OPERATION & MAINTENANCE PLAN
S.319-FUNDED BIOENGINEERING BANK STABILIZATION SITES
CONNECTICUT RIVER WATERSHED RESTORATION
PHASE I 96-08/319; PHASE II 00-04/319; PHASE III 03-07/319

OWNER OF THE BMPS AND SOURCE OF FUNDING FOR LONG-TERM OPERATION AND MAINTENANCE OF THE BMPS:

FirstLight Power Resources, Inc.
One Corporate Center
20 Church Street, 16th Floor
Hartford, CT 06103
(860) 895-6900

RESPONSIBLE PARTY FOR THE OPERATION & MAINTENANCE OF THE BMPS:

FirstLight Power Resources, Inc.

Contact Person:
John S. Howard, Station Manager
Northfield Mountain Station
99 Millers Falls Road
Northfield, MA 01360
(413) 659-4489 Office
(413) 659-4459 FAX
jhoward@firstlightpower.com

DESCRIPTION OF BIOENGINEERING BANK STABILIZATION SITES:

Phase I Sites:
Three sites were restored under Phase I (Project 96-08/319). These sites are known as Wickey, Shearer and Crooker. The three bioengineering treatment types used on the Phase I sites included:

Hard Toe: Sand or gravel fill was placed in the undercut/scour zone and then covered with rock rip-rap. Coir fascines were placed in vertical layers above the rock toe and cabled in place. The area above the coir fascines was protected by burlap or coir fabric and then planted with live stakes of woody species.

Breakwater: This treatment was designed to be built at the mean water level and includes a rock toe and coir roll or fascine at the water's edge. A flat area was created behind the toe and a pre-vegetated mattress was staked in place. The specified plants were designed to create an emergent wetland community. A gradual slope leads to the top of the bank. The

upper slope was protected with coir fabric or burlap and seeded or planted with live stakes.

Bank Reconstruction: Sand or gravel was used to fill the undercut/scour zone. A rock toe was constructed and coir fascines were placed above the toe. Fabric-wrapped geogrid lifts were placed in layers above the coir fascines to construct the new bank. Dormant live brush was placed in-between the layers.

Phase II and III Sites:

Geogrid lifts, brush mattresses and brush fascines used on the Phase I sites were not used at the Phase II (Project 00-04/319) and Phase III (Project 03-07/319) sites. The designs for these sites, known as the Urgiel Upstream site (Phase II) and the Urgiel Downstream site (Phase III), consist of four bank treatment types:

Top of Slope: Seed with native seed mix and plant Red Oak, Red Maple, Sycamore, Gray Birch, Quaking Aspen, Pin Oak, White Ash and Cottonwood trees.

Upper Bank: Seed with native seed mix and plant 1 gallon pot-sized woody vegetation, including: Arrow-wood, Staghorn Sumac, Gray Dogwood, Shadblow, American Hazelnut, Black Chokecherry and Nannyberry.

Lower Bank: Seed with native seed mix and plant 1 gallon pot-sized woody vegetation, including: Speckled Alder and Silky Dogwood.

Stone Toe: Plant tubelings (rooted cuttings) of Pussy Willow, Purple-osier willow, and Sandbar willow.

The Phase II and III designs incorporated several new techniques, including:

- Planting willow tubelings in the stone toe to "soften" the appearance of the stone;
- Reducing the size of the rocks used in the stone toe to 4 to 6-inch diameter stone;
- Installing an erosion control blanket that would biodegrade more quickly; and
- Simplifying bank reconstruction and revegetation by grading the cleared bank to a 1.5:1 slope and using hand techniques and installation to plant native herbaceous and woody vegetation.

PREVIOUS REPAIRS:

Shearer Site: In the Spring of 1997, one of the lower vegetated geogrid lifts on a bank reconstruction section became partially separated from the bank. The apparent cause of this failure was that the burlap that holds the geogrid lift in place had not been adequately secured to the bank. The

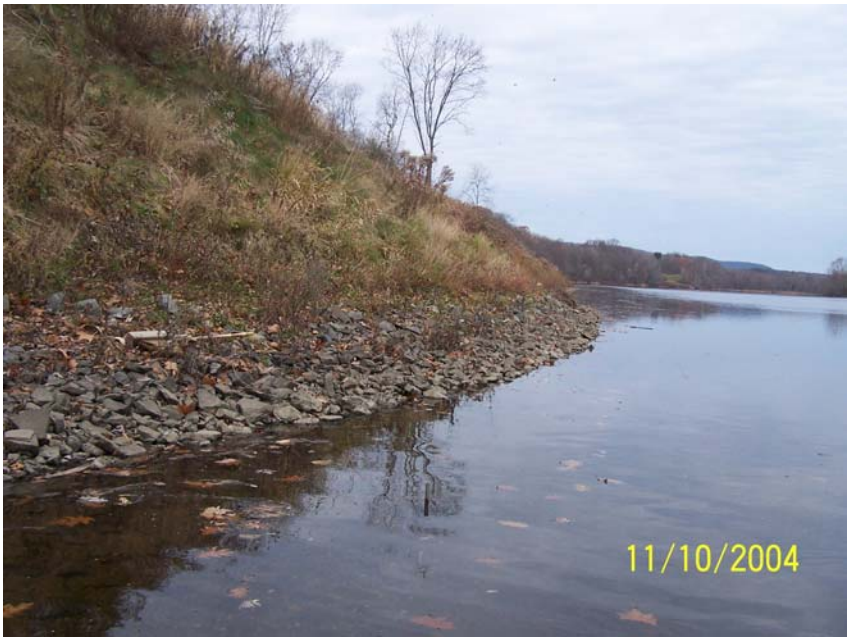
project consultant recommended a repair (pull the burlap back into place, secure it and then plant additional live stakes in the lift) which was completed by Northeast Utilities (now FirstLight Power Resources). To date, the repair has been successful.

Wickey Site: After the 1998 Spring freshet, a horizontal crack, approximately 30 feet long and about 1 foot wide, appeared mid-way up the repaired slope. The bioengineering consultant recommended that the crack be filled and re-staked. Northeast Utilities completed the repair.

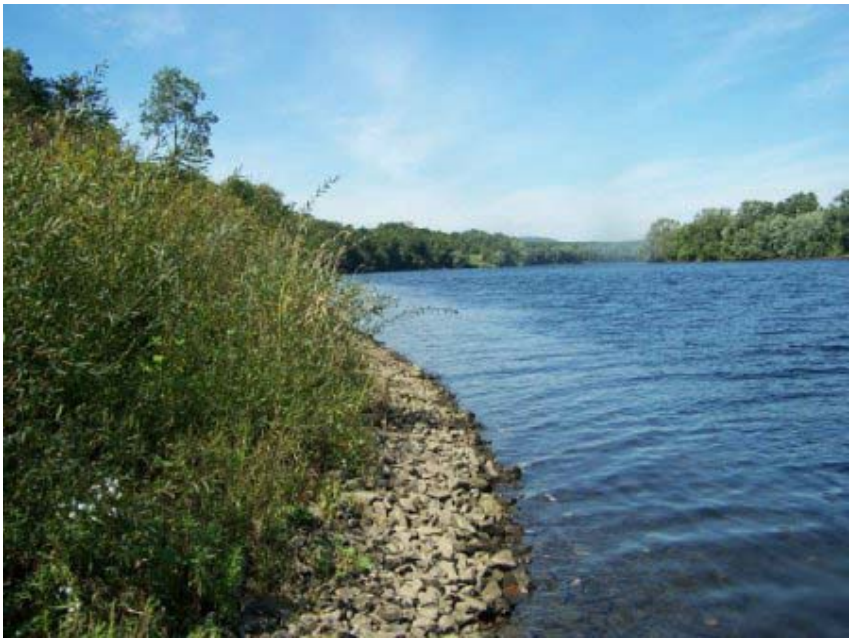
PREVIOUSLY IDENTIFIED PROBLEM AREAS:

Interface between the upper elevation of the stone toe and the lower vegetated bank. This has been a problem area in the past for the Urgiel Upstream site, the Wickey site, and the Shearer site. This area bears the brunt of the erosive forces associated with pool fluctuations. In November 2002, this interface at the Urgiel Upstream site was repaired with brush fascines and live stakes. To date, this repair has prevented a massive slope failure but there are still localized areas of erosion at this interface. The freshly eroded areas are adjacent to areas of the stone toe that trap fine sediments and, therefore, can be quickly colonized by vegetation, both native and non-native invasive.

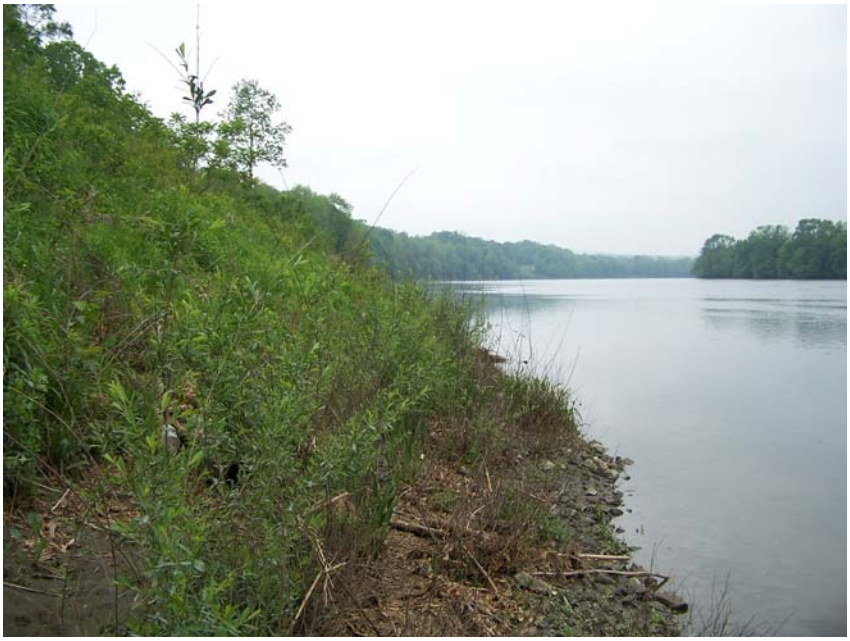
Installation of Coir Fascines and Live Stakes at Urgiel Upstream Site November 2002



Urgiel Upstream Site Area of Repair - November 2004



Urgiel Upstream Site Area of Repair - September 2005

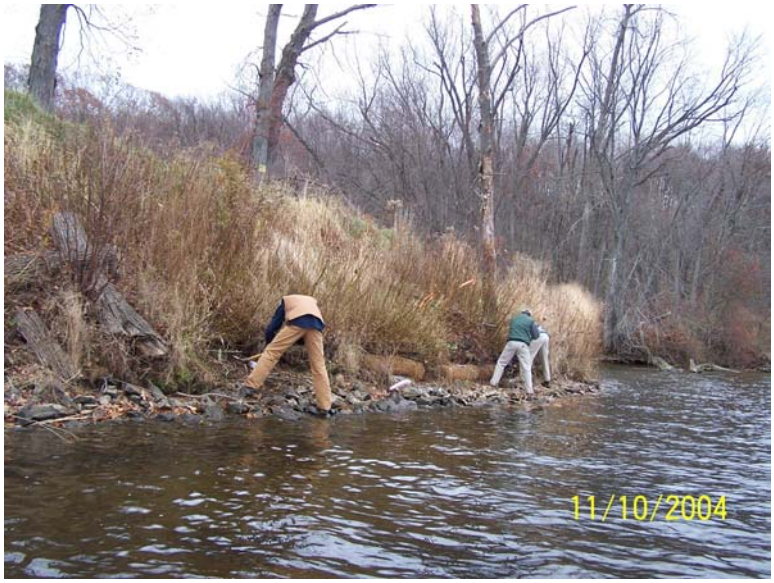


Urgiel Upstream Site Area of Repair – October 2006

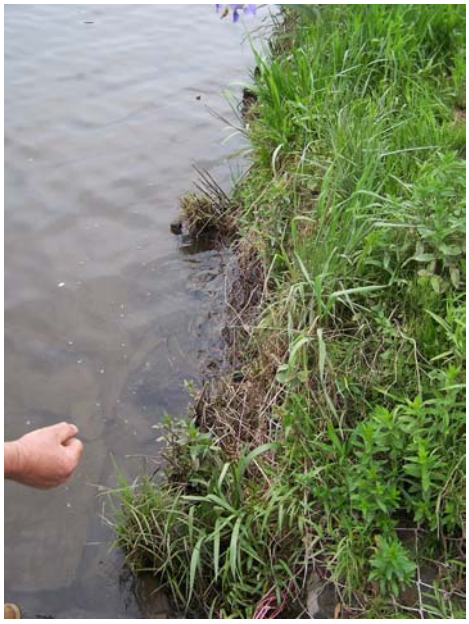
Localized Erosion between survey stakes 34 and 35. Looking upstream May 2006

Localized Erosion at Stone Toe/Lower Slope Interface at the Urgiel Upstream site between survey stakes 34 and 35– October 2006

Repairs have also been made to the Shearer site to address erosion at the stone toe/lower slope interface.

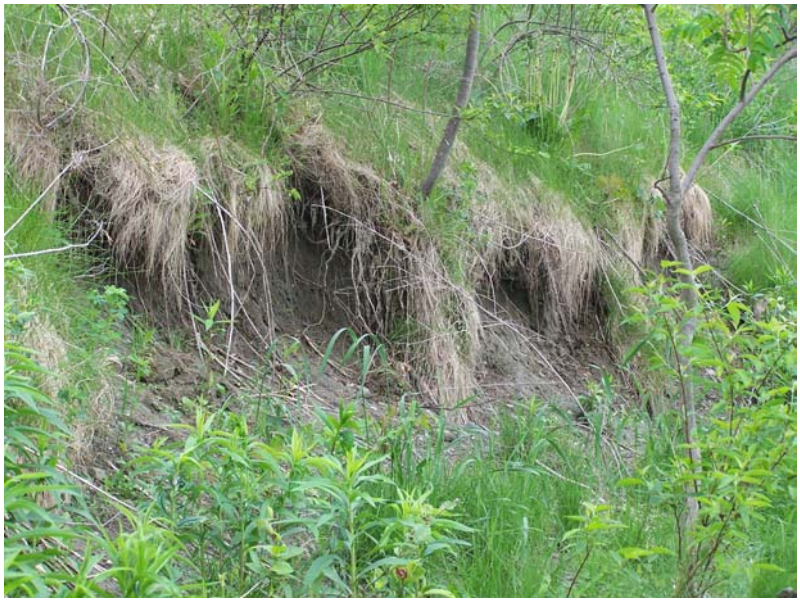


Repair at Shearer Site – November 2004

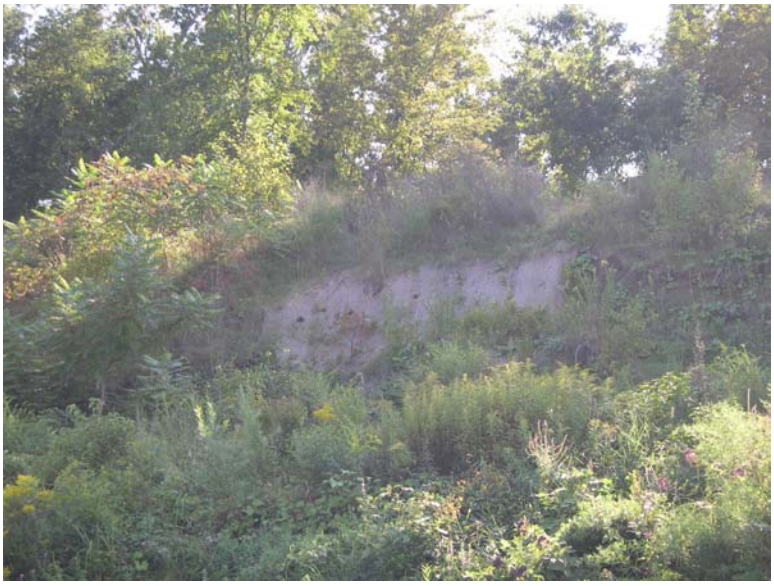


Portion of Repaired Area at Shearer Site – June 2006

Areas of Bank Slumping: Localized areas of bank slumping have occurred at the Urgiel Upstream site. Slumping has not been a problem at the Phase I sites, which may be due to the different bank stabilization design used for the Phase I sites (geogrid lifts, brush mattresses, and brush fascines). The Phase I bank stabilization techniques were more "engineered" and contrast markedly with the designs for the Phase II and III sites, which, other than the bank regrading, called for much less intensive stabilization techniques (seeding and the installation of potted plants and trees). Small, localized slumps do not necessarily indicate impending, massive slope failure. However, these areas must be monitored to: 1) ensure that their size and severity does not increase; 2) ascertain if and how they "stabilize" and/or revegetate without intervention; and 3) determine if the areas become habitat for a particular species, which is what has happened at the Urgiel Upstream site.



Urgiel Upstream – Bank Slump/Erosion at Stake 35 – May 2006



Urgiel Upstream – Eroded/Slumped Bank Face with Bank Swallow Nesting Cavities? – September 2006

Areas of Erosion Caused by Overland Runoff: In November 2002, another area of the Urgiel Upstream site that needed repair was a downstream section of the top of the bank. High runoff volume/velocity and/or ponding behind the berm at the top of the bank created a gulley in

the top of the bank. Apparently, surface water runoff was not being channeled to the rip-rap apron at the downstream edge of the site.

Crack in the Top of the Bank behind Berm – Urgiel Upstream Site November 2002

The area was repaired by placing gravel in the bottom of the gulley and then filling with soil to bring it back up to the existing grade. The downstream end of the berm was extended to wrap around the edge of the site to channel runoff back into the undisturbed, wooded portion of the site.

SCHEDULE FOR INSPECTION & MAINTENANCE OF ALL BMPS:

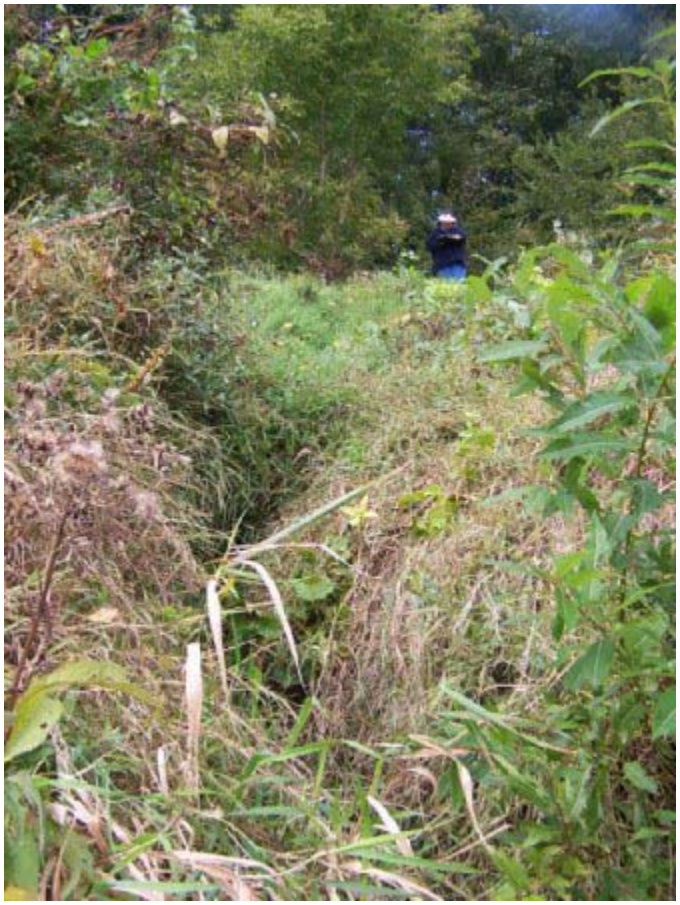
Quarterly Site Inspections: Staff from FirstLight Power Resources, Inc. (FirstLight) and/or their Bioengineering Consultant inspect each of the bioengineering bank stabilization sites every 3 months. These inspections are mandated by the Federal Energy Regulatory Commission (FERC) and are a condition of the FERC license to operate the Northfield Mountain Pumped Storage Facility.

In order to conduct the inspections, FirstLight staff can access the sites both from the land-side and via a boat. Staff walk the sites to visually inspect site conditions and, if weather and river conditions do not preclude it, visually inspect the sites from the river. Staff visually assess the site to

determine the overall stability of the bank and the integrity of the bioengineering bank stabilization treatments. Specific attention is given to known types of problems, previously identified problem areas, and areas previously repaired.

Types of Problems:

1. **Interface between the upper elevation of the stone toe and the lower vegetated bank.**
2. **Areas of Bank Slumping:**
3. **Areas of Erosion Caused by Overland Runoff**



Wickey Site – Gully caused by overland runoff – June 2006

Inspections following Large Flow Events: Sites are inspected after the Spring freshet and other unusually high flow events.

Permanent Monitoring Cross-Sections: Each site has permanent monitoring survey cross-sections which are spaced at 100-foot intervals for the whole length of the site. The cross-sections run from the top of the

bank, down the slope, and across the stone toe into the river. These cross-sections are monitored once per year to document bank conditions. The historic data for each of the sites and the on-going collection of data are invaluable in the evaluation of overall bank stability and tracking changes in the banks over time.

LIST OF ROUTINE AND NON-ROUTINE MAINTENANCE TASKS TO BE PERFORMED:

The following tasks are to be performed as part of the scheduled Quarterly Site Inspections and other site monitoring tasks.

1. **Inspect the Interface Between the Stone Toe and the Lower Slope:**
    a. Note location, length, and width of new areas of erosion. Photo-document conditions.
    b. Note the location, length, and width of existing areas of erosion. Note any change in vegetative cover and/or sedimentation. Photo-document conditions.
    c. FirstLight Power's Bioengineering Consultant should be asked to establish thresholds for each site which trigger when repair is necessary and the type of repair to implement. For example, for small areas of erosion, install willow stakes from the Bennett Meadow cutting block, as necessary, to revegetate areas. For larger areas, install coir fascine and willow stakes to stabilize and revegetate area.
2. **Inspect Lower and Upper Bank Areas:**
    a. Note the location and approximate size of new areas of slumping bank. Photo-document conditions.
    b. Note the location and approximate size of existing areas of slumping bank. Note any changes in vegetative cover, areas of bare/eroding soil, and/or habitat conditions. Photo-document conditions.
    c. Note the location and approximate size of new areas of gullying or other evidence of erosion due to overland flow. Photo-document conditions.
    d. Note the location and approximate size of existing areas of gullying or erosion due to overland flow. Note any changes in vegetative cover, areas of bare/eroding soil, and/or habitat conditions. Photo-document conditions.
3. **Evaluate the Data from the Permanent Monitoring Cross-Sections:**
    a. Following the annual monitoring of the cross-sections, note any new areas of change in the bank profile and evaluate the severity of the change (i.e., slump, eroded area, etc.).
    b. Following the annual monitoring of the cross-sections, note the change, if any, in previously identified areas of change in the

bank profile. Evaluate the severity of the change in the area (i.e., slump, eroded area, etc.).

c. Following the annual monitoring of the cross-sections, evaluate the overall stability of each site.

4. **If Necessary, Prepare and Implement a Schedule of Repairs for a Site.**