Executive Summary

WHEATLAND IRRIGATION DISTRICT
CONSERVATION STUDY, LEVEL II

Prepared for:

Wyoming Water Development Commission
Cheyenne, Wyoming

Prepared by:

States West Water Resources Corporation
Cheyenne, Wyoming

In association with:

Gannett-Fleming, Inc. - Denver, Colorado
WEST, Inc. - Cheyenne, Wyoming
Paul Reid, PLS - Cheyenne, Wyoming

October, 2005
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1. INTRODUCTION

1.1 GENERAL

This report is an executive summary of Wheatland Irrigation District Conservation Study Level II Report. This study develops conceptual design, cost estimates and operational plans for modifications or upgrades to the WID’s current irrigation system. The study was conducted for the WID under direction and funding of the Wyoming Water Development Commission (WWDC) by States West Water Resources Corporation in association with Gannett-Fleming, Western Ecosystems Technologies, Inc. and Paul Reid, PLS.

1.2 BACKGROUND

The Wheatland Irrigation District was formed in 1947 and delivers irrigation water to 54,183 acres that extends from as far as Sand Lake, south of Arlington, to areas east of Wheatland. The WID would like to evaluate some of the systems components to assist in a conservation effort. Three main areas were identified to be evaluated. On the upper end of the system, the Canon Canal’s capacity is limited and the WID would like to evaluate the possibility of enlarging the canal to capture peak flows. The second area is the large canal between Wheatland Reservoir No. 2 and No. 3 reservoirs where there is a problem regulating the amount of water stored in the canal. The third area is within the distribution system around Wheatland where several re-regulation reservoirs, pipelines diversion and check structures could be added or upgraded to assist in conserving the irrigation water.

1.3 PURPOSE OF STUDY

The purpose of the study was to develop conceptual designs with cost estimates, operational plans, upgrades to existing facilities and recommendations to the WID to assist in their conservation efforts. Some of the features evaluated were possible re-regulation reservoirs, enlargement of the Canon Canal, regulating flows into and out of Wheatland Reservoir No. 3, adding pipelines to the existing system and developing operational plans. Conceptual designs were developed and cost estimates for these features were produced. Associated with this work was an economic analysis, identification of possible permits and easement requirements, water quality sampling, surveying and geotechnical analysis.

2. SUMMARY OF LEVEL II FINDINGS

2.1 SCOPE

The Canon Canal located at the upper end of the system has a capacity of approximate 186 cfs. The canal has a water right of 215 cfs when water is available. An area of the canal between the diversion site on Rock Creek to where the canal crosses the interstate
would require a physical enlargement to flow 215 cfs. This study used historical
diversion data to evaluate the need and possible benefits of a physical enlargement.

The canal delivering water into and out of Wheatland No. 3 Reservoir is a very large
evacuated canal. The canal has a capacity of over 2,000 cfs. Recently, the WID
performed a cleaning operation on this canal, in large part to remove silt and increase the
capacity. By doing this cleaning, the amount of recoverable storage in Wheatland Reservoir No. 3 was also increased. During operation of Reservoir No. 3, this canal stores
water. It is believed that wave action erodes the canal sides and is deposited in the canal
thereby, decreasing the capacity of the canal and the amount of water that can be released
from Reservoir #3. Currently there is no way to dry out the canal and still have the
ability to maintain active storage in Reservoir No. 3. This study develops a conceptual
design for a head gate to control the water into and out of the reservoir and allow the
canal to be completely drained while still maintaining the maximum storage in the
reservoir.

The canal systems within the distribution are very long and have large capacities. During
the irrigation season as users call for the water system to be turned on or off, immediate
response of the canals is not possible. When a large number of users turn off, or if a large
precipitation event adds water to a canal, a large amount of excess water can be
developed in the system. Because most of the canals terminate in “dead-ends” large
volumes of water are wasted and not recovered. This study evaluates several options for
conserving the water that would normally be wasted. One of the options includes
creating additional re-regulation storage for excess water at several locations throughout
the system. Another option analyzed was to add pipe lines at some of the “dead-end”
locations to connect one canal system to another. This study develops conceptual designs
for four re-regulation reservoirs and two pipelines at different locations in the system.

An area of Canal No. 2 is known to have large losses due to seepage. This study
evaluates the amount and location of the large seepage losses associated with this canal
and presents several options to minimize the seepage losses.

2.2 SUMMARY

The Level II Study for the Wheatland Irrigation District Water Conservation Project was
to develop conceptual designs, cost estimates and operational plans for modifications or
upgrades the WID’s current irrigation system. The designs and recommendations
presented in this report are intended to assist the WID in its continuing effort to conserve
water.

This report evaluated some of the components of the WID’s irrigation system to provide
conceptual designs and costs for improving the system. Some of the items evaluated in
this study were the feasibility of enlarging the Canon Canal, constructing several
pipelines throughout the system to eliminate “dead ends” in some of the canals,
constructing re-regulation reservoirs within the distribution system to store excess water
flowing in some of the canals, constructing a headgate for Wheatland Reservoir No. 3
and a seepage evaluation on Canal No. 2, known to have significant seepage losses. A summary of costs for these projects is presented in Table 2.1. The costs include construction costs, construction engineering, preparation of final design plans and specifications, permitting and mitigation, legal fees and acquisition of access and rights-of-way. This table also presents the annual repayment required by the WID based on the WWDC funding of 50% grant and 50% loan at 6% for 20 years.

2.2.1 CANON CANAL ENLARGEMENT

The Canon Canal is at the upper end of the Wheatland Irrigation Districts system. This canal diverts water from Rock Creek and stored water from Sand Lake near Arlington (see Figure 2.1). This water is used to fill several of the WID’s reservoirs and then is released into the distribution system. The canal does not have the capacity to flow the WID’s appropriated water rights from Rock Creek.

An evaluation was performed for the feasibility of enlarging the Canon Canal from the Rock Creek Diversion to Interstate I-80. Diversion records indicate that when the WID has the right to divert their full appropriation, they are unable to because of the limited capacity of the canal. Currently, the existing capacity of the canal is approximately 130 cfs and water rights of 215 cfs. To allow the WID to divert the full appropriation an enlargement of the Canon Canal would be required. The WID indicated that a majority of the canals restrictions are between the diversion off of Rock Creek and Interstate I-80, a distance of approximately 2.5 canal miles. A cost was developed to enlarge this section of the canal.

2.2.2 PIPELINES

Many of the WID’s distribution canals terminate at “dead ends” within the system. When irrigators on these canals stop diverting, excess water in the canals has to be wasted. For two of these canals, pipelines could be constructed at the end of the canal which could deliver excess water into other canals rather than being wasted.

Pipeline designs were developed for two different locations (see Figure 2.2). Both designs would reduce the water that might be wasted at the “dead ends” of the No. 1 Lateral and the Lower Canal No. 1. Excess water from these canals could be distributed into Canal No. 2 and used by downstream irrigators. This is also beneficial because water could be diverted around some the areas on Canal No. 2 known to have large seepage losses.

The Geringer pipeline would be 3,000 feet of 12 inch pipe with two concrete diversion boxes. It was assumed that this would require a road bore under Preuit Road. This pipe would be installed just north of Highway 310 to transfer water from a private ditch at the end of Lateral No. 1 to Canal No. 2. The pipeline will also allow the landowner to divert from the pipe to irrigate the un-irrigated corners of the land irrigated by a center pivot circle.
The Jack Ray pipeline is a very short pipeline that would transfer water from the end of the Lower No. 1 canal into Canal No. 2 through private ditches. The Jack Ray ditch terminates at a point that is approximately 25 feet from Canal No. 2. The ditch would be connected to Canal No. 2 with 25 feet of PVC pipe. This would also include a concrete diversion and a 12” slide gate.

### 2.2.3 RE-REGULATION RESERVOIRS

Another alternative for decreasing the amount of water wasted at the end of the WID’s canals would be to provide storage for excess water until it is needed. Re-regulation reservoirs could be constructed at several locations to provide this storage (see Figure 2.2). This study evaluated re-regulation reservoirs for four canals within the District’s distribution system.

#### Kidd Re-regulation Reservoir

One site that was evaluated for storage was the Kidd Re-regulation reservoir near Canal No. 1. The potential site that would allow approximately 1,400 acre-feet of storage is located in a drainage that, in the past, has carried large amounts of storm water and discharged the water into Canal No. 1. These flows erode the canals sides and increase the water level in the canal which can overtop the canal. The Kidd Re-regulation reservoir would store excess water from Canal No. 1 and storm water from the drainage. A waste-way could be constructed in the canal to divert excess water from the canal to the reservoir and also provides protection and a waste-way for the canal in an area where storm water enters the canal. This site would not allow the stored water to return to Canal No. 1, but could release the water into Canal No. 3.

#### Wheatland No. 1 Re-regulation Reservoir

Another site that was evaluated would store excess water for the No. 1 Lateral. The potential site is located near Wheatland No. 1 Reservoir. Conceptual designs for a 1,100 acre-foot reservoir, a 500 acre-foot reservoir and a 350 acre-foot reservoir were developed. The reservoir would store excess water from the No. 1 Lateral and could release back to the No. 1 Lateral or into Wheatland Reservoir No. 1. The district indicated that the highest priority project evaluated in this Level II study would be a re-regulation reservoir near the Wheatland Reservoir No. 1.

#### Drive-In Re-regulation Reservoir

Conceptual designs were developed for a re-regulation reservoir near the end of the Lower No. 1 Canal. This potential site is at the end of the canal on land that was once the Drive-In movie theater. This parcel of land is for sale and could be developed to provide storage for excess water in the Lower No. 1 Canal. Water stored at this location could be released back into the Lower No. 1 Canal, or it could be released through private ditches to discharge into Canal No. 2. The conceptual design for this reservoir would allow approximately 11.3 acre-feet of storage.
Bordeaux Lateral Re-regulation Reservoir

Two potential re-regulation reservoir sites were evaluated to store excess water in the Bordeaux Lateral. One location is near the end of the canal. Conceptual designs were developed for a 14 acre-foot reservoir, a 10 acre-foot reservoir, and a 5 acre-foot reservoir at this location. Each of these reservoirs would be excavated reservoirs next to the canal. Another site was evaluated upstream from several irrigation diversions along the canal. A 40 acre-foot capacity and a 30 acre-foot capacity reservoir were developed at this site. It would be located near the canal and an irrigation ditch and could release water to either ditch. This reservoir would use on-site materials to construct the dam across a shallow drainage.

The conceptual designs for all of the reservoirs use conservative designs based only on a reconnaissance level geotechnical program. These reservoirs may be economized if a more detailed geotechnical analysis is performed. It is recommended that a geotechnical program be instituted to develop a more detailed design and possibly decrease the construction costs. With this geotechnical program, it is also recommended that the desired storage size of these reservoirs be finalized.

2.2.4 Wheatland Reservoir No. 3 Headgate

A large canal supplies water from Wheatland Reservoir No. 2 to Wheatland Reservoir No. 3 (see Figure 2.3). This canal is also used to release water from the reservoir to the Laramie River where it is delivered to the WID’s Distribution system. Currently, Reservoir No. 3 has no inlet or outlet to control flows. When the reservoir is full, water is stored in the canal. Wave action of the water stored in the canal erodes the canal sides and deposits material into the channel. Over time this accumulation of material decreases the capacity of the canal and also limits the amount of water that can be released from Reservoir No. 3. The construction of a head gate structure in the canal between Wheatland Reservoirs No. 2 and No. 3 would allow the WID to store water in Reservoir No. 3 and give them the ability to drain the canal. This would help eliminate maintenance of the canal.

A headgate structure was designed to provide the WID with a way to control water flow into and out of Wheatland Reservoir No. 3 and provide the ability to drain the canal between Reservoir No. 2 and No. 3. The conceptual design developed would include 3 gates capable of allowing large flows into the reservoir and smaller flows to be released from the reservoir. Concrete and earth would be used to construct a structure in the canal.

An alternate option to the headgate structure would be to flatten the canal side slopes to a 5H:1V slope. This would reduce the erosion caused by wave action of stored water in the canal, but would not offer the ability to control the flows into and out of the reservoir. This option would require the excavation and wasting of approximately 850,000 cubic yards of soil.
Wheatland Reservoir No. 2

PROPOSED HEADGATE LOCATION

INLET/OUTLET CANAL

SUPPLY CANAL

FIGURE 2.3

Wheatland Reservoir No. 3

1 inch equals 2,500 feet

FIGURE 2.3
2.2.5 CANAL NO. 2 SEEPAGE EVALUATIONS

One of the WID’s large canals is known to have significant seepage problems. This study evaluated the amount of seepage losses in Canal No. 2 and developed a possible solution to minimize some of the seepage losses. Stream gaging was performed at several locations in the canal to determine the amount of water loss and where the losses were occurring.

To reduce water seepage in the canal, a polyacrylamide (PAM) liquid can be sprayed on the canal just before water is released. The PAM acts as a flocculent to settle fine particles of dirt in the water that seal leaks in the canal. This treatment is an inexpensive way for the WID to conserve water in the system by minimizing the seepage in the canals. Costs for PAM treatment is approximately $0.35 to $0.40 per foot of ditch and the application can be implemented by the District’s forces. Because of the useful life of the PAM treatment, annual applications would be required.

Table 2.1 – Summary of Construction Costs

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<tr>
<th>Project</th>
<th>Total Cost</th>
<th>Annual Repayment</th>
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<tbody>
<tr>
<td>Canon Canal Enlargement</td>
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<tr>
<td>Geringer Pipeline</td>
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<tr>
<td>Jack Ray Pipeline</td>
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<td>Kidd Dam and Re-Regulation Reservoir</td>
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<td>Wheatland No. 1 Re-Regulation Reservoir</td>
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<td>Polyacrylamide Canal Treatment</td>
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