansion joints at 2.5m (8') o.c. across the width of the canal contained cracks in the shotcrete, so panels remained intact.
4. No dislodgement of the shotcrete layer was observed, and the canal remains in very serviceable condition without significant damage after 28 years in service.
Modern Day Project

Linear Low-density Polyethylene (LLDPE) Geomembranes
- Elongation capacity to protect against punctures
- Flexibility decreases wrinkle spacing and size

Reflective White Geomembranes
- Cost-effective control of temperature changes that drive thermal expansion
- Mitigates risk of damage during concrete installation
- Ideal for challenging desert conditions
- Can be used exposed or covered

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