Chapter 2 - Proposed Action and Alternatives

2.1 Introduction

The purpose of the Proposed Action is to repair the embankment of A.V. Watkins Dam. This EA analyzes the potential effects to the human environment from the Proposed Action and will serve to guide Reclamation's decision, along with other pertinent information, whether to implement the Proposed Action.

The Proposed Action Alternative is analyzed in this EA, along with a No Action Alternative, to facilitate comparison of potential effects between the two.

2.2 No Action Alternative

Under the No Action Alternative, Reclamation would not repair the dam's embankment. This alternative would require operation of the reservoir in a manner that avoids further compromise to the dam that might contribute to failure of the dam. Such operation would include a reservoir water surface elevation restriction. Based on risk analysis, the maximum water surface would not be allowed to exceed an elevation of 4212 feet. However, water levels could be allowed to go up to elevation 4214 feet for the duration of spring runoff with 24-hour a day, 7-day a week inspections and monitoring of observation wells and pieozmeters. Lesser degrees of vigilance in monitoring would require lower water surface elevation restrictions. Over the long-term, the maximum elevations of allowable reservoir use would be subject to change as the dam ages and/or its condition further deteriorates.

2.3 Proposed Action Alternative

The Proposed Action Alternative is to repair the embankment of A.V. Watkins Dam under Reclamation's Safety of Dams Program. An impermeable, fully-penetrating, cement-bentonite, or soil-cement cutoff wall would be installed laterally along the dam extending through the erodable sandy soils immediately below the dam into the less permeable lacustrine silt and clay layer at an average depth of 30 feet below the embankment foundation. This cutoff wall would extend horizontally approximately 26,000 feet from near the bend in the east embankment near Interstate 15 (station 733+00) to some distance beyond the inlet channel and marina (station 470+00) (Appendix 1, Map 3). The cutoff wall would be approximately 2.5-feet wide. In addition, the 300-foot section of the dam embankment that was damaged in November 2006 will be removed down to the foundation and reconstructed prior to the construction of the cutoff wall.

The cutoff wall would be constructed in one of two possible locations: (1) through the embankment aligned with the dam centerline; or (2) parallel to dam centerline at the upstream toe. In the event that the cutoff wall is constructed through the embankment, the top 5 feet of the existing dam embankment would be removed to provide sufficient room for construction equipment atop the dam, after which the cutoff wall can be constructed. Upon completion of the cutoff wall, the dam crest would be rebuilt backup to original height.

In the second option, the cutoff wall would be constructed at the upstream toe of the existing embankment. First, a portion of the upstream embankment would be removed and a working platform created. The cutoff wall would then be constructed. Lastly, the upstream embankment would be replaced and a berm built above the cutoff wall to prevent excessive seepage above the cutoff wall through the dam.

This cutoff wall is expected to provide a continuous horizontal and vertical barrier to seepage through the dam and underlying sandy foundation soils. The use of cement-bentonite for the cutoff wall was based upon ease of construction and long-term strength.

All land between the upstream toe of the dam and the far side of the south drain, has the potential to be disturbed during this project (see contractor staging and stockpiling areas, Appendix 1, Map 4). These lands may be used for access roads and ramps, staging equipment, stockpiling of debris and materials, or other construction purposes. Existing roads would be used for construction to the extent possible.

An area 100 to 150 feet upstream of the dam embankment in the reservoir could be used for stockpiling riprap and embankment materials and mixing of the soil-bentonite backfill material. Earth berms and/or silt fencing would be constructed upstream of these stockpiles to preclude the possible contamination of the reservoir.

The highest allowable water surface elevation of the reservoir during construction would be dependent upon the location of the cutoff wall and the degree of monitoring during construction. For the first option, where the cutoff wall is constructed through the dam, the reservoir could be restricted to elevations between 4209 and 4212; however, the reservoir could be allowed to rise to a maximum elevation 4214 feet during spring runoff with 24 hour monitoring 7-days a week. For the second option, where the cutoff wall is located at the upstream toe of the dam, the water level would likely be lower during construction, and the reservoir restriction elevation would also depend upon the location of the western terminus of the cutoff wall. Currently, the western end of the cutoff wall is anticipated to terminate at station 470+00, which would require the reservoir to be drawn down to approximate elevation 4207 feet.

If construction begins in 2008, repair of the dam is estimated to be completed by November 2009. Filling of the reservoir after the proposed repairs have been made would be rigorously monitored to ensure the new dam section is performing satisfactorily. With satisfactory performance, the reservoir would be allowed to fill in the spring 2010.

All disturbed lands would be recontoured and revegetated using an approved native seed mix and seeding methods. Success of this effort would be evaluated on the basis of percent vegetative cover of the ground surface and level of plant species diversity.

2.4 Alternatives Considered but Eliminated from Further Analysis

During a SOD Scoping Study (Reclamation 2007), identification of alternatives for the dam's repair were developed. The following alternatives could reduce the risks created by the dam's safety deficiencies as discussed in Section 1.2 above. These alternatives were considered but eliminated from further study because they did not meet the purpose and need of the SOD modifications as outlined in Section 1.2 above, or were determined to be too costly, environmentally unacceptable, or too disruptive to dam operations and project purposes.

2.4.1 Downstream Toe Interceptor Trench/Toe Drain

This option would consist of installing a vertical interceptor trench which includes a toe drain along the downstream toe of the dam. The interceptor trench would extend approximately 12 feet below the existing ground surface with the intent of interrupting any hardpan layers within that depth zone. The downstream wall of the trench would be lined with a flexible geomembrane supported at the ground surface. The geomembrane liner would serve to prevent backward progression of potential piping channels initiated at the South Drain as well as direct seepage flows upward to the toe drain. The remaining space in the interceptor trench would be backfilled with filter sand so as to retain the existing in place sandy foundation material. A perforated pipe enveloped in drainage gravel and filter sand (i.e., toe drain) would form the toe drain portion within the interceptor trench. Seepage collected by the interceptor trench/toe drain would discharge to the South Drain at locations spaced approximately 500 feet apart. Each perforated pipe would be connected to an inspection man-hole structure. The inspection man-holes would in turn be connected to solid wall outlet pipes which flow to the South Drain.

An approximate 5-foot thick soil berm would overlay the entire width of the interceptor trench/toe drain and would lap up onto the downstream face of the dam. The contact between the embankment and berm would consist of a layer of filter sand and serve to divert seepage at the toe of the dam into the interceptor trench/toe drain for collection and removal. The berm thickness was chosen to balance potential reservoir-like water pressures should undetected piping channels exist in the dam or dam foundation that could be closely connected to the reservoir level.

Due to groundwater conditions expected to be present at the toe of the dam, difficulty in unwatering excavations which penetrate the hardpan layer(s) is anticipated.

This alternative does not address the dam's currently damaged embankment.

2.4.2 South Drain Filter System

This option would consist of reconstructing the northern bank slope of the South Drain such that the soil left in place is protected from unfiltered seepage outletting and initiation of backward erosion piping. The existing northern bank slope of the South Drain would be removed to form a new bank slope inclined at 2 horizontal to 1 vertical. The excavated bank slope would then be filled using layers of filter sand, drainage gravel, riprap bedding, and stone riprap. The filter sand would be placed directly against the excavated bank slope to retain the in place soil particles. The remaining bank slope buildup would consist of layers of drainage gravel, riprap bedding, and riprap in that order. The filter sand, drainage gravel, and riprap layers would each have thicknesses of approximately 3 feet measured normal to the slope. The bedding layer would have a thickness of approximately 1.5 feet measured normal to the slope.

Spoils from the bank slope excavation would be used to construct a horizontal berm of limited thickness between the toe of the dam and the new top of slope for the South Drain. Construction of the South Drain filter will necessitate continual management of water flowing in the South Drain. Methods will need to be devised to unwater portions of the South Drain such that excavation and bank slope reconstruction can be performed in dry conditions. Methods such as cofferdams and bypass pumping and/or bypass piping are anticipated.

This alternative does not address the dam's currently damaged embankment.

2.4.3 Upstream Partially Penetrating Soil-Bentonite Cutoff Wall/Interceptor Trench - Toe Drain/South Drain Filter Alternative

This alternative would involve implementation of both the interceptor trench/toe drain and South Drain filter alternatives, along with construction of a partially penetrating soil-bentonite cutoff wall along the upstream toe of the dam. The interceptor trench/toe drain and South Drain portions of the alternative would be the same as that described for the stand-alone alternatives. Construction of the upstream soil-bentonite (S-B) cutoff wall would involve temporary removal of a portion of the upstream face of the dam, such that an approximate 30-foot-wide working platform at the upstream toe was formed. The work platform would be used by the equipment constructing the S-B wall. The S-B wall depths would be on the order of up to 10 feet. Following completion of the S-B wall, the upstream face of the dam would be reconstructed using compacted, low-permeability embankment material (likely different from the material removed from the upstream face of the dam). The contact between the embankment material and S-B wall would be such that a connection resistant to seepage was formed. In this way, essentially the entire upstream portion of the dam (including much of the underlying sandy foundation soil) would be improved to resist seepage from the reservoir. Construction of the interceptor trench/toe drain and the South Drain filter, would serve as support measures to control seepage which might pass beneath or through the partially penetrating cutoff wall and through the reconstructed upstream dam face.

Cost estimates for this alternative were determined to be too high to warrant further consideration.

2.4.4 Fully Penetrating, Sheet Pile Cutoff Wall Alternative

This alternative is essentially the same as the Proposed Action Alternative except driven steel sheet piles would be used to form the continuous horizontal and vertical barrier to control seepage through the dam and underlying sandy foundation soils. Driven sheet piles are expected to have sufficient integrity to disrupt any piping channels which might exist in or beneath the dam. A sheet pile cutoff wall is also expected to exhibit sufficient resistance to potentially high seepage gradients in the event undetected piping channels exist at locations in the dam or dam foundation.

Cost estimates for this alternative were determined to be too high to warrant further consideration.