GEOSYNTHETICS AND CONSTRUCTION OF THE SECOND POWERHOUSE CORNER COLLECTOR SURFACE FLOW BYPASS PROJECT

BONNEVILLE LOCK AND DAM PROJECT OREGON AND WASHINGTON

US Army Corps of Engineers
Portland District
By: Art Fong
Geotechnical Design Section
Hydraulics, Hydrology, and Geotechnical Design Branch
TOPIC: Geotechnical Engineering and Use of Geosynthetic Fabrics, Geogrids, Geofoam, and Geocomposite Wall Drains.

Geosynthetics were used for Foundation Improvement, Reinforced Embankments and Slopes, minimizing Lateral Earth Pressures, providing subsurface drainage path for the Transportation Channel wall, and for materials separation.
Project used Geosynthetic materials to:

- Contain (separate) and Improve foundation materials
- Distribute loading under the Transportation Channel slab
- Provide strength and stability using Geogrids in reinforced soil embankments
- Provide drainage from upslope
- Provide scour protection in the Plunge Pool area
Contract type was “Best Value” evaluated on construction planning, schedule, and cost. Project was completed in 2004.

Contractor for the Second Powerhouse Corner Collector Surface Bypass Project was:

Kiewit-Manson, Joint Venture
Project Site Map and Vicinity Map

WASHINGTON

PROJECT SITE
~ 3,000 linear ft

SECOND POWERHOUSE

CASCADES ISLAND

OREGON

SPILLWAY

FIRST POWERHOUSE
Feature Map

FOUNDATION – GEOTEXTILE FABRIC FOR SEPARATION, STABILIZATION, REINFORCEMENT

PLUNGE POOL – GEOTEXTILE FABRIC FOR SEPARATION UNDER CONCRETE MATTRESSES

RSS – BIAXIAL GEOGRID - REINFORCEMENT AND STABILIZATION

MSE – UNIAXIAL GEOGRID FOR REINFORCEMENT, GEOFOAM FILL

VARIABLE FOUNDATION AREAS – GEOTEXTILE FABRIC WITH ROCK - FOR STABILIZATION, REINFORCEMENT, AND SEPARATION

GEOCOMPOSITE DRAIN USE ALONG BACKFILLED TRANSPORTATION CHANNEL
Bonneville Second Powerhouse
Cascades Island site of the Transportation Channel
Geotextile fabric over soft foundation sands - covered with rock for foundation improvement
Upstream Plan View – Rockfill RSS

In-Water Work for Pipe Piles, rip rap and RSS with Geogrids and rockfill
RSS Cross Section

~40 FT HIGH

EXISTING GROUND

TRANSPORTATION CHANNEL

4' GRouted RIPRAP PATH

CLASS II RIPRAP 3'-0" THICK

INTERLOCKING CONCRETE WALL BLOCKS FOR FACING 2.5' X 2.5' X 8' EACH

PIPE PILES 4'-0" O.C.
PIPE X-STRONG

2H-11V

PLACE ROCKFILL

BIAXIAL GEORGET REINFORCEMENT @ 2'-6" SPACING TYP.

ELEVATION, FT.

SECTION E G1
Construction of the Rockfill RSS Embankment Alignment piles, Concrete Block Facing, and Geogrid Reinforcement.
Construction of the RSS Embankment - Layered Bi-Axial Geogrids with Rockfill
To provide separation, improve foundation bearing, and drainage for the Transportation Channel slab, a compacted bedding gravel layer on a Geotextile Fabric was constructed. The Transportation Channel slab was then formed and placed on the bedding.
Geotextile fabric installed and 2-foot thick gravel layer was placed and compacted.
Geotextile Fabric and Geocomposite Drain
Geocomposite Drain on Transportation Channel Wall
Geocomposite Drain ran full length of the wall
To provide access to the top of the Transportation Channel, two Mechanically Stabilized Embankments (MSE) fills were constructed using Geogrids and compacted gravel.

One-foot thick Geofoam was placed against the Channel wall prior to start of constructing the MSE fill to reduce lateral pressures of the embankment.
Uniaxial Geogrids and Lightweight Geofoam

MSE SECTION
Geocomposite Wall Drain and Geogrid Reinforcement
Geogrid reinforced MSE embankment with concrete block facing on Geofoam against the channel wall
Contractor VE Proposal - use a MSE embankment to backfill an open cut was accepted for the upstream portion of the Channel wall. Originally a soil nail wall and top-down excavation had been planned - but the elected open cut remained stable.

Layered geogrids and granular backfill, wire mesh facing with geotextile fabric butted up to Geofoam on the Channel wall.
Geogrid reinforcement on backfill. Embankment facing wire mesh with the geotextile fabric against Geofoam blocks
50 foot excavation

~80 feet; +10 to -70

Plunge Pool - Articulated Concrete Mattresses over Geotextile Fabric
Mattress and frame for placement in the water
Bypass in Operation
Conclusion:
Many Geosynthetic Products were used as originally designed or as proposed during construction by the Contractor.

Geosynthetics used contributed toward the successful construction and operation of the Bypass System.

Questions?

Thank You!