Assessment Report

American Fork – Dry Creek Watershed
Silver Lake Flat Dam
Utah County, Utah

Natural Resources Conservation Service
Salt Lake City, Utah

September 22, 2004
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Abstract

The Small Watershed Rehabilitation Amendments, PL 106-472, authorized funding and technical assistance to rehabilitate aging flood control dams built under the USDA Small Watershed Program. Sponsors of these project dams can apply for rehabilitation assistance to extend the service life of their dams 50 to 100 years and ensure that the dams meet applicable safety and performance standards. The policy established by the Natural Resources Conservation Service (NRCS) allows sponsors of dams to request an assessment of their site. This assessment by NRCS will provide the sponsor with information to help them decide if they should pursue the rehabilitation of their aging dam. On June 24, 2004, Mr. Van Burgess, President of the North Utah County Water Conservancy District, requested an assessment of the American Fork – Dry Creek Watershed Project Silver Lake Flat dam. Teams of NRCS specialists completed field assessments of the site on July 19 and 20, 2004. NRCS field personnel also conducted additional support work in gathering data for this assessment.

Silver Lake Flat dam was built within the American Fork – Dry Creek Watershed under the Small Watersheds Program (PL 83-566). The construction of Silver Lake Flat dam was completed in 1971. While designed to serve irrigation regulation purposes, Silver Lake Flat dam also provides flood prevention benefits. The sponsors requested an assessment on the basis of their concern that due to possible sediment accumulation in Tibble Fork Reservoir downstream, additional demands are being placed on the Silver Lake Flat reservoir that may cause it to no longer be capable of serving its flood control purposes. There are also concerns that the dam was not constructed so as to sufficiently handle potential maximum flows given existing hydrologic conditions. It is important to note that Silver Lake Flat and Tibble Fork dams exist in series within the American Fork watershed. Should either dam fail, visitors and campers in American Fork Canyon – including the Timpanogos National Monument Visitors Center and multiple Forest Service campgrounds – and occupants of the cities of Highland, American Fork, and Lehi, which sit in the inundation path of the dam, would be in imminent danger. Canyon visitors, in particular, are at significant risk. Dams with downstream hazards have more stringent design criteria than sites without downstream hazards. Because of the current downstream hazard, Silver Lake Flat dam does not meet current safety and performance standards. This assessment addresses the options available to the sponsors of rehabilitation for Silver Lake Flat dam.

The current status of Silver Lake Flat dam qualifies for inclusion in the Small Watershed Rehabilitation Amendments, PL 106-472.
Description of Silver Lake Flat Dam

The 1,500-feet long recreational and flood retarding dam is located on Silver Creek tributary of the American Fork River at an elevation of 7,525 feet MSL (Mean Sea Level). The watershed is currently in the Uinta National Forest with a wilderness area boundary just west of the lake perimeter road, with the watershed divide at 10,200 feet MSL. This area was historically a silver mining area.

Silver Lake Flat dam is an 84-ft. tall earthen embankment with a drainage area of 4 square miles. The reservoir is designed to store 921 ac.ft. of irrigation water with a surface area of 43 acres. The site has the capability to store 24 ac.ft. of sediment and 921 ac.ft. of water at the spillway crest elevation; for a total of 945 ac.ft. The principal spillway system consists of a 30 in. diameter reinforced concrete pipe passing through the dam with a concrete intake structure in the pool area of the reservoir. This system controls the release of floodwater. The pipe discharges into a reinforced concrete outlet works. Potential seepage alongside the pipe system is controlled with 25-ft. x 30-ft. concrete anti-seep collars surrounding the principal spillway pipe.

Brief History and Existing Condition of Silver Lake Flat Dam

Silver Lake Flat dam was completed in 1971. The site was designed and constructed as a Class “c” (high) hazard site, meaning there was a high probability of loss-of-life if the dam should fail. The dam was planned and built for the primary purpose of storage of irrigation water and has incidental benefits of flood control and sediment retention. It was designed to have a 100-year economic life. The site has been generally well maintained.

There is a seepage area in the left downstream groin of the dam. It is visible in normal to wetter precipitation years and not visible in dry years. This seep has been noted since the completion of the dam. No investigation has been performed to determine the relationship of the seep to the safety of the dam. Only clear water has been noted in the flows.

There has been a seep noted in the toe area of the right downstream area at the bend of the dam. This seepage crosses the approach road and flows into a wetland area. The situation has not been investigated in detail. Only clear water has been noted in the flows.

There was a major seep and soil slough observed in 1997 in the left abutment about 150 feet east and away from the dam. It did not appear to affect the dam or the groin seep. This most recent seep and the groin seep indicate the presence of a ground water system in the left abutment area that could be affecting the dam over time.

Sloughing has periodically blocked the bottom of the concrete chute and damaged the fence. Sloughing occurs from the right side of the chute and is related to natural water
loading of the soils on the steep construction slope of the chute area. These occurrences have been addressed through ongoing maintenance as needed.

A series of sinkholes with vortices and pipeholes were noted in 1995 in the left area of the reservoir within about 200 feet of the dam. The reservoir was lowered and the sinkholes were investigated. Dye testing of the sinkholes was inconclusive. No seepage was noted in the left abutment area or the left groin area. It was determined that the topsoil and a pipeline trough had not been removed during construction and that a large mass of waste boulders to 4 feet in diameter was present in the area of the sinkholes. The boulders and topsoil were removed and the area was repacked to merge with the existing blanket.

**Sponsors of Silver Lake Flat Dam:**

The original sponsors of Silver Lake Flat included:

- North Utah County Water Conservancy District
- Lehi Irrigation Company
- American Fork Irrigation Company
- Alpine Irrigation Company
- Alpine Soil Conservation District
- Pleasant Grove Irrigation Company
- Lehi City
- Alpine City
- Pleasant Grove City
- American Fork City
- Utah County
- Utah State Department of Fish and Game
- Soil Conservation Service (NRCS)

Other sponsors may be added during the rehabilitation process if added purposes or uses of the site are desired and the site conditions are suitable.

**Existing Beneficiaries**

The benefited area for the Silver Lake Flat dam is shown on the Project Map. The dam provides flood prevention or reduction benefits on the recreational, agricultural, residential, and business areas downstream. The watershed work plan estimated that the value of average annual irrigation benefits from construction of the Silver Lake Flat dam and other associated structures was estimated at an amount of $57,850. The American Fork – Dry Creek Watershed Project as a whole, including both structural and land treatment measures, was projected to result in an 84% reduction in flood, sediment, and other damages within the project area. Significant development has occurred in the flood inundation area, drastically increasing the average annual value of flood-prevention benefits that accrue as a result of completion of the watershed project. In order to accurately quantify these benefits in 2004 dollars, a detailed economic study would be
necessary. A study at this level of detail is not required under the provisions of the NRCS Watershed Rehabilitation Program.

Seismic Dam Safety

The dam was constructed before seismic criteria were developed. An NRCS seismic evaluation is in progress and will be available for the rehabilitation design work.

Sediment Yield Data

This structure has a sediment pool storage capacity for a 50 year period. The design sediment storage capacity is 24 acre-feet. Sedimentation from the watershed has been minimal and well under original estimates. US Forest Service work in rehabilitating previously mined sites and recreation paths have been very successful in controlling erosion and sediment yield. No sediment volume study has been conducted since completion of the dam and there has been no request for one.

Hydrology Summary

The dam and reservoir were designed prior to 1971. A Dam Failure Inundation Study was completed in 1992 for both Silver Lake Flat and Tibble Fork dams. The conclusion of this report was that the emergency spillways of both dams are meet agency criteria. The hydrologic design conditions used for sizing the principal spillway and auxiliary (emergency) spillway need to be re-evaluated with regards to current hydrological design criteria. Therefore, it is recommended that an updated hydrologic study be completed.

Hazard Classification

The current hazard classification for Silver Lake Flat dam is Class “c” (high) hazard meaning that if the dam should fail for any reason there is a high probability that loss-of-life will occur. The potential losses exist due to the hazards associated with the recreation areas, homes, businesses, and schools that are downstream of the site and within the flood zone if the dam should ever fail. The downstream floodplain is in a rapidly developing area. It is certain that additional homes and businesses will be constructed within the flood zone in the near future.

Rehabilitation Needs of Silver Lake Flat Dam

Several items need to be addressed in order for Silver Lake Flat Dam to meet current NRCS criteria associated with a high hazard site and to insure the useful life of the site as stated in the 1958 Work Plan. General rehabilitation work would include:

1. Modify the dam and auxiliary (emergency) spillway to meet the modern criteria required of a Class “c” (high) hazard dam.
2. Extend the principal spillway system if the dam is raised.
3. Investigate the ground water conditions in the left abutment and right downstream areas of the dam and modify dam as needed.
4. Investigate the geologic character of the left abutment in regards to landslide, mining, seepage, faulting and stratigraphy in relationship to dam safety
5. Meet current NRCS and Utah Dam Safety standards and criteria for hydrology, seismicity, design, environment laws, cultural preservation laws and other items as needed.

**Eligibility of the Dam for Rehabilitation**

Silver Lake Flat dam is eligible for the Rehabilitation provisions of the Watershed Program. Funding for rehabilitation is based upon a priority ranking system, which considers the potential for dam failure and the potential consequences of a dam failure. Class “c” (high) hazard dams can have a higher ranking for funding than low hazard dams.

The sponsors of the potential rehabilitation project should be aware that additional landrights might be required for construction. This cost is part of the sponsor’s cost for the project and can be included in their portion of the total project cost. Sponsors are also responsible for any permitting costs or water and resource rights costs, which are not considered part of the total project cost.

The rehabilitation provisions of the PL 106-472 can provide 65% of the total rehabilitation cost, but shall not exceed 100% of the actual construction costs incurred in the rehabilitation. Total rehabilitation cost for the project shall include all costs associated with all components of the project, including acquisition of land, easements, rights-of-way, project administration, non-Federal technical assistance (TA), non-structural measures, contracting, and construction. The cost of TA provided by NRCS shall not be considered part of the total cost of the rehabilitation project. If, however, the sponsor provides or otherwise obtains TA for planning, design, and/or construction, the TA cost is included in the computation of total cost of the rehabilitation project. The sponsor is responsible for the cost of all water, mineral, and other resource rights and all federal, state, and local permits, which are not considered part of the total cost of the rehabilitation project. The sponsor’s 35% can be in the form of cash, in-kind services, the value of land rights in addition to those acquired for the current project, or any combination of these items.

**Adequacy of O&M for the Dam**

The dam has been generally well maintained by the owner in accordance with the O&M agreements. There are minor erosional impacts due to Off Road Vehicles (ORVs) on the upstream left side of the embankment. About 100 feet of road cut for ORVs has been in this area removing about 1 foot vertical depth of material in the embankment. Drainage in the centerline of the dam is causing erosion around the concrete spillway bridge and along the downstream concrete chute.
The following items need to be accomplished and are not applicable for rehabilitation funding:

1. Perform erosion control maintenance on the centerline of the embankment especially around the concrete structures and the right side downstream embankment disturbance area.
2. Eliminate and rehabilitate the damage of Off Road Vehicles in the upstream left side of the embankment.
3. The chain link fence along the chute has been detached from the fence posts in many locations. This needs repair.
4. The upstream wing walls appeared to have rotated downward leaving a gap at the top of the seams. This need inspection and repair as necessary.

Planning and Implementation Process

Should the sponsors make application for rehabilitation of Silver Lake Flat dam, the application will go through the conventional watershed planning process with consideration and evaluation of all potential alternatives and their impacts (economically, environmentally, socially, etc.). During the planning process, there will be opportunities for public participation and comment.

The estimated time-frame for the activities are:

- Planning: 1 year
- Design: 1 year
- Implementation: 1 year

This time frame is subject to revision as needed for compliance with provisions of the National Environmental Policy Act (NEPA).

Potential for Addressing Other Resource Needs

Beyond bringing the dam up to current standards, there do not appear to be any additional resource needs that could be met through dam rehabilitation.

Potential Scope of the Rehabilitation Project

The following are rehabilitation needs for this site:

1. Extend the Useful Life of the Structure by upgrading the site to current NRCS criteria for a Class “c” (high) hazard dam by raising the top of the dam. This alternative would involve some or all of the following actions: Raising the auxiliary (emergency) spillway, providing adequate auxiliary (emergency) spillway capacity, raising the top of the dam, extending the 54-inch steel pipe, upgrading the monitoring system, repairing or replacing metal components of the water conveyance system.

   a. Estimated Total Project Cost: $9,000,000.
   b. The costs do not include landrights cost
2. Other possible alternatives would include either removal of the dam or removal of the downstream hazards. Due to the economic and social value of downstream developments, these alternatives are not considered practical or desirable.

Rehabilitation of Silver Lake Flat Dam

In order to pursue the rehabilitation of Silver Lake Flat Dam, the sponsors must complete a Standard Form 424 “Application for Federal Assistance” with the following information attached to the application:

- Project name,
- Dam number,
- Original Project Authority,
- Dam location (legal description)
- List of the current Sponsoring Local Organizations (SLOs)
- The name(s), address(es), and contact information for the person(s) designated as the contact(s) for each of the SLO(s),
- Year the dam was constructed,
- Description of existing conditions and known rehabilitation needs of the dam,
- Description of current benefits provided by the dam.
- Dam Safety Agency information; permit needs, comments, and recommendations on rehabilitation needs for the specific dam. If the State Dam Safety Agency ordered any action on the dam, attach a copy of the order.
- Statements that the SLO(s) commit to:
  - Assistance in leading a locally-led planning effort,
  - Obtaining the required landrights including the use of power of eminent domain, if necessary,
  - Providing local cost-share funds and/or in-kind services to provide the required 35 percent of the total project costs,
  - Enter into a new Operation and Maintenance (O&M) Agreement with the Natural Resources Conservation Service,
  - Providing funds for continuing O&M actions,
  - Obtaining required permits and approvals at their costs,
  - Providing leadership to assure appropriate land use controls are enacted or acquired for downstream areas prior to construction if a Class “a” (low) or Class “b” (significant) hazard dam is involved, and
  - Providing leadership to assure adequate land treatment measures have been installed on at least 50 percent of the watershed areas above the dam.
- Statement the SLO(s) plan to provide in-kind services and/or acquire landrights will sign a Memorandum of Understanding with NRCS before being credited with the value of any in-kind contribution.
Pictures of Existing Conditions at American Fork – Dry Creek Watershed
Silver Lake Flat Dam