

PRELIMINARY ENGINEERING REPORT

for

RESERVOIR NO. 2 AND NONPOTABLE WATER TRANSMISSION LINE EVALUATION

Prepared for the:

TOWN OF ORDWAY

GMS, Inc.
Consulting Engineers

PRELIMINARY ENGINEERING REPORT
FOR
RESERVOIR NO. 2 AND NONPOTABLE WATER
TRANSMISSION LINE EVALUATION

PROJECT NO. 14059.150

NOVEMBER 2020

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SECTION I INTRODUCTION

A. PURPOSE AND SCOPE

This Preliminary Engineering Report has been prepared for the Town of Ordway to address the January 2014 dam safety inspection by the Office of the State Engineer, Division of Water Resources, Dam Safety Branch (DSB). This Report has been updated from the original June 2016 version. It has incorporated information from the consultant's previous Ordway studies where appropriate. The Town's reservoir facility consists of three (3) cells that are separated by interior dikes and encompassed by a perimeter earthen berm structure. Although this report may refer to all three reservoirs, only Cell No. 2 is active and holding water. Cell Nos. 1 and 3 have not been used for many years. The term reservoir as used herein solely pertains to this cell. The DSB inspections have focused on the embankments that encompass Cell No. 2 which currently holds water and is described as the southeast cell or south cell of the reservoir complex. Both Cell No. 1 (North Cell) and Cell No. 3 (Southwest Cell) are typically empty and are not used to store water. The Ordway Dam has been identified by the DSB as a small size and low hazard structure, Dam ID No. 170235, in Water Division 2 and Water District 17. This report presents repair recommendations for the dam and dike embankments for Cell No. 2, and improvements to the nonpotable water transmission line that extends from the reservoir to the Town.

B. BACKGROUND

The Town of Ordway's governmental authority is that of a statutory Town located in Crowley County, Colorado. The Town was incorporated in 1900 and has operated a water supply system since around its time of incorporation. The Town also installed a central sanitary sewer collection system in the early 1900s. Records indicate that water supply pipeline easements were conveyed to the Town as early as 1913. Ground water wells in the Horse Creek alluvial aquifer were developed in the early 1930s. This well field is located approximately 10 miles northeast of Town, and is referenced as the Faw well field, named after the original property owner of the land where the wells were installed.

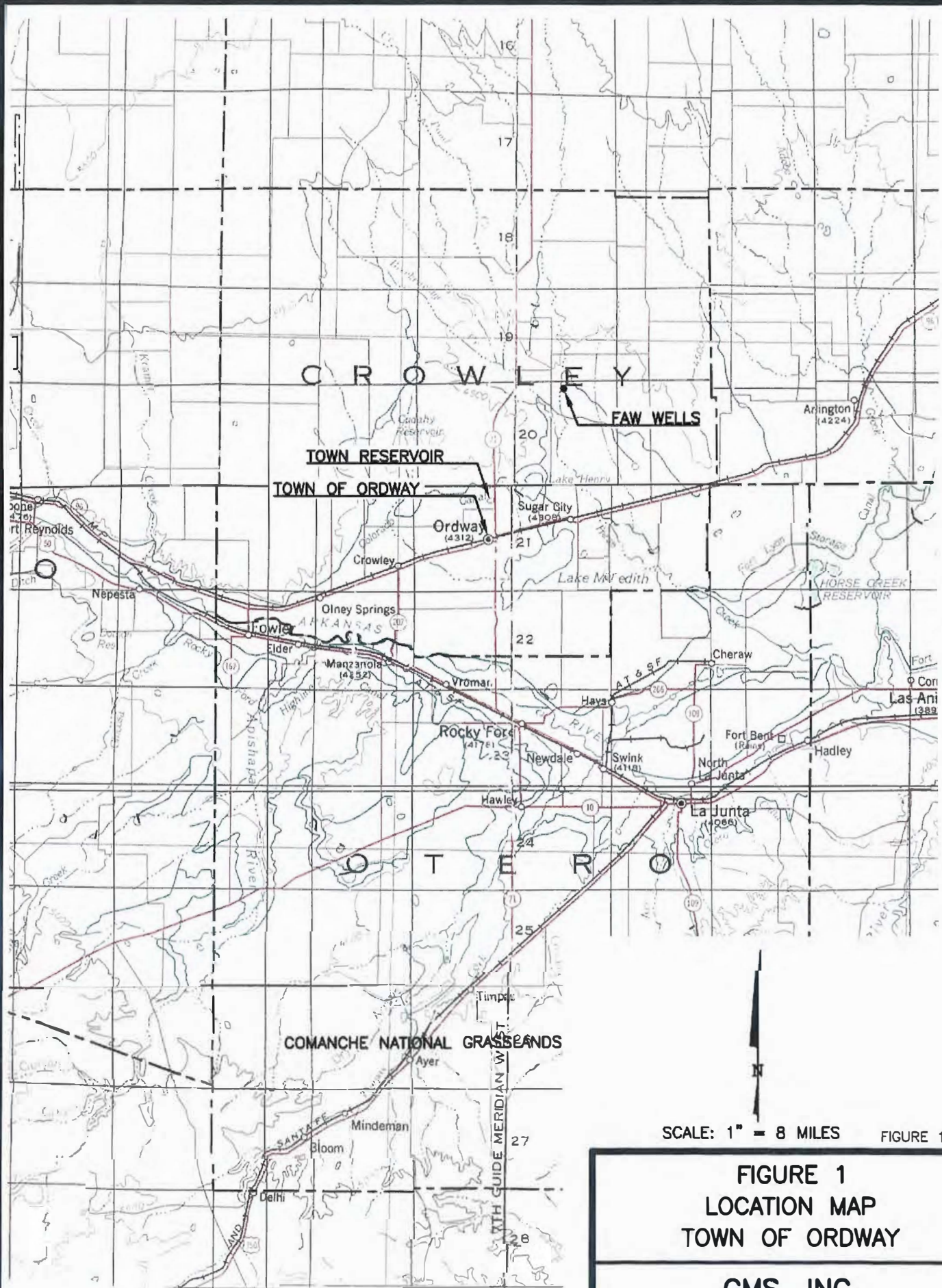
Easements for the original Faw well field pipeline leading into Town were deeded in 1934 and 1935.

Up until 1980, the Town operated a dual water system. The two systems had separate sources of supply. Potable water was provided to the Town's customers from the Faw well field as it had better water quality. The potable water system was also referred to as the soft water system because the water is relatively soft. The nonpotable water system provided irrigation water to Town residents. The source of the nonpotable supply was the Ordway Town reservoir located approximately 1.5 miles north of Town on the west side of Colorado Highway 71. The South Reservoir Dam is generally located at a latitude of 38°14'56"N and a longitude of 103°45'4"W. The Town reservoir is filled from the East Ordway Lateral off the Colorado Canal which draws water from the Arkansas River near Avondale located in Pueblo County, Colorado. This surface water source consists of hard water and is designated as the nonpotable water system. Use of the nonpotable water system for residential irrigation ceased in 1980 with the implementation of a major potable water system improvement project. The nonpotable water system has been used since that time to irrigate the Town Park and the school's athletic fields. The Town reservoir also provides fishing opportunities for the area as the reservoir is stocked periodically by Colorado Parks and Wildlife.

C. PLANNING AREA

The Town of Ordway is located in southeastern Colorado within Crowley County. The general location of the community can be seen with respect to its relationship to neighboring communities as shown on Figure 1 - Location Map. Also shown on Figure 1 is the location of the Town's reservoir and the nonpotable water transmission pipeline. Figure 1 has been taken from the U.S. Geological Surveys mapping of the State of Colorado and is shown at a scale of 1-inch equals approximately 8 miles. The area of concern with respect to reservoir and existing nonpotable water transmission pipeline lie north of the Town limits. The corporate limits of the Town and associated planning area can be seen on Figure 2 - Site Map. Figure 2 has been taken from the U.S. Geological Survey's Sugar City, Ordway and Lake Henry quadrangle maps. Figure 2 is shown at a scale of approximately 1-inch equals 3,000 feet. The corporate limits of Town are within Section 14, Township 21 South, Range 52 West of the 6th Principal Meridian. The Town's reservoir lies

in Section 2, Township 21 South, Range 57 West, and the nonpotable water transmission pipeline extends through Sections 2, 11 and 14, Township 21 South, Range 57 West. Additional future water demands on the Town of Ordway's nonpotable water system are not expected to increase.



SCALE: 1" = 8 MILES

FIGURE 1.DWG

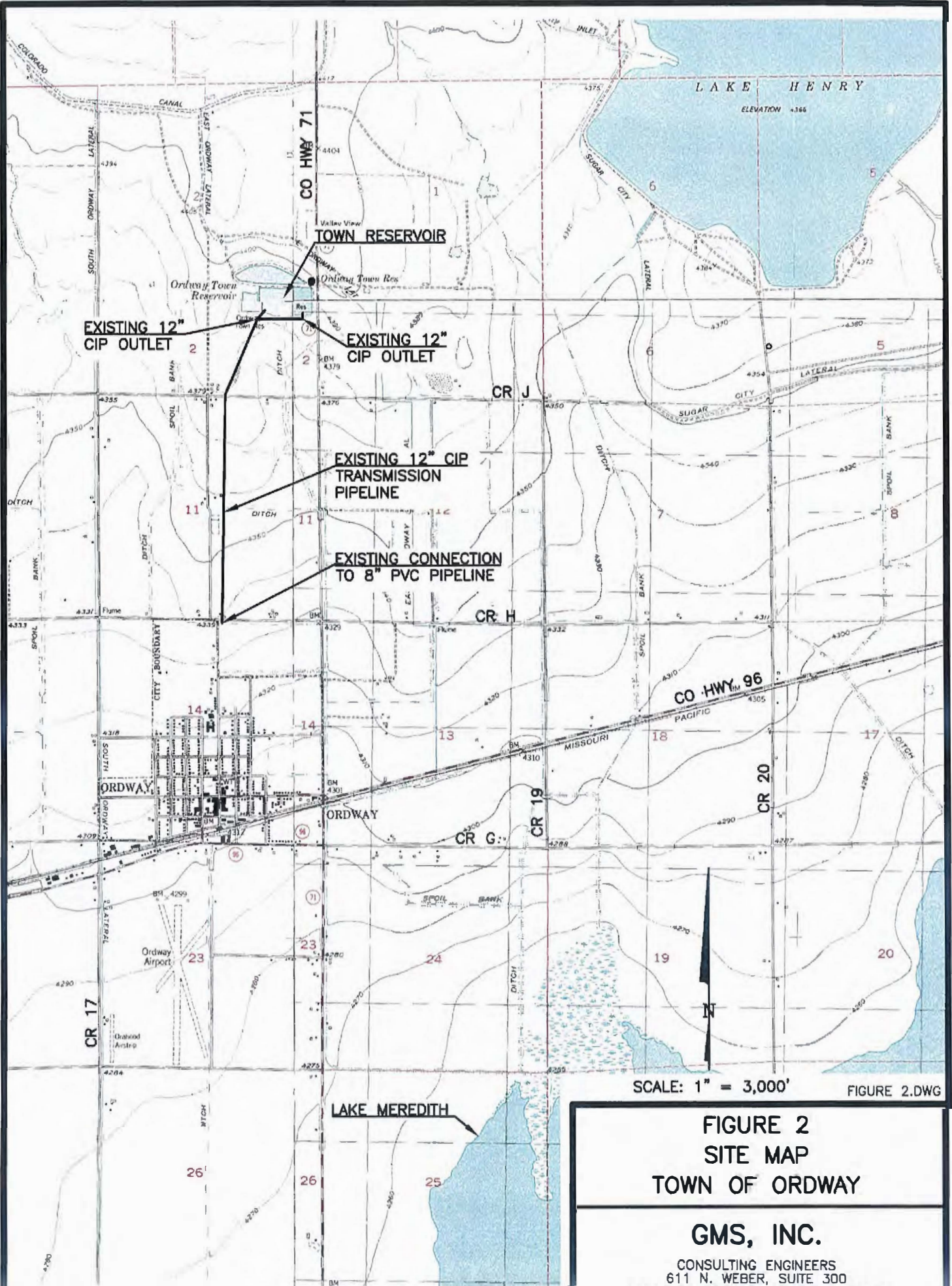
**FIGURE 1
LOCATION MAP
TOWN OF ORDWAY**

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MARCH 2016

3:\ORDWAY\140591\17016 Reservoir Study\Figure 2.dwg, Figure 2, 4/7/2016 1:07:03 PM, sc, \IGMSSV02\WorkCenter\17045 PS, 1:1



SCALE: 1" = 3,000'

FIGURE 2.DWG

FIGURE 2
SITE MAP
TOWN OF ORDWAY

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MARCH 2016

Base map from USGS Ordway, Sugar City, Nero Hill and Lake Henry Quadrangle maps

SECTION II EXISTING SETTING

A. LOCATION

The Town of Ordway is located in the southeastern portion of Crowley County. Crowley County lies in southeastern Colorado and abuts Pueblo County on the west. The community lies approximately 12 miles north of the Town of Rocky Ford and 16 miles northeast of the Town of Fowler. The City of Pueblo is 51 miles due west. The Town is bisected by Colorado Highway 96 which provides convenient east/west access to the communities in the Arkansas Valley. Colorado Highway 71 extends north/south on the east side of Town providing access to U.S. Highway 50 to the south which parallels the Arkansas River and extends north to the Town of Limon where Interstate 70 can be accessed. It is a major transportation link in the region.

Figure 2 has been annotated to show the location of the reservoir and nonpotable water transmission pipeline along with the street configurations, general building locations, topography, drainage locations, the old CKP short line of the BNSF Railroad which is currently programmed to be abandoned and the rails and ties salvaged, Colorado Highways 71 and 96, Lake Henry, Lake Meredith and local County roads and their relationship to the Town.

Lake Meredith and Lake Henry are the most prominent natural topographic features within the immediate area of Town. As shown on Figure 2, the general topography of the Town is such that the land drains southerly, then to the east toward Lake Meredith. The topography generally rises gradually across the Town. Elevations range from a low of approximately 4,295 feet on the southeast side of Town to a high of 4,340 feet on the north side of Town. The Town reservoir is located approximately 1.5 miles north of Town, west of Colorado Highway 71 as depicted on Figure 1.

B. WATER RESOURCES

The reservoir is filled via the East Ordway Lateral which extends south off the Colorado Canal. The Colorado Canal is fed by the Arkansas River. The river diversion of the canal from the Arkansas River is located between Avondale and Boone, Colorado, small towns located on US Highway 50. The canal originates approximately 30 miles due west of the Town's reservoir.

The East Ordway Lateral extends south off the Colorado Canal with a branch extending north and east of the Town reservoir and a branch that extends to the northwest corner of the reservoir. The north/east portion of the lateral continues southward into the east Spoil Bank Ditch network which discharges into Lake Meredith. The East Ordway Lateral diverts the Colorado Canal near the western portion of the Spoil Bank Ditch and extends south and west of the Town of Ordway. The West Spoil Bank Ditch conveys above normal water diversions which protects the Ordway reservoirs from overflowing.

Ground water within this portion of the state is primarily drawn from shallow alluvial aquifers associated with major streams and the Arkansas River. This shallow ground water supply is administered by the State Engineer's office as being tributary to the Arkansas River. Deeper aquifers such as the Dakota and Cheyenne aquifers in this area are excessively deep for economical use when compared to the available shallow ground water supplies. The Town of Ordway and the Crowley County water systems derive their water supply from ground water sources. The Town's Faw well field draws from the Horse Creek alluvium. The Crowley County water system draws from multiple Arkansas River alluvial wells located southwest of Olney Springs.

C. PHYSIOGRAPHY, TOPOGRAPHY AND SOILS

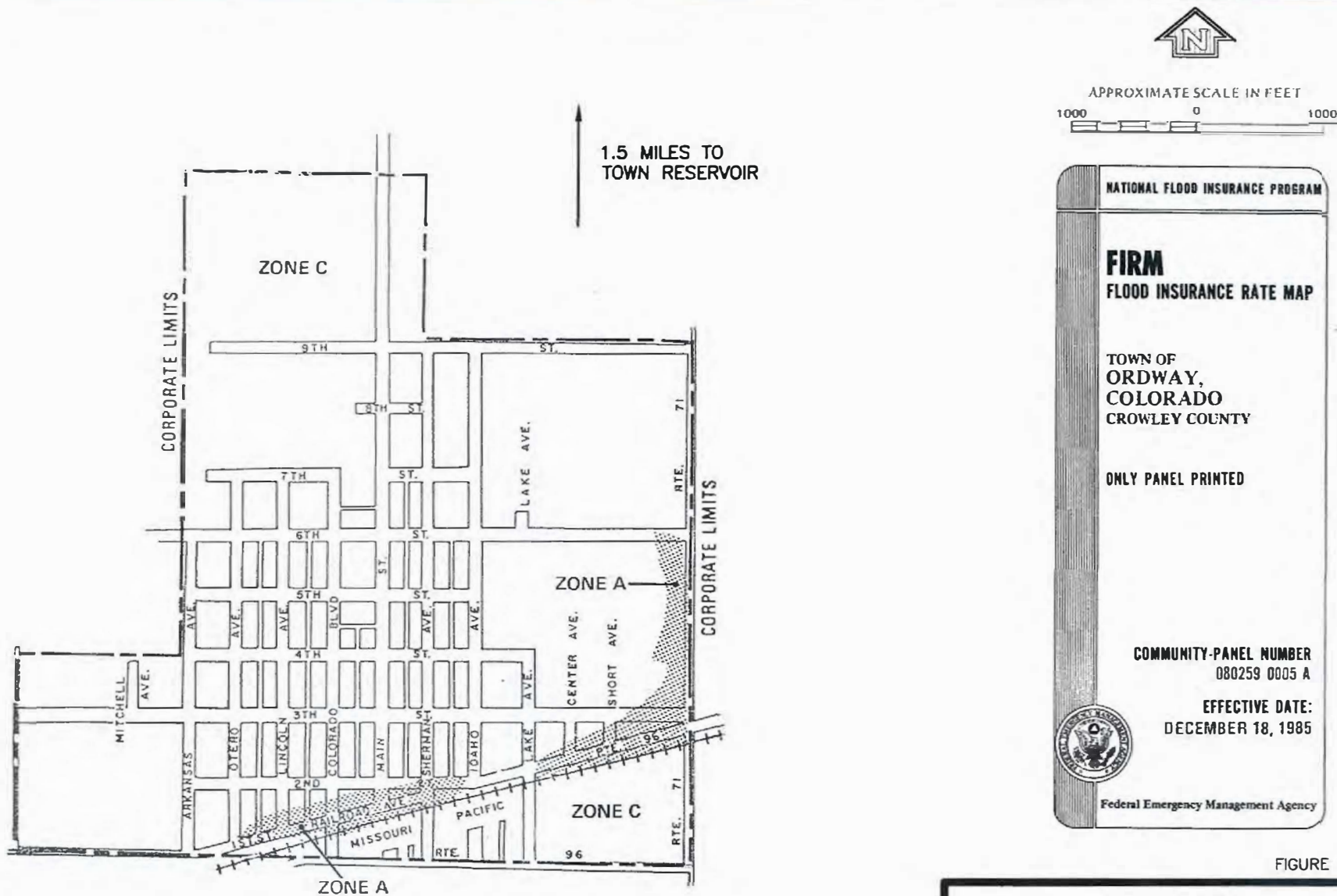
Crowley County lies entirely within the physiographic province of the Great Plains. For the most part the relief of the land area slopes gently southeast to the Arkansas River. Topography of the planning area is shown on Figure 2. Runoff from the Town primarily flows south and east toward Lake Meredith.

Local soils in the area range from gravely sands in the streambeds to clays and silty clays in the majority of the upland areas. In the vicinity of Lake Meredith, where ground slopes are relatively mild, soils are predominantly silts and clays. Soil types within the Town of Ordway were determined using the Natural Resource Conservation Service (NRCS) web soil service. Native soils on the west side of Town consist primarily of Limon clay soils. These alkali laden soils are deep, well drained and typically consists of 2 feet of clay overlying a silty clay. A majority of the native soils between the Town reservoir and the center of Town consists primarily of Ordway clay soils. These soils are moderately deep, well drained and moderately saline. This soil type typically consists of 3 feet of clay overlying weathered bedrock. The immediate north side and east side of Town is underlain with Numa clay loam soils. This deep, well-drained soil has a moderately high water transmissivity.

An "Important Farmlands Map of Crowley County, Colorado" prepared by the NRCS shows pockets of land around Ordway as being classified as "Prime Farmland, if irrigated". Local soils are viable for crop production. Current aerial photography of the Town shows irrigated parcels of farmland in proximity to the Town. A variety of irrigated and non-irrigated crops are cultivated within Crowley County; however, the extent of irrigated crops has fallen over time as a result of the sale of surface water rights primarily to outside municipal interests. Livestock grazing and feedlots are also common in this area.


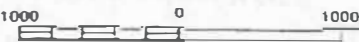
D. FLOODPLAINS

The December 18, 1985 FEMA Flood Insurance Rate Map for the Town of Ordway shows portions of the Town within a 100-year floodplain. These areas are located on the southern portion of Town on the north side of the railroad tracks between Otero and Idaho Avenues and between Lake Avenue and State Highway 71. This 100-year floodplain area continues north along the west side of Highway 71 to 6th Street. As there is no major stream in the vicinity, these 100-year floodplain areas represent flooding as a result of local runoff and correspond to undersized drainage facilities installed under the railroad tracks and/or highways. These flood areas are shown on the following Figure 3.



ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.

NOTE:
 FEMA FLOODPLAIN MAPPING CURRENTLY DOES NOT EXIST BEYOND THE TOWN'S CORPORATE LIMITS.


 APPROXIMATE SCALE IN FEET



NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
 TOWN OF
ORDWAY,
COLORADO
 CROWLEY COUNTY
 ONLY PANEL PRINTED
 COMMUNITY-PANEL NUMBER
 080259 0005 A
 EFFECTIVE DATE:
 DECEMBER 18, 1985

 Federal Emergency Management Agency

FIGURE 3.DWG

FIGURE 3
FLOODPLAIN MAP
TOWN OF ORDWAY

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 MARCH 2016

The Town reservoir is sited west of Colorado Highway 71 approximately 1.5 miles north of Town. Currently FEMA floodplain maps do not extend beyond the Town limits. The reservoir and nonpotable water transmission pipeline are situated upgradient of Town and are not within the vicinity of a major stream. The canal and lateral that are used to fill the reservoir contain water structures to control inflows. The reservoir is currently filled with canal/lateral diversions off of the Arkansas River. The water availability is dependent upon water availability and Pueblo Reservoir releases. The tributary drainage area to the reservoir complex is very small; estimated by the DSB at 19 acres. Based on the isolated location of the Town's reservoir from major surface water sources and limited tributary drainage area, local flooding in this area is minimal with runoff captured by Cell No. 1 and within the west Spoil Bank Ditch network which extends toward Lake Meredith.

E. PRECIPITATION, TEMPERATURE AND PREVAILING WINDS

Data pertaining to these factors has been obtained from the National Weather Service, National Oceanic and Atmospheric Administration in conjunction with data available through the Colorado Climate Center. Also referenced is the Climatic Atlas of the United States prepared by the Department of Commerce, Environmental Science Service Administration Environmental Data Service.

Based on the Climatic Atlas of the United States, the average annual precipitation in the area is approximately 12 inches. The Colorado Climatic Center database has extensive precipitation data for two stations located near Ordway. One station (No. 056136) is located approximately 19 miles north of Town on Colorado Highway 71. For the period from 1980 through 2006, total precipitation has averaged 12.83 inches per year. The second station (No. 056131) is located along Colorado Highway 96 in Ordway. For the period from 1939 to 2006, total precipitation at this station has averaged 11.32 inches per year. The dry year precipitation having a one-in-ten year recurrence probability equates to the 2003 precipitation total of 6.65 inches. Average annual lake evaporation in this area is approximately 51 inches based on the Climatic Atlas; however, site specific evaporation data from the Colorado Climate Center for the period from 1963 to 2005 indicates that the average pan evaporation at Lake Meredith is 39.71 inches. This is for the six-month period of May through October. Pan evaporation from November through April is estimated to add 16 inches for a total annual pan evaporation of 55.71 inches. Using a pan

to lake evaporation coefficient of 0.69 equates to an average year total lake evaporation of 38.44 inches. Under dry year conditions, the lake evaporation is estimated at 125% of average, or 48.05 inches per year. These average and dry year values of precipitation and evaporation are used later in this study to estimate evaporative losses from the Town reservoir.

On an annual basis, the area experiences an average of 81 days with maximum temperatures exceeding 90°F, and 170 days with minimum temperatures below 32°F. In 2001 through 2003, the southeast portion of the state experienced extreme drought conditions. According to the National Weather Service Drought Monitor for 2007, this region of the state has experienced moderate drought conditions and is currently classified as abnormally dry. The Ordway precipitation stations show that below average rainfall has been experienced annually since 2000, with the exception of 2004 which had slightly above average precipitation. Extremely dry and windy conditions contributed to a severe wildland fire on April 15, 2008 that burned 9,000 acres within Crowley County. The fire resulted in the loss of 16 homes outside of the Town and 8 inside the Town limit. Two firefighters died responding to the fire.

F. VEGETATION

The majority of the planning area consists of the urbanized area of the Town of Ordway. A portion of the general region is under cultivation as agriculture is still the largest industry in this area. Crop production is typically rotated. The major irrigated crops in the area consist of corn and sugar beets with non-irrigated crops consisting of winter wheat, sorghum and hay. Native vegetation in the area consists of a variety of short and mid-tall grasses. Lake Meredith to the southeast is commonly drawn down in the late summer as a result of irrigation withdrawals exposing an expansive area of dry lakebed.

G. WILDLIFE

The area is frequented by cottontails and jackrabbits, bobwhite and scaled quail, pheasants, occasional turkeys, mourning doves and a host of smaller varieties of songbirds common to the eastern plains of Colorado. Migratory waterfowl are common and, in the case of snow geese, are often densely populated on Lake Meredith during

migratory periods. No rare or endangered species are known to exist within the planning area.

H. AIR QUALITY AND NOISE

The Town of Ordway is a relatively small community located in the Arkansas Valley of eastern Colorado. The closest air monitoring station with air quality data is located in the City of Lamar, east of Ordway. The primary constituent monitored at the rural Lamar location is particulate matter, specifically particulate matter 10 micrometers in diameter and smaller, or PM₁₀. The most recent data available from the Lamar station shows generally good compliance with established particulate matter standards with excursions occurring as a result of uncontrollable natural events. Air quality in Ordway is generally viewed as good; however, the nearby feedlot located to the east of Town often taints this perception. Air quality is envisioned to continue into the foreseeable future at acceptable levels.

Noise generated within the community is limited to those normal domestic activities that occur within a small residential community with limited commercial activities. No significant noise generation occurs within the planning area. Limited traffic noise is associated with State Highways 71 and 96.

I. ENERGY PRODUCTION AND CONSUMPTION

There is no energy production within the planning area. Energy consumption is typical of a small agricultural based community.

J. POPULATION

The general population in the eastern plains of Colorado has historically seen a long-term steady decline in numbers. The 2010 Census provides the most recent data available. Despite the 16.9% gain in the statewide population from 2000-2010, the 2010 Census data substantiated that 9 of the 16 eastern Colorado plains counties posted losses in population from those reported in 2000.

The Town of Ordway is located in Crowley County. The County is within Colorado Planning District No. 6. The District encompasses the southeast corner of the state and includes the counties of Baca, Bent, Crowley, Kiowa, Otero and Prowers. This region of the state had a population base in 2000 of 52,449. That base population decreased by 3,542 people to a total of 48,907 in the 2010 census. The decrease amounted to a population loss of 6.8%. Crowley County over this same 10-year period saw a population gain of 5.5%, rising from the 2000 census of 5,518 to 5,823 in 2010. From 1990 to 2000, the County saw a 39.8% rise in population. The decade prior to that logged a 32.1% population increase. These prior substantial increases were primarily attributed to inmate populations introduced over those two decades at the Crowley County Correctional Facility and the Arkansas Valley Correctional Facility; however, neglecting the migration component of Crowley County's population change (which includes inmate population), births have continued to outpace deaths.

When reviewing the populations for the four incorporated communities within Crowley County from the year 2000 to 2010, all experienced population losses ranging from a low of 5.9% in the Town of Crowley to a high of a 13.5% loss in the Town of Ordway. Thus, the base population of the residents within the incorporated community decreased over this ten-year census period. The offsetting factor that results in a 5.5% increase in the population of the County primarily is associated with inmate population densities in the two correctional facilities. The State Demographer's office has estimated the Town of Ordway's population at 1,084 in the year 2019, indicating a stable population base since 2010. Similarly, population stability and slight increases are reflected in the State Demographer's estimates for the other communities within Crowley County.

The long-term gradual decline in population in the eastern plains of Colorado has been influenced by changes occurring within the ranching and agricultural industries as they have continued to become less labor intensive. Those counties in close proximity to the burgeoning growth of the Front Range are experiencing substantial spillover growth. Those counties that have been able to encourage economic development have posted positive gains. In general, the eastern counties are benefiting from a combination of the slow migration of people from metropolitan areas seeking the lower cost and quieter life style afforded by small, rural communities; Colorado's robust economy; and the ability to

work at off-site locations through the use of the internet. These positive effects on growth are expected to continue regionally and should affect the county's future projections.

The following table presents the previous eight census periods for Crowley County and the Town of Ordway. Population data for the unincorporated portion of Crowley County is not presented as it contains the prison population which skews the numbers upward dramatically. From 1980 to 1990, the unincorporated portions of Crowley County grew by 91%. From 1990 to 2000, the growth rate was 62% while the 2000 to 2010 period yielded a 5.5% population growth. Again, this is primarily attributed to the introduction of a sizable inmate population into the county. As can be seen in the table, the population of Ordway increased in the 1940s, remained fairly steady in the 1950s, declined in the 1960s and remained fairly steady through the 1970s and 1980s. A significant percentage increase occurred in the 1990s. Population estimates by the State Demographer's office indicate a stable population base from 2010 to 2019.

TABLE 1
TOWN OF ORDWAY
HISTORICAL POPULATION

Year	Crowley County (People)	Town of Ordway ¹⁾ (People)
1940	5,398	1,150
1950	5,222	1,290
1960	3,978	1,254
1970	3,086	1,017
1980	2,988	1,135
1990	3,946	1,025
2000	5,518	1,248
2010	5,823	1,080
2015 ²⁾	5,597	1,030
2019 ²⁾	6,032	1,084

- 1) Population within the incorporated Town boundaries
- 2) Estimate provided by the Colorado Department of Local Affairs, State Demographer's office, August 2020

The State Demographer's office compiles population projections for both counties and regions. They do not compile any statistical projections for individual communities or

unincorporated portions of individual counties. Population projections are based on regional statistical data for births, deaths and migration into and out of an area. The most recent population projection data available from the State Demographer's office dated November 2019 indicates a slight population increase in County population rising from 5,915 in 2020 to 6,618 in 2040; a rate of 0.56% per year.

The population base within the Town is influenced by factors other than County and regional growth rates. Major factors influencing the base population of the community are the stable agricultural nature of the area and the area's correctional facility employment opportunities.

Population declines in rural counties tend to occur first within the numbers of people residing in the non-community settings, as well as people residing in smaller communities. The larger communities contained within rural areas that provide general community services tend to have a more stable population base. When comparing the historical population data presented in the previous table, the Town of Ordway has shown a fairly stable population from 1970 through 1990 with a significant increase of 21.8% in population during the 1990's and a decrease of 13.5% in the 2000's. From 1940 to 1980, the County has shown steady declines in population; however, from 1990 to 2000, the County saw a 39.8% increase in population which continued at a rate of 5.5% in the 2000's. Countywide growth rates outpaced Town growth rates in the 1980's through the 2000's due to the inclusion of prison inmates into the population numbers. In consideration of this condition, the annual growth rate for the Town of Ordway would be expected to increase at a rate similar to the county, as the County projections do not appear to include a prison population increase component. Therefore, the projected growth rate for Ordway is conservatively assumed to grow at a modest rate of 0.56% per year through 2040. The expected growth rate of the Town will likely have very little impact on the continued use of the nonpotable water used to continue to irrigate the Town Park and school's athletic fields.

K. LAND USE AND DEVELOPMENT

The Town of Ordway reflects the land use patterns of typical small rural communities. The majority of the community is zoned residential. Limited commercial activity occurs within

the planning area. No industrial development exists within the planning area. Future projections are for a continuation of current land use practices. No major departures are envisioned from the current land use patterns established within the Town's service area. At this time, representatives of the Town are not aware of any significant development pressure. Limited growth is anticipated to primarily be a result of utilization of vacant homes and infilling within the service area.

The economic roots of the area lie in agriculture, although in the last few decades diversification of the employment base has been pursued. While agriculture activities are still a portion of the employment base in the region, major employers in the area include the local school district; Crowley County government; banking institutions and a nursing home. Nearby employers include the Crowley County Correctional Facility; a major feedlot; the Arkansas Valley Correctional Facility and various other employers in the nearby Cities of Rocky Ford and La Junta. Agricultural related activities still serve as a major economic activity within the region.

L. PUBLIC AND PRIVATE FACILITIES AND SERVICES

The Town of Ordway is a statutory Town created under the Colorado Revised Statutes. The Town was incorporated in 1900. As an incorporated statutory entity, the Town provides the general public the services for which it is empowered including potable water service, sanitary sewage service, trash service, street maintenance, drainage, municipal park, street lighting, cemetery and other related activities.

The residents of Ordway enjoy the availability of electric power as provided by Black Hills Energy. Natural gas is also provided to the Town residents by Black Hills Energy. Propane gas is not used inside the Town limits for heating; however, it is the primary source of heating fuel for residents outside of the Town limits. Central telephone facilities are available through CenturyLink Communications and central cablevision through Net Horizon.

SECTION III EXISTING FACILITIES

A review of the Town's reservoir and nonpotable water transmission system was undertaken within the course of this study effort. Residential use of the Town's nonpotable water system was discontinued in 1980, and the distribution components of the residential system abandoned. The remaining components of the nonpotable water system are now used only for irrigation of the school district's ball fields and the Town Park.

A. WATER SUPPLY

The Town of Ordway currently receives its potable water supply from two ground water sources; these are the Town's Faw wells drawing from the Horse Creek alluvium and the County's Arkansas River alluvial wells. The Town's original potable water system, the Faw well field, provided a soft water domestic supply to the Town, while the Town's nonpotable water system, fed from the Arkansas River, Colorado Canal, and East Ordway Lateral network, provided an irrigation supply for residential, commercial, and municipal use.

In 1980, significant water supply changes were implemented. The Town was connected to the new Crowley County water system at the northeast and southwest corners of Town. The Town's Faw well field pipeline was connected to the County system near Lake Henry to supplement the County's water supply. The nonpotable water irrigation system was, for the most part, disconnected. The Town's potable water storage tank in the center of Town was demolished. The Town's water customers are currently supplied with a varying blend of County water and Faw well field water, depending upon demand conditions not only in the Town's water system, but also the County's water system.

1. Nonpotable Water System

The Town's nonpotable water system historically provided untreated surface water to the Town of Ordway for irrigation, while the soft water system from the Faw wells provided softer, treated ground water for potable use. The residential components of the nonpotable water distribution system were abandoned when the Town secured its

potable water supply from the newly created County water system in 1980. The nonpotable water conveyance system still provides water to the school's athletic fields as well as the Town Park. The nonpotable water system consists of one currently active water holding impoundment, Cell No. 2, designated as the Town reservoir, and a 12-inch cast iron pipe (CIP) pipeline extending south to County Road H. The 12-inch pipeline extending south from County Road H together with the old booster station were eliminated in 2004 as a result of the installation of a new 8-inch Polyvinylchloride (PVC) water line extending into Town to service the athletic fields and the Town Park. The 12-inch piping extending from Cell No. 2 to County Road H is the original piping. This pipeline is in poor condition. The Town reservoir is located approximately 1.5 miles north of Town as shown on Figure 2. Preceding the Cell No. 2 reservoir is a large settling basin which is a diversion off of the East Ordway Lateral. Flow from the East Ordway Lateral enters the settling basin where sediment carried in the canal and lateral settles out. Water then flows into Cell No. 2, the largest of the three cells. Cell Nos. 1 and 3 are connected by means of interconnecting piping with Cell No. 2. Water can also be directly diverted to Cell Nos. 1 and 3 from the lateral diversion structure. The interconnecting pipelines and diversion structure have not been used for an extended period of time. The following table is a summary of the Town reservoir facility basin and cell sizes as determined by a prior detailed survey.

TABLE 2
TOWN OF ORDWAY
RESERVOIR FACILITY

Designation	Bottom Elevation	Maximum Depth, feet	Maximum Volume, million gallons	Maximum Water Surface, acres
Settling Basin	4,388	7.8	3.9	2.6
Cell No. 1	4,390	5.8	23.9	15.2
Cell No. 2	4,385	10.8 ¹⁾	52.4	18.4
Cell No. 3	4,390	5.8	5.3	4.1
Total Cell Nos. 1, 2 and 3			81.6	37.7

1) Operational limitation by the Dam Safety Branch, 1991, was 7-feet. Operational limitation by Dam Safety Branch, 2014, was 3-feet below dam crest.

In April 1991, Cell No. 2 was inspected by the Dam Safety Branch (DSB) of the State Engineer's Office. The inspection found a potential seepage area along the

downstream toe of the embankment, a failed condition of the upstream concrete slope liner, and the outlet piping in poor condition. As such, Reservoir No. 2 was placed under a restricted level of operation with a maximum operating depth of approximately 7 to 8 feet. The outlet piping was replaced in 1996 within the dam embankment and downgradient of the dam. No follow up action was conducted on the part of the State Engineer's Office with respect to the dam.

The Division 2 State Dam Safety Inspector reinspected the Cell No. 2 dam and dike embankments on January 29, 2014. Such resulted in correspondence addressed to the Town dated February 5, 2014 in which multiple deficiencies were noted with the facility. The restrictive height was again formally restated. In addition, the Town was required to prepare a five-year maintenance and repair plan that commits to addressing the deficiency issues cited in the detailed report.

Cited deficiencies include:

- Removal of all trees and roots in the dam embankments and backfill with compacted soil;
- Inspection of concrete facing and filling voids less than three feet deep with concrete
- Concrete slab removal and riprap installation where voids exceed three feet deep
- Grading the dam crest to drain surface water to the upstream slope
- Placement of compacted fill on the downstream slope at the southwest corner of the facility to provide drainage away from the toe
- Installation of a reservoir staff gauge

The required five-year reservoir improvement plan was prepared for the Town in March 2017 by the consultant. The plan was not submitted to the DSB, as the Town did not provide authorization to the consultant to submit it to the DSB.

Additional improvements included in the DSB in inspection report require engineered plans and specifications for:

- A level control spillway to prevent overflowing of the Cell No. 2 Reservoir

- Reconstruction and widening of the west interior embankment to provide freeboard control and the required crest width

Subsequent inspections of the Ordway reservoir Cell No. 2 were conducted in 2015, 2016, 2017 and 2020. Copies of the original 2014 inspection and the most recent 2020 inspection reports are found in Appendix B.

If the Cell No. 2 reservoir is to be relied upon for nonpotable water for irrigation purposes, the piping extending from the dam to County Road H will require replacement. The piping can most cost effectively be replaced through the use of a high-density polyethylene (HDPE) 6-inch pipe that is sleeved through the existing 12-inch CIP transmission line and connected to the 8-inch PVC piping originating at County Road H or alternatively paralleled by the installation of a 6" PVC replacement main.

2. Water Rights

The Town of Ordway has water rights for the Faw wells' potable water system. The Town holds water right shares in the Colorado Canal Company for direct flows and the Lake Meredith Reservoir Company for storage rights. Shares are also held in the Twin Lakes Reservoir and Canal Company. The Town is also entitled to water available from the Fryingpan-Arkansas Project (referred to as Project water) as administered by the Southeast Colorado Water Conservancy District (SECWCD).

The Town holds 445.4 shares in the Colorado Canal and Lake Meredith Reservoir Companies. These are direct flow and storage rights, respectively. The shares were historically used by the Town for filling the Town reservoir which subsequently fed the Town's nonpotable water system. The Colorado Canal and Lake Meredith Reservoir shares are relatively junior rights. During average years, the Colorado Canal yields approximately 0.54 ac-ft per share; however, during drought years, the yield could be as low as zero. Therefore, the Colorado Canal and Lake Meredith shares cannot be reliably counted upon to provide water under drought conditions. The canal company operates in runs, transferring water in single events. Communities typically piggyback on calls for water by larger users to minimize transient losses. Typically, calls begin in

February with runs through the summer. The last run typically occurs in the fall. The Colorado Canal can also be used to transfer stored Project water or Twin Lakes water held in the Pueblo Reservoir. The Colorado Canal rights are for irrigation use.

In accordance with the 2012 Water Agreement with Crowley County, the Town makes a portion of its Twin Lakes shares available by lease to the County water system for out-of-priority depletions of the Arkansas River. The lease rate for these shares are provided at a pass-through cost.

The Town holds 445.4 shares in the Twin Lakes Reservoir and Canal Company. One share of Twin Lakes rights is typically equal to 0.90 to 0.95 ac-ft of water. From 1935 to 2007, shares have averaged 0.87 ac-ft each. However, during drought conditions this has been reduced to as little as 0.5 ac-ft of water per share. This water is stored in the Twin Lakes Reservoirs for one year before it can be called. These shares can be stored in Pueblo Reservoir using "If & When" storage rights. This water is transmountain in origin from the Roaring Fork basin and can be used 100% to extinction.

Fryingpan-Arkansas Project water is also a transmountain diversion and is administered by the SECWCD. This project allocation is typically adequate to cover most of the stream depletions, however, in 2004 and 2005 some of the Town's Twin Lakes shares were also needed and used by the County to cover a shortfall in available Project water allocation. Recent action by the Conservancy District prohibits use of Project water for agricultural augmentation, but not municipal. Therefore, this action does not impact the County water system or the Town of Ordway. Project water received from the SECWCD by the County has been allocated based on service population and availability. Allocations not used can be stored in the Pueblo Reservoir for subsequent years. The required level of storage is set forth in the 2012 Agreement.

The fourth source of water available to the Town is that generated by the Faw wells. These wells are limited to 228 gpm and 125 ac-ft per year. The supply is provided to the County's system; however, the water rights of the wells are not available for use by the County.

SECTION IV
EXISTING FINANCIAL STATUS OF THE POTABLE WATER SYSTEM

The Town of Ordway adopts a formal budget for each fiscal year for its operating funds including the: general fund, water fund, sewer fund, sanitation fund (trash), street fund, library fund, conservation trust and fireman pension fund. A financial audit of the Town's funds is conducted in accordance with the State of Colorado's requirements each year. Audits for the years 2009 through 2016, as well as year-end reported data for 2017 and budget data for 2018 through 2020 have been reviewed. This was the most current financial information available.

Based upon the available data pertaining to the Town's water fund, an assessment with respect to water fund revenues and expenditures can be made. The Town operates its water system within the financial framework of the water fund. The water fund is run independently from all other funds as an enterprise fund. The Town has an assessed valuation established annually by the County Assessor. A property tax mil levy of 26.698 mils is applied to property values. Property tax revenues generated from the mil levy are funneled into the Town's general operating fund.

In 1994 the voters of the Town of Ordway approved an ordinance allowing the Town to "collect, retain, and expend all revenues and other funds collected in 1994 and subsequent years, notwithstanding the limitations of Article X, Section 20 of the Colorado Constitution." The ordinance also provides that no local tax rate or mil levy shall be increased without voter approval. This action has effectively "debruced" the community. This action allows the Town to retain excess revenues generated within the water fund as well as to accept any state related grant assistance that may be available for the water fund as such activities have been preauthorized by virtue of the passage of the ballot question by the Town's constituents.

Currently, the water fund debt consists of three different loans. In 2014, the Town had paid off the Rural Development (formerly the Farmers Home Administration) debt that was associated with its 1980 Water System Improvement project.

In implementing the Faw well field project in 2003, the Town incurred a \$385,000 Energy and Mineral Impact Assistance loan. That loan carried 5% interest over a 20-year amortization

schedule. Annual principal and interest payments total \$30,893 with the final payment due in 2023. This loan was retired early in 2017.

The 2008 Water System Improvements project was partially funded with two Drinking Water Revolving Fund loans that correctively totaled \$314,300 made available through the Colorado Water Resource and Power Development Authority's Disadvantaged Community Program. The two loans carry a zero percent interest rate for 30-years with collective semi-annual payments totaling \$10,477.

The 2017 Water System Improvements project was partially funded by a Drinking Water Revolving Fund (DWRF) loan. The maturity of the project was funded by grant and local match funds. The DWRF loan of \$142,636 is a 30-year, 0% interest rate loan with annual payments of \$4,755. The current total water system debt burden equals \$15,232 per year.

The Town assesses monthly user charges to active water connections to its system. The principal source of water fund revenues is generated from charges assessed for water sales. The Town's current water rate schedule together with its tap fee schedule follow. These rates have been in place since 2007.

TABLE 3
TOWN OF ORDWAY
EXISTING WATER RATES

Rate	Price
Commercial and Residential (In-Town)	Base rate: \$32.10 for first 7,000 gallons plus \$2.20 per 1,000 gallons over base
Commercial and Residential (Out-of-Town)	Base rate: \$43.28 for first 7,000 gallons plus \$3.50 per 1,000 gallons over base
Inactive "Zero Use" Customers	\$20.00 per month
Disconnect and Reconnect Fee	\$25.00
"96" Pipeline Customers	\$1.60 per 1,000 gallons
Water tap fee, ¾-inch	\$400
Water tap fee, 1-inch	\$800
Water tap fee, 1½-inch	\$1,000
Water tap fee, 2-inch	\$2,000

Of note within the existing water rate structure, there is no fee structure for the nonpotable water provided to either the School District or the Town Park. Thus, this water is provided at no cost to the School District and is used for Town purposes to irrigate the Town Park.

The user fees implemented by the Town constitute the majority of their water system revenues. The following table has been developed from the financial audits for the years 2015 through 2016 together with the 2017 year-end statements and 2018 through 2020 water fund budget figures. The table depicts the operating revenues associated with the Town's water fund.

TABLE 4
TOWN OF ORDWAY
WATER SYSTEM REVENUES

Year	Charges for Service	Interest	Tap and Connection Fees	Lease of Water Shares	Misc. ⁴⁾	Total
2015 ¹⁾	\$251,649	\$850	\$3,395	\$89,000	\$8,022	\$352,916
2016 ¹⁾	\$268,500	\$863	\$6,223	\$89,000	\$29,672	\$394,258
2017 ²⁾	\$268,249	\$0	\$6,057	\$89,000	\$11,250	\$374,556
2018 ³⁾	\$276,923	\$0	\$5,650	\$89,000	\$11,250	\$382,823
2019 ³⁾	\$278,800	\$0	\$5,050	\$89,000	\$0	\$372,850
2020 ³⁾	\$270,100	\$0	\$6,050	\$89,000	\$10,000	\$375,150

- 1) Audited figures
- 2) Year-end projected data from 2018 Budget, unaudited
- 3) Budget Figures
- 4) Does not include grant and loan proceeds for capital construction projects, includes penalties

As can be seen in the table, the primary source of revenue is water sales. The lease of Town water shares in recent years has become a significant component in the fund's operating income.

A review of the expenditures is required to establish the overall viability of the current water user charge system versus the corresponding expenses. The following table of expenditures covers the same period of time as that of the revenues. It highlights the major categories of

TABLE 5
TOWN OF ORDWAY
WATER SYSTEM EXPENDITURES

Year	Salaries & Benefits	Contract Services	Maintenance & Supplies	Utilities	Admin. ³⁾	Capital Outlay	Water Purchases	Debt P&I	Total
2015 ¹⁾	\$84,941	\$29,512	\$27,496	\$16,334	\$29,280	\$0	\$51,857	\$41,370	\$280,790
2016 ¹⁾	\$92,595	\$0	\$95,423	-	\$20,620	\$0	\$47,733	\$37,854	\$294,225
2017 ²⁾	\$95,913	\$28,776	\$21,897	\$16,032	\$33,059	\$0	\$60,724	\$10,477	\$266,878
2018 ³⁾	\$89,303	\$35,836	\$23,859	\$13,250	\$43,097	\$0	\$63,324	\$15,232	\$283,901
2019 ³⁾	\$81,966	\$1,600	\$36,100	\$13,229	\$38,950	\$714,000	\$50,600	\$17,165	\$953,610
2020 ³⁾	\$114,350	\$15,500	\$41,500	\$21,500	\$22,300	\$0	\$73,000	\$16,000	\$304,150

- 1) Audited figures
- 2) Year-end statement paid, unaudited
- 3) Includes Water Rights assessment, general administrative, insurance, and other
- 4) Budget Figures (modified to reflect correct loan payments)
- 5) 2003 EMIA loan retired. Budget amount revised in this table to reflect remaining loans
- 6) 2016 water system loan for Water System Improvements added

expenditures as presented within the Town's audits and budget figures for the water system. Within the categories listed within the expenditure table, the administrative category includes insurance and "other" expenses as itemized within the audit reports. The water purchases line item reflects those payments made to Crowley County for net water provided to the Town.

Upon review of the expenditure and revenue tables for the Town's water system, several observations can be made. In the six-year period from 2015 to 2020 inclusive, revenues have exceeded, or were projected to exceed, expenditures on average by \$97,167 per year. The revenue stream is reliant initially upon service charges, but also is significantly supplemented by the lease of the Town's water shares. The reliance upon the lease of water shares has enabled the community to continue for this extended period of time without adjusting water rates.

With the significant rewrite of the County Water Service Agreement occurring in 2012, water purchase expenses have remained fairly consistent. Such underscores the critical need that existed to renegotiate the contract between the County and the Countywide water providers to establish a more equitable assessment of expenses against the water providers.

Debt service dropped dramatically beginning in 2014 with the retirement of the 1980 Water System Improvement Farmers Home Administration (Rural Development) debt. Debt service again dropped in 2017 with the retirement of the 2003 Faw Well Field Improvements project loan. Currently, the Town is paying on three water system loans for projects conducted in 2008 and 2016. These loans have zero percent interest rates with a 30-year amortization schedule. This reflects highly favorable conditions under which the loans were written for the community.

The Town of Ordway's water fund has in the recent past been steadily increasing its level of retained earnings. Audited funds as of the end of December 2016 reflected \$419,107 of unrestricted retained earnings, and \$68,858 of restricted funds for bond related purposes. The most recent audit is for 2016. The current 2020 year-end unrestricted retained earnings are estimated at \$116,000 based on budgeted annual surpluses and the cash match provided toward the 2016 Water System Improvements project.

Looking at the 2020 estimated revenues for water sales of \$270,100, and with 549 active, billable users on Ordway's water system, such indicates that the average residential water bill was \$41.00 per month. That figure compares to the Colorado Department of Local Affairs'

calculated average water rate during 2019 of \$50.81 per month. Thus, it would appear on average that the residential users within the community are paying less than the statewide average. One must consider the fact that the median household income within the community is also substantially less than the statewide average.

An emergency reserve fund for major unforeseen water system expenditures is recommended. This is typically covered with retained earnings within the water fund; however, the Town's debt service reserve funds can be considered for this purpose.

The implementation of the improvements recommended herein will not directly impact the Town's potable water system. Indirectly, if the improvements are not undertaken and the Town can no longer provide nonpotable water for irrigation use to both the School District ball fields and the Town Park, an increase in demand on the potable water system will occur.

The recreational value of the reservoirs is significant for the residents of the Town for fishing. Ordway reservoir No. 2 is only one of the two reservoirs in the Arkansas Valley that is stocked by the Division of Parks and Wildlife with trout.

The recommended improvements may result in some form of a loan to the Town coupled with potential grant assistance. If any related loan was obligated to the water fund with the new loan payment superimposed onto the existing water system expenditures (which currently includes three long-term debt notes), such may necessitate a re-evaluation of the water rates in order to generate sufficient revenues to cover the new debt service. The following sections evaluate the recommended reservoir facility and transmission pipeline improvements along with possible funding scenarios in greater detail.

SECTION V

RECOMMENDED RESERVOIR FACILITY AND TRANSMISSION PIPELINE IMPROVEMENTS

As previously documented in this report, the Town of Ordway's nonpotable water system has several deficiencies with its reservoir and nonpotable water transmission pipeline facilities. The improvements necessary to address the dam deficiencies fall under the categories of the State of Colorado Division of Water Resources, Dam Safety Branch (DSB) Rules and Regulations repair and maintenance items. Nonpotable water system reliability along with operations and maintenance are not within the DSB's jurisdiction with the exception for portions of the transmission pipeline system that penetrate the dam embankment. The deficiencies are summarized as follows and are not listed in order of prioritization:

A. STATE OF COLORADO DAM SAFETY BRANCH – REPAIR AND MAINTENANCE ITEMS

The DSB has set a storage restriction for the Town reservoir of a maximum impoundment depth of 3 feet below the south dam crest. The repair and maintenance items listed by the State must be implemented in a five-year time frame. Based on the size of the dam embankment and its hazard classification, Rule 6 of the DSB's Rules and Regulations is applicable for some of the recommended corrective measures. In brief, Rule 6 will apply to all repairs that are indicated on the DSB inspection report as not requiring an engineer's involvement such as the upstream slope protection, foliage and root removal, and dam crest re-profiling. Repairs and modifications to the outlet structure, the new spillway and gauge rod have been noted as requiring the assistance of a professional engineer. These also fall under the requirements of Rule 6. Worthy of noting, all repairs could be easily incorporated into a simple plan set, potentially requiring DSB approval. If the DSB approves the plan set, then the plans are typically applicable for a 5-year duration. The work can be phased unless additional problems occur within the time frame increasing the scope of work.

The deficiency items noted are summarized below. Cofferdams may be required during repairs and maintenance unless the work is performed while the reservoir is fully evacuated.

- Spillway

A new spillway that provides a passive means of reservoir discharge that protects the reservoir from overflowing and overtopping the dam embankments is required within the dam improvements. The DSB suggests installing a spillway on the west embankment to discharge into the west cell (Cell No. 3). Notably, the installation of a spillway on this embankment (dike) will require the dam embankments for the southwest cell to be inspected by the DSB. If the west and south embankments for Cell No. 3 are deemed inadequate, then additional earthwork will likely be required which could include a dam embankment breach so water is not stored above the native ground surfaces or allowed to collect along the toe of the dam's embankments for Cell No. 2. DSB comments to date solely pertain to the active water holding cell. The Town would be best served by keeping the DSB's focus solely on Cell No. 2.

Based on reviews of aerial photography, the installation of a spillway on the south embankment may serve as a better location for a passive means of reservoir release. Large trees currently exist on the embankments requiring removal of both the trees and root systems. A new spillway could be considered with excavations likely required to achieve adequate vegetation removal. A ditch network downgradient of the reservoir should contain small releases.

- Southwest Outlet Tower Modifications

The existing outlet tower located at the southwest corner of the reservoir will need to be modified to accommodate the necessary improvements. The outlet structure will be exposed after the reservoir is drained and water pumped out of this portion of the reservoir. The four old slide gates will be removed from the tower and three of the four windows filled with concrete. The remaining windows in the structure will be modified to allow for new gates that provide a water-tight seal at the structure providing upstream control. The existing outlet pipe will remain in service. Modifications to the downstream water box will allow draining of the outlet pipe under the embankment. The existing outlet pipe will serve as an irrigation supply line that could also be used to fully evacuate the reservoir. This is based on the assumption that the existing line

through the embankment is found to be in serviceable condition. See Figure 4 for the recommended Ordway Dam Improvements.

- Rehabilitation of the West Dike for Cell No. 2

The west embankment for Cell No. 2 will require significant tree and vegetation removal as an initial maintenance task for rehabilitation of the embankment. After the vegetation is removed, the voids in the embankment will require filling with suitable soil that is properly compacted and tested during placement. A spillway could be constructed into the west dike while converting the dike to a dam embankment as opposed to installing it on the south embankment. The crest of the existing embankment is very narrow, approximately 3 feet, and should be widened as a part of the embankment rehabilitation. The dam crest should be approximately 14 feet wide for a dam embankment of the height noted in the inspection report and sloped toward the reservoir with no less than a 0.5-foot camber.

Due to the shallow nature of the water impoundment, deepening may be considered to improve the aquatic life. Depending on the time of year when the improvements are implemented and the duration from the time the water is drained, the soils removed may be suitable for west embankment repairs.

- Add Gauge Rod

The DSB suggests that the gauge rod correlates to the historic stage-storage capacity table dated July 24, 1977. These stage-storage tables are found in Appendix A. The gauge can either be graduated and installed along the upstream face of one of the dam embankments and ideally easily viewed and accessible. A vertical gauge could be constructed in the reservoir, possibly attached to the existing outlet tower.

G:\ORDWAY\14059\150\2016 Reservoir Study\Figure 4.dwg, Figure 2, 12/13/2016 5:09:33 PM, sc, I\GMSSV02\WorkCentre 7345 PS, 1:1



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SCALE: 1" = 300'

FIGURE 4.DWG

FIGURE 4
ORDWAY DAM IMPROVEMENTS
TOWN OF ORDWAY

GMS, INC.

CONSULTING ENGINEERS
 611 N. WEBER, SUITE 300
 COLORADO SPRINGS, COLORADO 80903

MARCH 2016

- Upstream Slope Protection

The entire perimeter of Reservoir No. 2 is lined with concrete slab slope protection. Most all of this slope protection has been compromised. Voids are visible behind slabs and several slabs have collapsed. Concrete paving for slope protection has a high occurrence of failure according to a survey conducted by the U.S. Army Corps of Engineers. The U.S. Bureau of Reclamation favors the use of dumped riprap slope protection as being the most effective.

The best, long-term slope protection solution for Reservoir No. 2 is to install a 2-foot to 3-foot blanket of riprap on an 8-inch to 12-inch thick blanket of crushed rock. The existing concrete could be crushed on-site for this purpose; however, riprap would need to be imported from a hard rock quarry along the Front Range. This long-term improvement is estimated to cost approximately \$840,000.

The short-term solution for embankment protection, as recommended by the DSB, comes at a lower cost. However, frequent inspection and maintenance/repair will be required by the Town. For voids under concrete slabs of less than three feet, the void needs to be filled with concrete. This can be a low strength flowable fill or a pressure grout. For voids under concrete slabs of greater than three feet, or slabs that have collapsed or have broken up, the concrete needs to be removed and replaced with compacted select backfill, gravel bedding and riprap. The extent and scope of the concrete slab slope protection has not been established. A detailed inventory of all slabs around the reservoir needs to be conducted to establish final cost estimates for this repair activity. For the purpose of this report, the cost estimate is based on this short-term repair approach. The cost estimate uses 20% of the south, east, and west embankments to have concrete slab removal and replacement with bedding and riprap. The remaining 80% of the slope protection is assumed to require, on average, 4 cubic feet of flow fill or pressure grout injected under each individual slab. The north embankment is considered low-risk. No improvements to the north embankment are recommended with these short-term improvements.

- Tree and Tree Root Removal

All trees growing on the dam embankment will require complete removal, including the root systems. The tree roots can deteriorate over time and provide a conduit for water to readily flow through the embankment. Some tree removal was conducted by the Town in 2015, but was limited by the size of the Town's equipment. Using a 2019 image from Google Earth, approximately 90 trees remain to be removed from the west, south and east embankments. Trees on the north side of the north embankment were not considered for removal. The voids created during the removal activity must be filled with properly compacted soil.

- Dam Crest Repairs

Based on the reported dam height, all dam crests around Reservoir Cell No. 2 should be a minimum 14 feet wide. The crest of the west embankment is very narrow, approximately 3 feet, and should be widened as a part of the embankment rehabilitation. The east and south embankments are sufficiently wide enough; however, the southeast corner of the dam should receive fill as a 1-foot deep pothole was observed by the dam safety inspector. The dam crests are to be sloped toward the reservoir with no less than a 0.5-foot camber across the span of the embankment. A sufficient layer of gravel, minimum 4-inches thick, is recommended to protect the crest, although not mandatorily required.

- Southwest Embankment Downstream Toe

Wet and rutted soils were observed at the southwest corner of the south embankment toe. The 2014 inspection dug multiple holes in this area and found firm, dry soil at approximately 6-inches deep. The wet soils in this area are due to poor drainage. The DSB suggested approximately 300 feet of the downstream toe in this area receive fill to promote surface drainage away from the dam. The repaired area should be monitored to determine if wet conditions reappear which would indicate potential seepage in this area. Acceptable soil should be used for this fill activity.

- Outlet Pipes

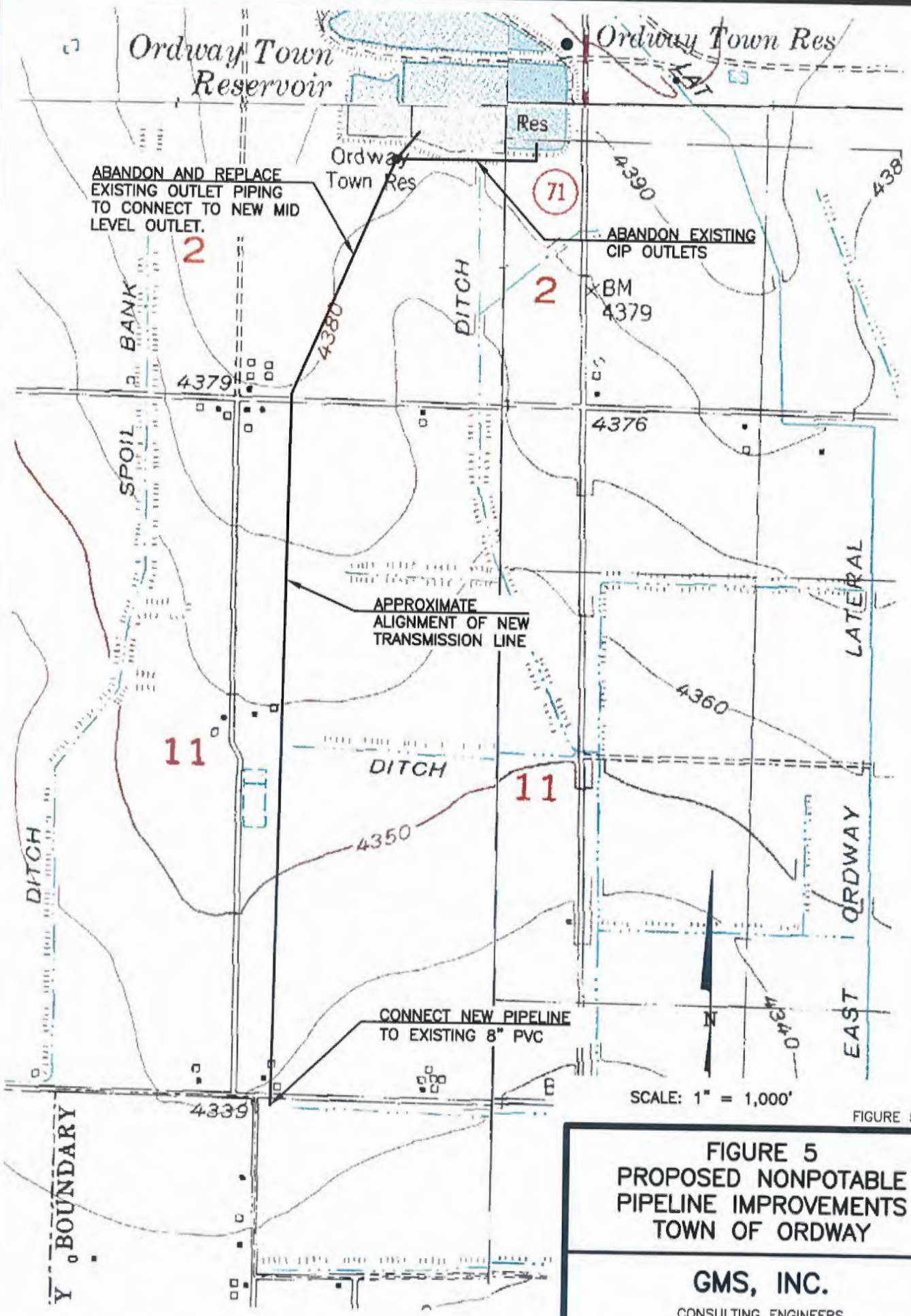
Due to the deteriorated condition, location, and age of the existing outlet pipes, reportedly two (2) 12-inch CIP, the recommendation is made that the east outlet pipe be grouted full and abandoned where it extends through the dam embankment. Modifications will valve off reservoir discharges on the upstream side of the embankment, eliminating a pressurized pipe under the embankment. This will also allow for camera inspections of the outlet pipe under the embankment.

B. NONPOTABLE TRANSMISSION PIPELINE REPLACEMENT - 12 INCH

- The 12" cast iron piping extending from the reservoir to County Road H has deteriorated where observed and has experienced several breaks. The pipeline from the water vault to the connection with the 8" PVC irrigation pipeline at County Road H could be abandoned and replaced with a new 6-inch PVC pipeline constructed in a separate trench, or with a 6-inch HDPE pipe slipped into the existing 12-inch CI pipe. The existing 12-inch piping between the outlet tower and water vault can remain in service, but needs to be drainable when not providing irrigation water to the Town. Diversions into the nonpotable pipeline will be provided with upgradient control with the outlet tower modifications previously discussed. See Figure 5 for the general alignment of the new nonpotable transmission pipeline between the reservoir and County Road H.

Increased nonpotable system capacities were not quantified within this study to accommodate future irrigation needs within the Town's service area. Nonpotable water use is not projected to change from the current uses.

Based on the limited use of the nonpotable water system to irrigate just the Town Park and school's athletic fields, the approach of sleeving a new 6-inch HDPE pipe in the existing 12-inch CI pipe is recommended to replace the existing transmission pipeline between the existing water vault and County Road H. The costs associated with irrigating the Town Park and the school's athletic fields with water from the potable water system is significant. Therefore, replacement of this transmission is recommended.



SCALE: 1" = 1,000'

FIGURE 5.DWG

**FIGURE 5
PROPOSED NONPOTABLE
PIPELINE IMPROVEMENTS
TOWN OF ORDWAY**

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MARCH 2016

Base map from USGS Ordway, Sugar City, Nero Hill and Lake Henry Quadrangle maps

The replacement of the existing 12-inch pipeline with a new fused 6-inch HDPE pipe is considered to be the most cost effective. Potential environmental impacts resulting from water system improvements with a slipline replacement are greatly reduced.

An assessment of endangered species, floodplains, historic and archeological resources will be conducted within the Environmental Report as required. Design and construction activities will be tailored to minimize impacts.

In addition to the irrigation supply benefit to the Town, the Ordway Reservoir Cell No. 2 provides recreational benefits to Town residents. The reservoir is stocked with trout by the Division of Parks and Wildlife. This is a popular site for fishing. The improvements recommended in this report will allow for greater irrigation and use of the reservoir; thus, flowing more water into and out of the reservoir. Due to regulated dam freeboard requirements, the maximum water level will not be increased. Areas of slope protection repair with riprap will make greater areas around the shore accessible to anglers. A Solar-Bee Aerator is also recommended to be installed to increase the dissolved oxygen in the water to enhance fish habitat.

The following table presents a preliminary project cost estimate for the recommended improvements assuming the reservoir is drained for construction. The construction cost estimates have been prepared on the basis of a general contractor undertaking the work. As discussed in the subsequent section, given the fact that the Town's two users for the nonpotable water do not pay for its use, the Town will not be in a position where it can afford to take on much in the form of a loan to implement these improvements as there is not a revenue source to cover the debt service.

TABLE 6
TOWN OF ORDWAY
RECOMMENDED RESERVOIR NO. 2 IMPROVEMENTS

Item	Description	Quantity	Unit Cost	Total Cost
1.	South, East and West embankments only. Upstream slope repairs - approximately 2,370 lineal feet			
	Remove concrete panels (estimated at 20% of the total length with panels at 10' long)	4,740 SF	4.00	\$18,960
	Place removed concrete panels with 12" thick gravel blanket made from crushed concrete panels and 24" of type L imported riprap.	4,740 SF	26.00	\$123,240
	Grout fill voids under remaining concrete panels. (estimated at 80% of the total length with 0.5 CF of grout per LF)	948 CF	50.00	\$47,400
	Subtotal			\$189,600
2.	Outlet Tower Modifications			
	Remove and replace existing slide gate	1 EA	9,000	\$9,000
	Install 4" valve in water vault to drain outlet pipe when not in use.	1 LS	4,500	\$4,500
	Concrete fill existing Outlet Tower windows	1 LS	3,000	\$3,000
	Furnish and install staff gauge to tower	1 LS	1,500	\$1,500
Subtotal			\$18,000	
3.	Abandon existing east outlet piping			
	Locate, expose, and isolate piping	1 LS	5,000	\$5,000
	Grout pipeline full	9 CY	500	\$4,500
Subtotal			\$9,500	
4.	Tree/Vegetation Removal			
	Remove and dispose of existing trees and root balls on south, east, and west embankments. Fill, compact and grade root ball void.	90 EA	800	\$72,000
Subtotal			\$72,000	
5.	West Embankment Widening			
	Clear and grub downstream side (west) of existing embankment	1 LS	10,000	\$10,000
	Widen existing embankment to provide 14' wide crest and 3:1 downstream slope.	1,600 CY	25.00	\$35,000
	Seed, mulch and water new downstream embankment slope.	1 LS	3,000	\$3,000
Subtotal			\$48,000	
6.	New level control spillway from Reservoir No. 2 to Reservoir No. 3			
	New concrete outlet box with level control aluminum stop logs and new 12" pipe through new widened embankment,	1 LS	35,000	\$35,000
	Riprap rundown chute to bottom of Reservoir No. 3	1 LS	4,000	\$4,000
Subtotal			\$39,000	
7.	Embankment Repairs			
	Fill and compact downstream slope at southwest corner of Reservoir No. 2 to provide drainage away from embankment toe.	600 CY	25.00	\$15,000
	Regrade downstream slope irregularities	1 LS	4,000	\$4,000
	Regrade top of embankments to drain to reservoir side and provide 0.5' camber at center of each embankment including any fill required.	1 LS	10,000	\$10,000
	Gravel surfacing, 12' wide by 4" thick, south, east and west embankments.	3,160 SY	6.00	\$18,960
	Seed, mulch and water downstream south embankment slope.	1 LS	3,000	\$3,000
	Install solar powered floating aerator to enhance aquatic habitat including moorings	1 LS	13,500	\$13,500
Subtotal			\$64,460	
Subtotal Recommended Reservoir Improvements				\$440,560
Project contingencies @ 15%				\$66,084
Engineering design/contract administration				\$42,051
Construction observation - Part time				\$30,000
Other engineering ¹⁾				\$55,500
Administrative expenses (Advertising, Legal Counsel, Bond Counsel, Project Audit)				\$16,000
Total Preliminary Construction Cost Estimate				\$650,195

1) Other engineering costs include: permits, Dam Safety Branch coordination, Environmental Report, easement/property evaluations, geotechnical services, reproduction, and funding administration

TABLE 7
TOWN OF ORDWAY
RECOMMENDED NONPOTABLE PIPELINE IMPROVEMENTS

Item	Description	Quantity	Unit Cost	Total Cost
1.	6" HDPE slip lined into existing 12" pipeline including access points	7,500 LF	25.00	\$187,500
2.	Connection to water vault at reservoir	1 LS	3,500	3,500
3.	Connection to irrigation piping at H Lane	1 LS	1,500	1,500
4.	New 6" valves	3 EA	1,600	4,800
	Subtotal			\$197,300
Subtotal Recommended Non-Potable Pipeline Improvements				\$197,300
Project contingencies @ 15%				29,595
Engineering design/contract administration				20,421
Construction observation - Part time				15,000
Other engineering ¹⁾				43,500
Administrative expenses (Advertising, Legal Counsel, Bond Counsel, etc.)				16,000
Total Preliminary Construction Cost Estimate				\$321,816

- 1) Other engineering costs include: permits, Dam Safety Branch coordination, Environmental Report, easement/property evaluations, geotechnical services, reproduction, and funding administration

The Town will need to provide a local funding match to the improvements project. The Town's Water Fund has an estimated cash balance of available funds of \$419,000. In addition, the General Fund may also be available to provide funds as a source of the local cash match.

The following is a summary of the preliminary construction cost estimates.

TABLE 8
TOWN OF ORDWAY
SUMMARY OF PROJECT COSTS

Description	Total Costs
Recommended Reservoir Improvements	\$650,195
Recommended Nonpotable Pipeline Improvements	\$321,816
Total Estimated Project Costs	\$972,011

The combined project cost for both the reservoir and pipeline improvements is estimated at \$972,011. If both projects were undertaken together, there would be considerable savings in administrative and funding administration costs, as well as saving in engineering and environmental report costs. This savings is estimated at \$54,500. Thus, the project cost if both pieces of work were undertaken together is estimated at \$917,500.

SECTION VI FINANCIAL IMPACTS OF THE RECOMMENDED IMPROVEMENTS

The nonpotable water system improvements recommended herein for the Town of Ordway are intended to improve safety of the existing Town reservoir, return the raw water irrigation supply to service and enhance aquatic habitat of the reservoir. The reservoir improvements work is required under the State Dam Safety Branch's most recent inspection of the reservoir. Failing to address the reservoir deficiency items identified by the State may ultimately result in the requirement to breach the embankment on Reservoir No. 2. This would result in a significant loss to the community, and the region. Loss of the reservoir would result in lost fishing opportunities and loss of the nonpotable irrigation supply for the Town and School District. If possible, both the recommended reservoir and pipeline improvements should be implemented. However, to fully address the identified deficiencies, the lack of a revenue stream for the nonpotable water use represents a financing challenge. Practically speaking, the Town has limited additional debt capacities given the nature of its user base, especially with no revenue generated by the use of the nonpotable system to lessen the financial impact of implementing the improvements. The estimated cost for both the reservoir and pipeline improvements is \$917,500.

Given the lack of revenue associated with the nonpotable system and the water impoundment, a project of this magnitude cannot be undertaken by the Town without sizeable grant assistance through State and/or Federal organizations. In the event loan funds are pursued, an acceptable pledge of a revenue source will have to be made to the lending entity to assure that the loan funds can be repaid. Funding for such projects has historically been available through: the Colorado Water Conservation Board (CWCB) within the Water Project Loan Program, the State of Colorado's Energy/ Mineral Impact Assistance Fund (EIAF) program, the Community Development Block Grant (CDBG) program, and potentially the Colorado Parks and Wildlife Fishing is Fun (FIF) grant program. The Water Plan Grant Fund, administered by the CWCB, has a new revenue source, as a benefactor of the newly legalized sports betting industry. These programs base their funding not only on the viability of the project, but also on other factors such as median household income, the need for the project, the debt burden of the community, and the percentage of population in the low to moderate income category.

CWCB also offers grants through the Water Supply Reserve Fund (WSRF), which funds the Basin Roundtable grants and Statewide grants. WSRF is funded through the oil, gas, and mineral extraction severance tax. The revenue from these taxes have decreased greatly in recent years; therefore, there is limited funding available.

Financing for reservoir projects is frequently secured through the Colorado Water Conservation Board (CWCB). The CWCB has limited grant funds for reservoir projects. They predominately provide money in the form of loans through their Water Project Loan Program. The program provides loans ranging from a minimum recommended amount of \$100,000 to well over \$10,000,000. Current rates for municipalities are 1.60% (low income), 1.80% (middle income) to 2.05% (high income). The standard loan-term is 30-years. This program requires that a loan feasibility study be provided, which evaluates the problems, provides the most cost-effective solutions and shows the impact on user rates. The typical process takes four to six months from the submission of a loan feasibility study and application to loan approval. As previously indicated, CWCB does have grant programs for projects like this. Current grant funds are however limited due to the drop in oil, gas and mineral severance tax revenues and overall statewide tax revenue shortfalls. The CWCB Water Plan Grant Fund requires impoundment enlargement, which this project does not offer; therefore, this project would not qualify for this grant.

Grant funds available through Colorado Department of Local Affairs (DOLA), consist of two programs that could be pursued. These include the Community Development Block Grant (CDBG) program and the Energy/ Mineral Impact Assistance Fund (EIAF) program.

A community is eligible for CDBG funds if the community has a low to moderate income percentage rate greater than 51%. Ordway has a 64.4% low to mod income rate; therefore, the Town is eligible for this program. The CDBG program has a cap of \$600,000 in grant monies for any given project. The program requires Davis-Bacon wages. The program accepts applications annually in the month of February. CDBG grant awards are usually in June of the same year.

The EIAF program obtains its funds from oil, gas, coal and mineral (mining) royalties from both the state and the federal tax revenues. The funding range for these projects is between \$20,000 to \$1,000,000 with two grant tiers. The grant requires a 50% match. The EIAF program

has been severely impacted by the reductions in severance taxes collected. The next round of funding applications is March 2021, after which it is unknown whether future funding applications will be accepted. The anticipated funds available in March 2021 are significantly lower than what was available in the past. Since the Town is eligible for CDBG funding, DOLA's Regional Manager has encouraged the Town towards the CDBG grant program due to the limited availability of funding in the EIAF program.

The Colorado Parks and Wildlife (CPW) offers a Fishing is Fun (FIF) grant program. The FIF provides grants in the range of \$2,500 to \$400,000 in federal matching funds. Typical grants average \$85,000. This program generally is used to improve aquatic resources and angling opportunities. The reservoir improvements contained herein would meet these criteria by making the shore line more accessible to anglers, increasing flow through the reservoir and installation of a floating aerator. The Town's reservoir provides recreational opportunities for the region in terms of fishing. Colorado Parks and Wildlife stocks the reservoir with regularity. The reservoir is a popular fishing location and serves the overall area. This grant funding source requires approval by the U.S. Fish and Wildlife Service. Therefore, the overall process from application to actually receiving grant funds is lengthy.

Taking into account the various funding programs that exist and their current viability, the following recaps the project's potential funding. A CDBG grant should be pursued together with a Fishing Is Fun grant. A Town local cash match is also shown. The funds are provided from cash reserves in the Water Fund. A CWCB 30-year loan is also included in the overall funding package. Annual payments will need to be made from the Water Fund. The following table presents the potential scenarios for the recommended reservoir improvements only, and for the combined project of reservoir and pipeline improvements.

TABLE 9
TOWN OF ORDWAY
RECOMMENDED RESERVOIR AND NONPOTABLE PIPELINE IMPROVEMENTS
POTENTIAL PROJECT FINANCING SCENARIO

Component	Reservoir Improvements Only	Combined Project ¹⁾
Total Project Cost	\$634,000	\$917,500
CPW ²⁾ Fishing is Fun Grant	\$134,000	\$134,000
CDBG ³⁾ Grant	\$400,000	\$500,000
Water Fund Local Match	\$0	\$100,000
CWCB ⁴⁾ Loan	\$100,000	\$183,500
New Debt Service per year ⁵⁾	\$4,223	\$7,750
Loan Reserve Requirement per year ⁶⁾	\$422	\$775
Total Annual Debt Cost ⁷⁾	\$4,646	\$8,525
Annual Debt Cost per user per month ⁸⁾	\$0.71	\$1.29

- 1) Reflects combined project soft cost savings of \$57,000
- 2) Colorado Parks and Wildlife
- 3) Community Development Block Grant
- 4) Colorado Water Conservation Board
- 5) For CWCB loan at 1.6% and 30-years
- 6) Required 10% reserve requirement on debt service
- 7) To be paid as Water Fund expenditure
- 8) Based on 549 existing active customers (2016)

The above funding figures are projections only. The local participation, grant and loan sources will depend upon the outcome of the discussions held with the funding agencies and the funding level at which the agencies are willing to participate in the project. Through the use of available funding sources, the project can be made a reality.

SECTION VII
PLAN OF ACTION

A plan of action and schedule has been developed for the dam and nonpotable water system improvements recommended herein. The following table has been developed based upon the normal progression of a project of this nature. The table is based on utilizing a CDBG grant, DWR Fishing is Fun grant, local cash match from the Water Fund, and a CWCB loan.

TABLE 10
TOWN OF ORDWAY
PLAN OF ACTION AND IMPLEMENTATION SCHEDULE

Scheduled Event	Date
Submit Final PER to Town and CDWR DSB	November 2020
Authorize Design and Funding Applications	January 2021
CDBG Grant Application	February 2021
CPW Fishing is Fun Grant Application	March 2021
Submit Plans and Specifications to DSB for Review and Approval	April 2021
Obtain CDWR DSB Design Approval	August 2021
CWCB Loan Application with Loan Feasibility Study	August 2021
CPW Fishing is Fun State Approval	June 2021
CDBG Grant Approval	June 2021
CWCB Loan Approval	September 2021
CPW Fishing is Fun Federal Approval	October 2021
CPW Fishing is Fun Contract Approval	December 2021
Finalize Funding Contracts	January 2022
Advertise Project for Bid	February 2022
Bid Opening	April 2022
Project Award	May 2022
Initiate Construction	June 2022
Completion of Construction	November 2022

DWR DSB = Colorado Division of Water Resources Dam Safety Branch
 CPW = Colorado Parks and Wildlife
 CDBG = Community Development Block Grant
 CWCB = Colorado Water Conservation Board

The above schedule realistically represents a tentative timeline for implementation of the recommended improvements. Notably, the Town of Ordway could potentially lose this water impoundment if the DSB repair and maintenance items are not completed. Significant activity

must occur prior to the initiation of design and construction. This activity focuses on securing the necessary funds together with completing, submitting to, and obtaining approvals from the State on various submittals.

This plan of action and schedule is a dynamic activity that will require modifications and refinements as the project evolves. A delay in one activity will result in subsequent delays in following activities. Securing adequate funding in a timely manner will be crucial not only to maintaining the schedule, but ultimately in implementing the needed improvements.

Once the DSB approves the dam repair plans, they are typically approved for a five-year timeframe. Depending on the timing of their reviews, project initiation may or may not commence in time to complete the given tasks before months of seasonal precipitation. Repairs to dams typically take place during late winter to early spring or during the fall/winter months.

**APPENDIX A - 1977 HISTORIC STAGE-STORAGE CAPACITY
TABLE**

CELL NO. 1

<u>ELEVAT.</u>	<u>GAUGE</u>	<u>SURFACE ACRES</u>	<u>ACRE FEET</u>	<u>1,000 GALS.</u>
4390.0	0.00	2.77	0.00	0.00
	0.10	3.72	0.75	246
	0.20	4.67	1.50	492
	0.30	5.62	2.25	737
	0.40	6.57	3.01	983
	0.50	7.52	3.76	1,229
	0.60	8.44	4.51	1,475
	0.70	9.42	5.27	1,720
	0.80	10.37	6.02	1,966
	0.90	11.32	6.77	2,212
4391.0	1.00	12.27	7.52	2,458
	1.10	12.33	8.78	2,869
	1.20	12.39	10.08	3,294
	1.30	12.46	11.30	3,691
	1.40	12.52	12.55	4,102
	1.50	12.58	13.81	4,923
	1.60	12.64	15.07	4,923
	1.70	12.70	16.33	5,334
	1.80	12.76	17.59	5,745
	1.90	12.82	18.84	6,156
	2.00	12.89	20.10	6,567
	2.10	12.94	21.42	6,996
	2.20	12.99	22.73	7,425
	2.30	13.04	24.04	7,855
	2.40	13.09	25.36	8,284
	2.50	13.14	26.67	8,713
	2.60	13.19	27.98	9,142
	2.70	13.24	29.30	9,571
	2.80	13.29	30.61	10,000
	2.90	13.34	31.92	10,429
4393.0	3.00	13.39	33.24	10,859
	3.10	13.44	34.60	11,305
	3.20	13.50	35.97	11,751
	3.30	13.55	37.33	12,197
	3.40	13.60	38.70	12,643
	3.50	13.66	40.07	13,090
	3.60	13.71	41.43	13,536
	3.70	13.77	42.80	13,982
	3.80	13.82	44.16	14,428
	3.90	13.88	45.53	14,875
	4.00	13.93	46.90	15,321

WEST

CELL NO. 3

<u>ELEVAT.</u>	<u>GAUGE</u>	<u>SURFACE ACRES</u>	<u>ACRE FEET</u>	<u>1,000 GALS.</u>
4394.1	4.10	3.76	9.48	3,097
	4.20	3.78	9.87	3,224
	4.30	3.82	10.26	3,350
	4.40	3.84	10.64	3,477
	4.50	3.87	11.02	3,601
	4.60	3.90	11.424	3,730
	4.70	3.93	11.804	3,856
	4.80	3.96	12.194	3,983
	4.90	3.98	12.584	4,109
	4395.0	5.00	4.01	12.974
5.104		4.02	13.374	4,369
5.204		4.04	13.784	4,502
5.304		4.05	14.194	4,635
5.404		4.07	14.604	4,769
5.50		4.08	15.004	4,902
5.60		4.09	15.414	5,035
5.70		4.114	15.824	5,168
*4395.8	*5.80	*4.12	*16.234	*5,301
4396.0	5.90	4.13	16.64	5,423
	6.00	4.15	17.044	5,556

* MAXIMUM SAFE CAPACITY

The Foregoing Tables Were Prepared From Data Obtained
By Survey During The Months Of June and July, 1977.

July 24, 1977


Wallace A. Doe, Reg. P.E. No. 3728



~~North~~
CELL NO. 2

ELEVAT.	GADGE	SURFACE ACRES	ACRE FEET	1,000 GALS.
4385.0	0.00	1.00	0.00	000
	0.10	1.66	0.43	140
	0.20	2.31	0.86	280
	0.30	2.97	1.29	420
	0.40	3.63	1.72	561
	0.50	4.29	2.15	701
	0.60	4.94	2.57	841
	0.70	5.60	3.00	981
	0.80	6.26	3.43	1,121
	0.90	6.91	3.86	1,261
	1.00	7.57	4.29	1,402
	1.10	7.98	5.25	1,716
	1.20	8.39	6.22	2,031
	1.30	8.81	7.18	2,385
	1.40	9.22	8.14	2,660
	1.50	9.63	9.11	2,975
	1.60	10.04	10.07	3,289
	1.70	10.45	11.03	3,604
	1.80	10.87	11.99	3,918
	1.90	11.28	12.96	4,233
	2.00	11.69	13.92	4,548
	2.10	11.89	15.19	4,962
	2.20	12.09	6.46	5,376
	2.30	12.28	7.72	5,790
	2.40	12.48	18.99	6,205
	2.50	12.68	20.26	6,619
	2.60	12.88	21.53	7,033
	2.70	13.08	22.80	7,447
	2.80	13.27	24.06	7,862
	2.90	13.47	25.33	8,276
	3.00	13.67	26.60	8,690
	3.10	13.85	28.06	9,166
	3.20	14.02	29.51	9,642
	3.30	14.20	30.97	10,117
	3.40	14.38	32.42	10,593
	3.50	14.56	33.80	11,042
	3.60	14.73	35.34	11,544
	3.70	14.91	36.79	12,020
	3.80	15.09	38.25	12,496
	3.90	15.26	39.70	12,971
4389.0	4.00	15.44	41.16	13,120

bottom
cell #2
"Safe Capacity":
= 4395.8
- 4385.0

10.8

blue paint mark is
supposedly for safe
level,
Survey @ 4387.0
3.25' below dam
crest on 1/29/14.
Max depth water
= 14.05' to dam
crest (no spillway)

South
Ordway Reservoir

CELL NO. 2

<u>ELEVAT.</u>	<u>GAUGE</u>	<u>SURFACE ACRES</u>	<u>ACRE FEET</u>	<u>1,000 GALS.</u>
4389.1	4.10	15.57	42.77	13,973
	4.20	15.70	44.38	14,498
	4.30	15.83	45.9	15,024
	4.40	15.96	47.6	15,550
	4.50	16.09	49.21	16,075
	4.60	16.21	50.81	16,601
	4.709	16.34	52.42	17,127
	4.80	16.47	54.03	17,652
	4.90	16.60	55.64	18,178
	4390.0	5.00	16.73	57.25
5.10		16.80	58.96	19,261
5.209		16.86	60.66	19,818
5.309		16.93	62.37	20,375
5.40		17.00	64.07	20,9329
5.50		17.07	65.78	21,489
5.60		17.13	67.48	22,046
5.709		17.20	69.19	22,603
5.80		17.27	70.89	23,160
5.90		17.33	72.60	23,7179
4391.0	6.00	17.40	74.30	24,2749
	6.10	17.43	76.05	24,846
	6.20	17.46	77.80	25,417
	6.309	17.49	79.55	25,989
	6.40	17.52	81.30	26,5619
	6.50	17.56	83.05	27,132
	6.60	17.59	84.80	27,704
	6.70	17.62	86.55	28,276
	6.80	17.65	88.30	28,848
	6.90	17.68	90.05	29,419
4392.0	7.009	17.71	91.86	30,0119
	7.109	17.73	93.64	30,5939
	7.20	17.75	95.42	31,174
	7.30	17.77	97.20	31,756
	7.40	17.79	98.98	32,3389
	7.50	17.81	100.97	32,920
	7.60	17.83	102.55	33,5029
	7.70	17.85	104.33	34,0849
	7.80	17.87	106.11	34,6659
	7.90	17.89	107.89	35,247
4393.0	8.00	17.90	109.67	35,829

APPENDIX B - DAM SAFETY REPORTS



DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

John Hickenlooper
Governor

Mike King
Executive Director

Dick Wolfe, P.E.
Director & State
Engineer

Steven J. Witte, P.E.
Division Engineer

February 4, 2014

Mr. George Johnson
Public Works Director
Town of Ordway
315 Main Street
Ordway, CO 81063
townofordwayclerk@gmail.com

VIA E-MAIL and CERTIFIED: 7009 2820 0002 2075 4455

When replying, please refer to:
ORDWAY TOWN RES. CELL NO. 2 DAM
DAMID: 170235
Water Division 2, Water District 17

SUBJECT: Transmittal of Dam Safety Inspection Report

Dear Mr. Johnson:

A dam safety inspection of the above-referenced dam was performed on January 29, 2014, in accordance with Colorado Revised Statute Section 37-87-107, which assigns to the State Engineer's Office (SEO) the responsibility for determining the safe storage levels for all reservoirs in this state. The enclosed inspection report summarizes the conditions observed during the inspection and identifies actions required to improve the condition and extend the useful life of the structure. Please review the report and implement all recommendations listed in the section entitled, "Items Requiring Action by Owner to Improve the Safety of the Dam". Please sign, date, and return one copy of each inspection report and retain the other copy for your files and future reference.

The referenced dam was a "Non-Roster" dam meaning it was not previously in the State's database; however, we determined that it was inspected by an SEO Dam Safety Engineer (DSE) in 1991. He recommended a Storage Restriction, but did not enter the dam in our database or issue a Restriction Order and did not return to the dam. The current SEO DSE found the dam during the 2013 inspection season and contacted the Town to arrange an inspection.

According to the 1991 inspection report, the previous Public Works Director (Leonard Weiss) indicated the Ordway Town Reservoir was constructed in the 1930's by the WPA and that he had construction plans for the dam. Currently the SEO has no construction plans for this dam in our files. PLEASE ATTEMPT TO LOCATE CONSTRUCTION PLANS FOR THE DAM AND PROVIDE THEM TO THE SEO, IF FOUND. The SEO maintains archives of all construction plans for dams

Water Division 2 • Pueblo

310 E. Abriendo Ave. Suite B • Pueblo, CO 81004 • Phone: 719-542-3368 • Fax: 719-544-0800

www.water.state.co.us

DIVISION OF WATER RESOURCES

Mr. George Johnson
2/4/2014
Page 2 of 3

in the State. Construction plans are extremely useful if problems develop with dam or if repairs/modifications are made.

The facility consists of three cells separated by interior dikes and perimeter dams. Cell No. 1 is the north cell, Cell No. 2 is the Southeast, and Cell No. 3 is the Southwest, according a 1977 reservoir capacity table in our file. Currently ONLY Cell No. 2 is used, and the current inspection only applies to Cell No. 2. **PRIOR TO USING CELL NO. 1 OR CELL NO. 3, THE TOWN MUST NOTIFY THE SEO TO SCHEDULE INSPECTIONS OF THESE FACILITIES AND DETERMINE WHAT REPAIRS ARE NEEDED.**

The Cell No. 2 dam is poorly maintained and has an irregular and deteriorated appearance. The upstream slope concrete facing is deteriorated, there are trees growing on the upstream shoulder, and poor surface drainage along the downstream toe. Because this dam has not been actively regulated by our office, we realize it may take some time to restore it to a Satisfactory level of maintenance and repairs. We are requiring the Town to submit a 5-Year plan to address the Required Actions in the attached inspection report.

As the Town is new to the SEO Dam Safety program, we have mailed hard copies of various pamphlets that discuss trees on dams, outlet conduits through embankment dams, responsible dam ownership, hiring a professional engineer, etc. We have also mailed a hard copy of a pamphlet entitled "Guide to Construction and Administration of Dams in Colorado" to explain the SEO Dam Safety regulatory program and its Statute Authority. We have also included a list of engineers who are experienced with dam design and construction in Colorado. Finally, we provided you with a copy of the State's Dam Safety Rules & Regulations at the time of the inspection.

Construction, modification, and major repairs of dams in Colorado require State Engineer approval of plans & specifications prepared by a licensed engineer with a minimum of 5-years experience in design & construction of dams. Rule 12 of the Rules & Regulations explains regular maintenance work that can be performed without an engineer. The attached inspection report lists Required Engineering Actions Needed to Improve the Condition of the Dam.

Finally, a State Engineer's Restriction Order will be issued in a separate letter to formalize the historic operational restriction. In order for the Restriction to be lifted, the Required Actions in the attached report must be satisfactorily addressed. While the dam is under a Storage Restriction, Dam Safety Branch policy is that we will inspect the dam annually to ensure progress is being made and conditions are not getting worse. If conditions worsen, further storage restrictions may be needed.

Please contact me if you have any questions about the enclosed inspection report or any other dam safety issues that I can assist you with. I can be reached at 719-542-3368 x2109. Thank you for your cooperation.

DIVISION OF WATER RESOURCES

Mr. George Johnson
2/4/2014
Page 3 of 3

Sincerely,

A handwritten signature in black ink, appearing to be 'M. Perry', written in a cursive style.

Mark A. Perry, P.E.
Dam Safety Engineer

Encls.

ec: Bill McCormick, Chief Dam Safety Branch
Steve Witte, Division Engineer
Lonnie Spady, WD 17 Water Commissioner

ENGINEER'S INSPECTION REPORT

INSPECTOR: MP3

OFFICE OF THE STATE ENGINEER - DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH

1313 SHERMAN STREET, ROOM 818, DENVER, CO 80203, (303) 866-3681

DAM NAME: ORDWAY TOWN RES. CELL NO. 2	T: 210S R: 0570W S: 2	COUNTY: CROWLEY	DATE OF INSPECTION: 1/29/2014
DAM ID: 170235 YRComp: 1935	DAM HEIGHT(FT): 19.0	SPILLWAY WIDTH(FT):	PREVIOUS INSPECTION: 4/26/1991
CLASS: Low hazard	DAM LENGTH(FT): 2880.0	SPILLWAY CAPACITY(CFS): 0.0	NORMAL STORAGE (AF): 161.0
DIV: 2 WD: 17	CRESTWIDTH(FT): 29.0	FREEBOARD (FT):	SURFACE AREA(AC): 19.0
EAP: Not Required	CRESTELEV(FT): 4398.0	DRAINAGE AREA (AC.): 19.0	OUTLET INSPECTED:

CURRENT RESTRICTION: -- NONE --

OWNER: LYNN CHUBBUCK	OWNER REP.: LYNN CHUBBUCK
ADDRESS: TOWN OF ORDWAY	CONTACT NAME: GEORGE JOHNSON
ORDWAY CO 81063	CONTACT PHONE: (719) 267-3134Xm

INSPECTION PARTY: GEORGE JOHNSON MARK PERRY
 REPRESENTING: TOWN OF ORDWAY, PUBLIC WORKS D STATE OF COLORADO, DAM SAFETY

FIELD CONDITIONS OBSERVED	WATER LEVEL: BELOW DAM CREST <u>-3 (South)</u> FT. Above Spillway _____ FT.	GAGE ROD READING "GH 7-FT"
	GROUND MOISTURE CONDITION: <input type="checkbox"/> DRY <input type="checkbox"/> WET <input checked="" type="checkbox"/> SNOWCOVER	OTHER * <u>PAINTED BLUE LINE ON</u>

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY

UPSTREAM SLOPE

- PROBLEMS NOTED** (0) NONE (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED (2) WAVE EROSION - WITH SCARPS
 (3) CRACKS WITH DISPLACEMENT (4) SINKHOLE (5) APPEARS TOO STEEP (6) DEPRESSION OR BULGES (7) SLIDES
 (8) CONCRETE FACING - HOLES CRACKS DISPLACED UNDERMINED (9) OTHER

The dam has concrete paving on the upstream slope around the entire perimeter. The concrete has moved, with open joints between slabs. Voids are visible behind slabs and some have collapsed. Wave action can pump soil out from behind the slabs over time. The slabs tend to bridge and obscure voids that form behind them. Eventually the slabs collapse. Interlocking riprap with all dimensions nearly the same (not m slabs) with proper gravel bedding is preferable.

For short term repair/stabilization of the concrete facing, we recommend performing a detailed inventory of the voids & condition behind the concrete facing. Determine how deep voids are: if less than 3-ft, we recommend filling voids with concrete or removing the slab and replacing with gravel bedding and riprap. If more than 3-ft deep, contact an engineer experienced in the design and construction of dams to assist with rehab.

Trees along the upstream shoulder of the south dam and the entire west dam. All trees & roots should be removed from the dam embankment and backfilled with compacted soil.

CONDITIONS OBSERVED: Good Acceptable Poor

CREST

- PROBLEMS NOTED** (10) NONE (11) RUTS OR PUDDLES (12) EROSION (13) CRACKS - WITH DISPLACEMENT (14) SINKHOLES
 (15) NOT WIDE ENOUGH (16) LOW AREA (17) MISALIGNMENT (18) IMPROPER SURFACE DRAINAGE (19) OTHER

Width varies, East Dam: 40'-50', South Dam: 20'-35', and West Dam (interior dike between Cell Nos. 2 & 3): ~3', m

The crest should be maintained with gravel to provide good access for emergency response, especially during wet weather. The crest should m be graded to drain toward the upstream side, m

An ~1' deep pothole was observed on the east dam near the SE corner of the facility. Backfill hole and monitor this area for other signs of distress (cracks, sinkholes, depressions, etc.)

Again the West Dam (interior dike between Cells 2 & 3) needs to be completely rehabilitated (clear trees, strip topsoil, raise and widen the m embankment with compacted fill, etc.) OR ELSE the Cell 3 South Dam needs to be maintained or part of the facility. Rehabilitating the West Dam must be done under the direction of a licensed engineer in accordance with Rule 6 of the State's Rules & Regulations for Dam Safety and Dam Construction.

The crest of the dam had 1" snow cover during the inspection, m

CONDITIONS OBSERVED: Good Acceptable Poor

DOWNSTREAM SLOPE

- PROBLEMS NOTED** (20) NONE (21) LIVESTOCK DAMAGE (22) EROSION OR GULLIES (23) CRACKS - WITH DISPLACEMENT (24) SINKHOLE
 (25) APPEARS TOO STEEP (26) DEPRESSION OR BULGES (27) SLIDE (28) SOFT AREAS (29) OTHER see below

The downstream slope of the South Dam (maximum embankment section) is terraced in some areas and the slope generally has an irregular appearance, m

Vegetation cover is poor, m

CONDITIONS OBSERVED: Good Acceptable Poor

SEEPAGE

- PROBLEMS NOTED (30) NONE (31) SATURATED EMBANKMENT AREA (32) SEEPAGE EXITS ON EMBANKMENT
- (33) SEEPAGE EXITS AT POINT SOURCE (34) SEEPAGE AREA AT TOE (35) FLOW ADJACENT TO OUTLET (36) SEEPAGE INCREASED / MUDDY
- DRAIN OUTFALLS SEEN No Yes Show location of drains on sketch and indicate (37) FLOW INCREASED / MUDDY (38) DRAIN DRY / OBSTRUCTED
- (39) OTHER see below

-We observed extensive rutting and salts from evaporation along the downstream toe of the south dam for ~300-ft east of the SW corner. This generally corresponds to an area marked as a "seepage area" in the 1991 dam safety inspection report. During the current inspection, we dug several potholes by hand and found that soils below ~6" were dry and firm throughout the rutted area. The owner reports that the area becomes wet after rains due to poor surface drainage.

-The rutted area along the toe of the south dam should be filled with compacted soil to create positive drainage away from the dam.
-Monitor for seepage and soft areas on the downstream slope of the dam and along the toe. Notify Dam Safety Engineer of any new or worsening seepage.

CONDITIONS OBSERVED: Good Acceptable Poor

OUTLET

- PROBLEMS NOTED (40) NONE (41) NO OUTLET FOUND (42) POOR OPERATING ACCESS (43) INOPERABLE
- (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET OPERATED DURING INSPECTION YES NO
- INTERIOR INSPECTED (120) NO (121) YES (48) CONDUIT DETERIORATED OR COLLAPSED (47) JOINTS DISPLACED (48) VALVE LEAKAGE
- (49) OTHER See below

-Mr. Johnson described the outlet works as consisting of two 12-inch diameter Cast Iron Pipe (CIP) outlet conduit pipelines: both penetrate the South Dam foundation, one ~100-ft west of the SE corner of the facility, and the other near the SW corner. Both pipes are controlled by downstream gate valves and so are continuously pressurized by the reservoir. The SW outlet has an intake tower with four 2' x 18" upstream slide gates, which could be used as upstream control (with considerable leakage reported); the SE outlet does not have an upstream gate.

Rule 5.9.6.2 of the State's Rules & Regulations for Dam Safety & Dam Construction requires:

- (1) all outlets connected to a pipeline have a by-pass valve to draw down the reservoir under emergency conditions in a reasonable period of time, and
- (2) outlet conduits shall have a guard gate installed at the upstream end of the conduit (this is critical as an emergency shutoff is the pipe were to fail within the dam's foundation).

-Around 1999-2000 the owner reportedly installed new downstream gate valves on both outlet pipelines. They excavated ~20 feet below the dam crest to locate the conduits (no engineering oversight was done) and it sounds as if there was some settlement of backfill materials afterwards. Also, owner reports that the outlet pipelines are not encased in concrete and are severely corroded.

PLEASE BE AWARE THAT MODIFICATIONS AND MAJOR REPAIRS TO DAMS (FOR EXAMPLE, INVOLVING EXCAVATION AND BACKFILL OF THE EMBANKMENT) REQUIRE OVERSIGHT BY A LICENSED ENGINEER WITH A MINIMUM OF 5-YEARS EXPERIENCE IN THE DESIGN & CONSTRUCTION OF DAMS AND STATE ENGINEER APPROVAL PRIOR TO CONSTRUCTION. WE HAVE PROVIDED THE OWNER WITH A COPY OF THE STATE'S RULES & REGULATIONS FOR DAM SAFETY AND DAM CONSTRUCTION.

CONDITIONS OBSERVED: Good Acceptable Poor

SPILLWAY

- PROBLEMS NOTED (50) NONE (51) NO EMERGENCY SPILLWAY FOUND (52) EROSION WITH BACKCUTTING (53) CRACK - WITH DISPLACEMENT
- (54) APPEARS TO BE STRUCTURALLY INADEQUATE (55) APPEARS TOO SMALL (56) INADEQUATE FREEBOARD (57) FLOW OBSTRUCTED
- (58) CONCRETE DETERIORATED / UNDERMINED (59) OTHER

-Cell No. 2 (currently the only cell in use) needs to have a passive overflow spillway to prevent accidental overfilling. Overfilling this reservoir could be disastrous for this dam. A spillway needs to be engineered in accordance with State Dam Safety Rules and Regulations, and should be done along with rehabilitating the West Dam.

-Until a spillway is provided, we recommend at a minimum keeping the gate on the connector pipe to Cell No. 3 open. This will limit storage to around gage height 5 ft (2 ft below the blue paint mark).

CONDITIONS OBSERVED: Good Acceptable Poor

MONITORING

- EXISTING INSTRUMENTATION FOUND (110) NONE (111) GAGE ROD (112) PIEZOMETERS (113) SEEPAGE WEIRS / FLUMES
- (114) SURVEY MONUMENTS (115) OTHER
- MONITORING OF INSTRUMENTATION (116) NO (117) YES PERIODIC INSPECTIONS BY: (118) OWNER (119) ENGINEER

-A gage rod is needed and should be tied to the existing reservoir stage-capacity table (dated 7/24/77).

-No existing instrumentation was found.

-The dam should receive a thorough visual inspection the owner at least 1x/3 months in accordance with Rule 15.2. We have mailed a hard copy example inspection report for your use.

CONDITIONS OBSERVED: Good Acceptable Poor

MAINTENANCE AND REPAIRS

PROBLEMS NOTED (60) NONE (61) ACCESS ROAD NEEDS MAINTENANCE (62) LIVESTOCK DAMAGE

(63) BRUSH ON UPSTREAM SLOPE, CREST DOWNSTREAM SLOPE, TOE (64) TREES ON UPSTREAM SLOPE, CREST DOWNSTREAM SLOPE, TOE

(65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST DOWNSTREAM SLOPE, TOE (66) DETERIORATED CONCRETE - FACING, OUTLET SPILLWAY

(67) GATE AND OPERATING MECHANISM NEED MAINTENANCE (68) OTHER See below

The dam suffers from a lack of maintenance. It appears to be in much the same condition as it was in 1991 when our office previously inspected the dam. A 5-YEAR Maintenance Plan must be submitted to the SEO to address Required Maintenance Actions including:

1. Removal all trees on the dam. Remove roots and backfill with compacted soil.
2. Inspect concrete facing on upstream slope. If voids are less than 3-ft deep into the dam embankment, fill voids with concrete. If more than 3-ft deep, contact a qualified engineer to assist. Alternatively remove concrete slabs that bridge voids and replace with riprap and bedding gravel.
3. Grade dam crest to drain surface water to the upstream slope.
4. Place compacted fill at the downstream toe for ~300-ft at the SW corner of the facility where it is currently wet and rutted. The toe should be graded to drain surface water away from the dam so that a firm foundation is maintained and to allow monitoring for seepage.
5. Provide a permanent reservoir staff gage tied to the July 24, 1977 Stage-Capacity table (currently there is only a painted blue mark on the tower showing the operational restriction level).

CONDITIONS OBSERVED: Good Acceptable Poor

Go to next page for Overall Conditions and Items Requiring Actions

OVERALL CONDITIONS

This was essentially a non-roster dam, but it was actually inspected by the State Engineer's Office in 1991 and the Inspector at that time assigned a DAMID and Recommended a Storage Restriction at GH 7-ft. However, he never entered the dam in the database or issued a Restriction Order. He never returned to the dam. The current Inspector found the dam during the 2013 inspection season and believed it to be a Non-Roster dam. Only afterward did we find a hard file with the 1991 inspection report.

According to the 1991 inspection report, the previous Public Works Director (Leonard Weiss) indicated the Ordway Town Reservoir facility was constructed in the 1930's by the WPA, and he had construction plans for the dam. Currently the SEO has no construction plans for the Ordway Town Reservoir Dam on file. PLEASE ATTEMPT TO LOCATE CONSTRUCTION PLANS FOR THE DAM AND PROVIDE THEM TO THE STATE ENGINEER'S OFFICE, IF FOUND. The State Engineer's Office maintains archives of all construction plans for dams in the State. Construction plans are extremely useful

The facility consists of three cells separated by interior dikes. Cell No. 1 is the north cell, Cell No. 2 is the Southeast, and Cell No. 3 is the Southwest. Currently ONLY Cell No. 2 is used, and so this inspection only applies to it. PRIOR TO USING CELL NO. 1 OR CELL NO. 3, THE TOWN OF ORDDWAY MUST NOTIFY THE STATE ENGINEER'S OFFICE TO SCHEDULE INSPECTIONS OF THESE FACILITIES AND DETERMINE WHAT REPAIRS ARE NEEDED.

Cell No. 2 is poorly maintained and has an irregular and deteriorated appearance. The upstream slope concrete facing is in poor condition. There are trees growing on the upstream shoulder. Because this dam has not been actively regulated by our office, we realize it may take some time to restore it to a Satisfactory level of maintenance and repairs. We have mailed hard copies of various pamphlets to the Town that discuss trees on dams, outlet conduits through embankment dams, responsible dam ownership, hiring a professional engineer, etc. We have also mailed a hard copy of a pamphlet entitled "Guide to Construction and Administration of Dams in Colorado" to explain the State Engineer's Office Dam Safety regulatory program and its Statute Authority.

Finally engineering design and plans & specifications are needed for:
-A level-control spillway with a minimum of 3-ft of freeboard to prevent accidental overfilling
-Rehabilitation of the west interior dam to provide minimum 3-ft of freeboard and adequate crest width
-A reservoir gage rod needs to be installed and tied to the 7/24/77 stage-capacity survey

An UNSATISFACTORY RATING is assigned based on the poor condition of the West berm and general poor maintenance including trees on the dam and deteriorated upstream face concrete. Water cannot be stored higher than approximately 3 feet below the South Dam crest, which roughly corresponds to the blue paint mark maintained by the Town on the SW outlet tower.

Based on this Safety Inspection and recent file review, the overall condition is determined to be:

(71) SATISFACTORY

(72) CONDITIONALLY SATISFACTORY

(73) UNSATISFACTORY

ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or dikes resulting from a failure of the dam.

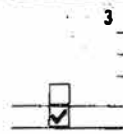
MAINTENANCE - MINOR REPAIR - MONITORING

- (80) PROVIDE ADDITIONAL RIPRAP:
 - (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE
 - (82) CLEAR TREES AND/OR BRUSH FROM: SOUTH DAM: UPSTREAM SHOULDER OF CREST, WEST DAM: ENTIRE EMBANKMENT
 - (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES:
 - (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE:
 - (85) PROVIDE SURFACE DRAINAGE FOR: Place compacted fill along the soft, rutted portion of the downstream toe, South Dam, in order to create positive drainage away from the dam
 - (86) MONITOR: Perform thorough dam inspection at least 1x/3 months (we have mailed an example inspection Form for your use), monitor for seepage, monitor around pothole in east dam, monitor for signs of distress along both outlet pipe alignments (holes, leaks, etc.)
 - (87) DEVELOP AND SUBMIT AN EMERGENCY ACTION PLAN:
 - (88) OTHER See Maintenance and Repairs section of this report (item 2) to address failed concrete facing on the upstream slope
 - (89) OTHER SUBMIT A 5 YEAR MAINTENANCE PLAN TO ADDRESS THE ABOVE REQUIREMENTS
- ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO: (Plans and Specifications must be approved by State Engineer prior to construction.)
- (90) PREPARE PLANS AND SPECIFICATIONS FOR REHABILITATION OF THE DAM: Level control overflow spillway to provide min. 3-ft freeboard. ALSO, complete rehabilitation of the Cell No. 2 west dam (interior dike b/w Cells 2 & 3) OR ELSE maintain Cell No. 3 as part of the facility.
 - (91) PREPARE AS-BUILT DRAWINGS OF: In 1990 Mr. Weiss had reported the Town has construction drawings for the facility. PLEASE LOCATE CONSTRUCTION PLANS AND SUBMIT A COPY TO OUR OFFICE FOR OFFICIAL ARCHIVES.
 - (92) PERFORM A GEOTECHNICAL INVESTIGATION TO EVALUATE THE STABILITY OF THE DAM:
 - (93) PERFORM A HYDROLOGIC STUDY TO DETERMINE REQUIRED SPILLWAY SIZE:
 - (94) PREPARE PLANS AND SPECIFICATIONS FOR AN ADEQUATE SPILLWAY: level control spillway
 - (95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS:
 - (96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET:
 - (97) OTHER: Submit a 5-YEAR plan to rehab outlet conduits to provide industry std. design for pressure pipes thru an embankment dam (encasement/carrier pipe, upstream guard gate, sand filter) & a blow-off valve for reservoir drawdown during an emergency.
 - (98) OTHER:
 - (99) OTHER:

SAFE STORAGE LEVEL: RECOMMENDED AS A RESULT OF THIS INSPECTION

- (101) FULL STORAGE
- (102) CONDITIONAL FULL STORAGE
- (103) RECOMMENDED RESTRICTION
- (104) CONTINUE EXISTING RESTRICTION

RESTRICTED LEVEL
OFFICIAL ORDER TO FOLLOW



3
 FT. BELOW DAM CREST
 FT. BELOW SPILLWAY CREST
 FT. GAGE HEIGHT
 NO STORAGE-MAINTAIN OUTLET FULLY OPEN
 corresponds to blue paint mark on outlet tower

REASON FOR RESTRICTION

The dam does not have an overflow spillway, therefore it has historically had an operational restriction at ~3-ft below the South Dam crest. The Town maintains a blue paint mark. We are formalizing the restriction so it is documented in SEO files.

ACTIONS REQUIRED FOR ~~CONDITIONAL FULL STORAGE~~ OR CONTINUED STORAGE AT THE RESTRICTED LEVEL:

See Required Actions above.

Engineer's
Signature

INSPECTED BY

Owner's
Signature

OWNER/OWNER'S REPRESENTATIVE

DATE:

1 / 1

2/4/14

GUIDELINES FOR DETERMINING CONDITIONS**CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, OUTLET, SPILLWAY****GOOD**

In general, this part of the structure has a near new appearance, and conditions observed in this area do not appear to threaten the safety of the dam.

ACCEPTABLE

Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.

POOR

Conditions observed in this area appear to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE**GOOD**

No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.

ACCEPTABLE

Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in seepage. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.

POOR

Seepage conditions observed appear to threaten the safety of the dam. Examples:
1) Designed drain or seepage flows have increased without increase in reservoir level.
2) Drain or seepage flows contain sediment, i.e., muddy water or particles in jar samples.
3) Widespread seepage, concentrated seepage, or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MONITORING**GOOD**

Monitoring includes movement surveys and leakage measurements for all dams, and piezometer readings for High hazard dams. Instrumentation is in reliable, working condition. A plan for monitoring the instrumentation and analyzing results by the owner's engineer is in effect. Periodic inspections by owner's engineer.

ACCEPTABLE

Monitoring includes movement surveys and leakage measurements for High and Significant hazard dams; leakage measurements for Low hazard dams. Instrumentation is in serviceable condition. A plan for monitoring instrumentation is in effect by owner. Periodic inspections by owner or representative. OR, NO MONITORING REQUIRED.

POOR

All instrumentation and monitoring described under "ACCEPTABLE" here for each class of dam, are not provided, or required periodic readings are not being made, or unexplained changes in readings are not reacted to by the owner.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR**GOOD**

Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.

ACCEPTABLE

Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.

POOR

Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam.

OVERALL CONDITIONS**SATISFACTORY**

The safety inspection indicates no conditions that appear to threaten the safety of the dam, and the dam is expected to perform satisfactorily under all design loading conditions. Most of the required monitoring is being performed.

CONDITIONALLY SATISFACTORY

The safety inspection indicates symptoms of structural distress (seepage, evidence of minor displacements, etc.), which, if conditions worsen, could lead to the failure of the dam. Essential monitoring, inspection, and maintenance must be performed as a requirement for continued full storage in the reservoir.

UNSATISFACTORY

The safety inspection indicates definite signs of structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if the reservoir is used to full capacity. The dam is judged unsafe for full storage of water.

SAFE STORAGE LEVEL**FULL STORAGE**

Dam may be used to full capacity with no conditions attached.

CONDITIONAL FULL STORAGE

Dam may be used to full storage if certain monitoring, maintenance, or operational conditions are met.

RESTRICTION

Dam may not be used to full capacity, but must be operated at some reduced level in the interest of public safety.

HAZARD CLASSIFICATION OF DAMS**High hazard**

Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.

Significant hazard

Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of human life is expected.

Low hazard

Loss of human life is not expected, and damage to improved property is expected to be small, in the event of failure of the dam while the reservoir is at high water line.

NPH hazard - No loss of life or damage to improved property, or loss of downstream resource is expected in the event of failure of the dam while the reservoir is at the high water line.

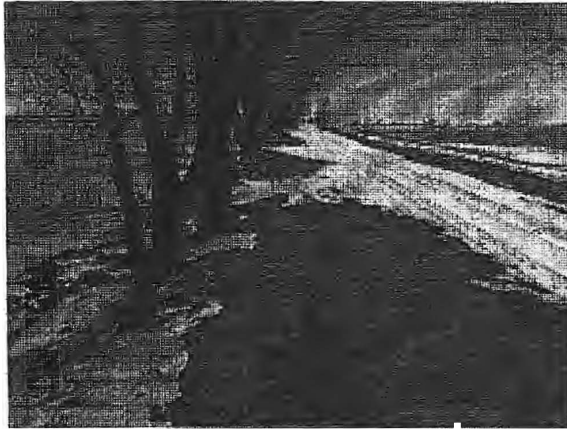


Photo 1- Dam crest and trees on upstream shoulder, looking left across the south dam of Ordway Town Res. Cell No. 2.

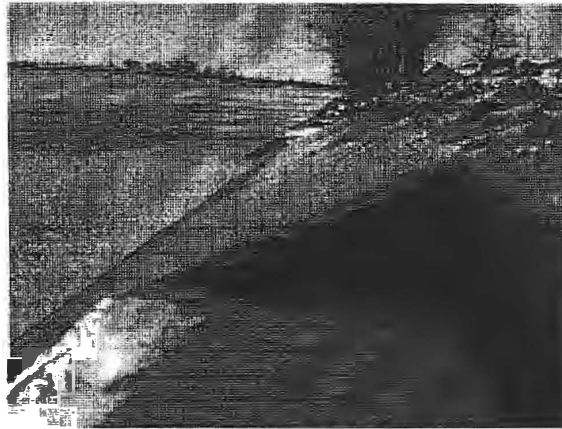


Photo 2 – Upstream slope with typical collapsed concrete slab facing (foreground).

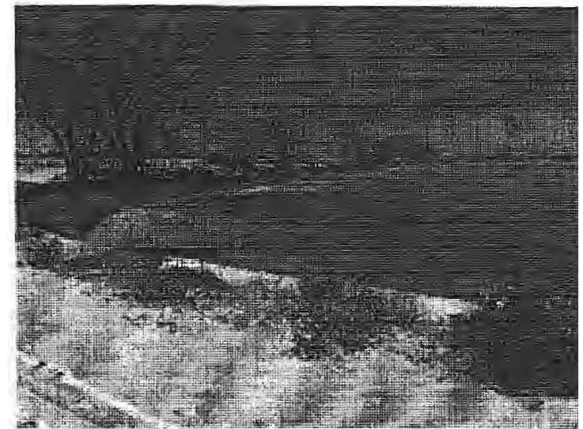


Photo 3 – View of the reservoir and upstream slope of the south dam, looking right from the east dam.



Photo 4 – Downstream slope of the south dam, looking right from the SE corner of the facility. Valve box in the foreground (red arrow) is reportedly for one of two 12” CIP outlet pipelines (other is near the SW corner).



Photo 5 – Downstream slope of the south dam looking left (east). Slope is terraced.



Photo 6 – Downstream slope of south dam looking right near SW corner of the facility.



Photo 7- Rutted area along the downstream toe of the south dam near the SW corner of the facility. Potholes with shovel revealed that soil below the top 6 inches was dry and firm.

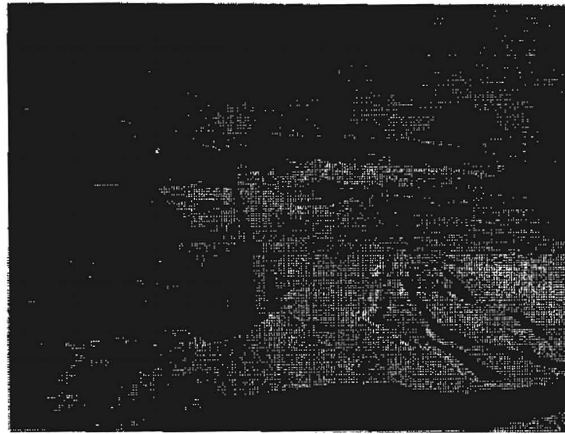


Photo 8- SW corner of the facility. Red arrow points to the valve box for the 2nd of 2 12" outlet pipelines.



Photo 9 - Concrete vault located several hundred feet downstream of the dam at SW corner. Reportedly both 12" CIP pipelines join here and pipeline continues to Town.



Photo 10 - Looking from the west dam (interior dike between Cells 2 & 3) across reservoir at south dam. Red arrow shows the outlet tower for the SW 12" outlet pipeline.



Photo 11 - Connector pipe between Cell 2 (photo left) and Cell 3 (photo right).



Photo 12 - Concrete slab facing on the upstream slope of the west dam (interior dike between Cells 2 & 3). Note overgrown trees on west dam (photo left).

ORDWAY TOWN RES. CELL NO. 2 DAM (DAMID 170235) LEVEL SURVEY

Date:	29-Jan-14				
BY:	MAP (level), G. Johnson (rod)				
Survey In Assumed Datum:					
PT	BS	HI	FS	Elev.	Notes
1				100.00	downstream toe of embankment, near max. embankment section ~200-ft left of SW corner of Cell No. 2
S1	15.27	115.27			
2			0.82	114.45	Dam crest
3			15.10	100.17	downstream toe 2
4			15.22	100.05	downstream toe 3
5, TP			0.54	114.73	dam crest 2
S2	3.80	118.53			
6			10.25	108.28	WSEL during inspection (ice)
7			7.05	111.48	blue paint mark on concrete outlet tower (reportedly GH 7-ft), SW corner of Cell No. 2
8, TP			3.69	114.84	Top of concrete outlet tower
S3	3.83	118.67			
9			9.20	109.47	INV IN, west embankment connector pipe between Cell No. 2 and Cell No. 3
10			6.10	112.57	West embankment dam crest, interior dam between Cell No. 2 and Cell No. 3
Downstream Channel Slope = $(10'/1700') * 100\% = 0.6\%$ (from USGS topo map)					
Approximate D/S slope of dam = 2.5H:1V					
Crest Width = 29-ft (varies, South Dam = 20'-35', East Dam=40'-50', West Dam = 3')					
Approx. U/S slope of dam = 2.5H:1V					
Embankment Height (at Centerline) = $114.73 - 100 - (14.7 * 2.5 + 15) * 0.006 = 14.4$ ft					
Freeboard = 0 ft (no spillway)					
Jurisdictional Height, Hd = Unknown depth to excavated outlet pipeline through dam foundation. Use Hd=19-ft, which is height from 1991 inspection report and matches closely to owner's report that they excavated ~20-ft below dam crest to locate the pipeline for valve repairs. Would put pipe invert ~4.6 ft below original ground.					
Embankment Height at U/S toe (Hb) = $114.73 - 100 - (14.7 * 2.5 + 29 + 14.4 * 2.5) * 0.006 = 14.1$ ft					
Alternatively, using the 7/24/77 stage-capacity survey by Wallace Doe, P.E.: Hb = 10.8 ft (Maximum Safe Storage, height above zero storage) + 3.25 ft (surveyed freeboard above blue paint mark; assume blue paint mark corresponds to 1977 "max safe storage") = 14.1 ft, agrees.					
Height of water at U/S Toe (Hw) = 14.1 ft (no spillway, 0' FB)					
Surface Area at Operational Restricted Level = 18.4 AC (from 7/24/77 capacity table at "Max Safe Level, 10.8' above zero storage)					
Operational Restricted Storage Capacity = 160.52 AF (ref: 7/24/77 capacity table at "Max Safe Level, 10.8' above zero storage)					
Normal (no spillway)/Maximum Storage Capacity = ~160.52 + (18.4 AC * 3.24 ft Operational FB) = 220 AF					

Engineers with Experience in Design & Construction of Dams in Colorado

Contact	Business Name	Business Street	Business City	Business State	Business ZIP	Business Phone	Email
Mike Applegate	Applegate	1490 W 121st Ave, Ste 100	Westminster	CO	80234	(303) 452-6611	mikeapplegate@applegategroup.com
Colby Hayden	Deere & Ault	600 S Airport Rd	Longmont	CO	80503	(303) 651-1468	colby.hayden@deereault.com
John Gauthiere	Gauthiere Engineering	2157 Buena Vista Dr	Greeley	CO	80634	(970) 330-0855	john@gauthiere-engineering.com
Chad Masching	GEI	4601 DTC Blvd	Denver	CO	80403	(303) 264-1088	cmasching@geiconsultants.com
Rod Eisenbraun	Kleinfelder	611 Corporate Cir, Ste C	Golden	CO	80401	(303) 953-6906	REisenbraun@kleinfelder.com
Terry Arnold	MWH	1801 California St, Ste 2900	Denver	CO	80127	(303) 291-2230	Terrence.E.Arnold@mwhglobal.com
Duane Smith	Smith Geotech	1225 Red Cedar Circle, Suite H	Fort Collins	CO	80524	(970) 217-8540	dsmith@smithgeotech.com
Tara Schutter	Tessara Water	13101 Cavanaugh Rd	Hudson	CO	80642	(303) 990-5128	tara@tessarawater.com
Dan Johnson	Tetra Tech	350 Indiana St, Ste 500	Golden	CO	80401	(303) 217-5700	Dan.Johnson@tetratech.com
Ed Toms	URS	8181 East Tufts Ave	Denver	CO	80237	(303) 740-3949	ed.toms@urs.com
Greg Monley	Kumar & Associates	2390 South Lipan St	Denver	CO	80223	303-742-9700	gmonley@kumarusa.com
Robert Huzjak	RJH Consultants, Inc.		Englewood	CO		719-250-7533	rhuzjak@rjh-consultants.com
Chris Manera	Colorado River Engineering		Rifle	CO		970-625-4933	
James Norfleet	JN Engineering		Montrose	CO		970-249-7879	
George Sabol	Stantec Consultants		Denver	CO		505-334-1184	gsabol@stantec.com
Steve Jamison	W.W. Wheeler	3700 S. Inca St.	Englewood	CO	80465	(303) 761-4130	steve.jamison@wwwheeler.com

NOTE: This list is provided as a service to dam owners. It is not meant to endorse any engineer nor is it intended to exclude other engineers who meet the experience requirements of Rule 4.2.9 of the State's Rules & Regulations for Dam Safety and Dam Construction.

ENGINEER'S INSPECTION REPORT

INSPECTOR: MP3

OFFICE OF THE STATE ENGINEER - DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH

1313 SHERMAN STREET, ROOM 818, DENVER, CO 80203, (303) 866-3581

DAM NAME: ORDWAY TOWN RES. CELL NO. 2	T: 210S R: 0570W S: 2	COUNTY: CROWLEY	DATE OF INSPECTION: 5/8/2020
DAM ID: 170235 YRComp: 1935	DAM HEIGHT(FT): 19.0	SPILLWAY WIDTH(FT):	PREVIOUS INSPECTION: 7/21/2017
CLASS: Low hazard	DAM LENGTH(FT): 2880.0	SPILLWAY CAPACITY(CFS): 0.0	NORMAL STORAGE (AF): 220.0
DIV: 2 WD: 17	CRESTWIDTH(FT): 29.0	FREEBOARD (FT):	SURFACE AREA(AC): 18.0
EAP: Not Required	CRESTELEV(FT): 4398.0	DRAINAGE AREA (AC): 18.0	OUTLET INSPECTED:

CURRENT RESTRICTION: 3-FT BELOW THE SOUTH DAM CREST

OWNER: LYNN CHUBBUCK	OWNER REP.: LYNN CHUBBUCK
ADDRESS: TOWN OF ORDWAY	CONTACT NAME: GEORGE JOHNSON
ORDWAY CO 81063	CONTACT PHONE: (719) 267-3134X

INSPECTION PARTY: MARK PERRY
 REPRESENTING: Colorado Dam Safety Branch

FIELD CONDITIONS OBSERVED	WATER LEVEL: BELOW DAM CREST <u>~4</u> FT. Below Spillway FT.	GAGE ROD READING: None
	GROUND MOISTURE CONDITION: <input checked="" type="checkbox"/> DRY <input type="checkbox"/> WET <input type="checkbox"/> SNOWCOVER	OTHER: See below*

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY

UPSTREAM SLOPE

- PROBLEMS NOTED: (0) NONE (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED (2) WAVE EROSION - WITH SCARPS
 (3) CRACKS WITH DISPLACEMENT (4) SINKHOLE (5) APPEARS TOO STEEP (8) DEPRESSIONS OR BULGES (7) SLIDES
 (8) CONCRETE FACING - HOLES, CRACKS, DISPLACED, UNDERMINED (9) OTHER

This inspection was performed while in the area for other work, as a cursory annual inspection in accordance with State Dam Safety policy for restricted dams. The purpose of the inspection was to verify that the SEO Storage Restriction is being observed and that conditions have not further deteriorated. As such it was confirmed that the reservoir was found in compliance with the Storage Restriction (*reservoir stage ~1-ft below blue line on the outlet tower, which marks the restricted level) and the original conditions that lead to the storage restriction are generally unchanged since the previous inspection.

Upstream Slope: (8) Concrete facing conditions are Poor, but have not noticeably worsened since the 2014 SEO inspection (ref: 1/29/2014 SEO Inspection Report for details).

CONDITIONS OBSERVED: Good Acceptable **Poor**

CREST

- PROBLEMS NOTED: (10) NONE (11) RUTS OR PUDDLES (12) EROSION (13) CRACKS - WITH DISPLACEMENT (14) SINKHOLES
 (15) NOT WIDE ENOUGH (18) LOW AREA (17) MISALIGNMENT (18) IMPROPER SURFACE DRAINAGE (19) OTHER

(11) dam crest is rutted due to poor drainage. This is undesirable for a dam because rutting allows ponded water to infiltrate the dam embankment and lead to various structural problems with the dam (cracking, shrink-swell, slope instability, etc)

(15) & (16) west dam only

CONDITIONS OBSERVED: Good **Acceptable** **Poor**

DOWNSTREAM SLOPE

- PROBLEMS NOTED: (20) NONE (21) LIVESTOCK DAMAGE (22) EROSION OR GULLIES (23) CRACKS - WITH DISPLACEMENT (24) SINKHOLE
 (25) APPEARS TOO STEEP (26) DEPRESSIONS OR BULGES (27) SLIDE (28) SOFT AREAS (29) OTHER

Slope is generally irregular in appearance and has poor vegetative cover.

CONDITIONS OBSERVED: Good **Acceptable** **Poor**

SEEPAGE

- PROBLEMS NOTED: (30) NONE (31) SATURATED EMBANKMENT AREA (32) SEEPAGE EXITS ON EMBANKMENT
 (33) SEEPAGE EXITS AT POINT SOURCE (34) SEEPAGE AREA AT TOE (35) FLOW ADJACENT TO OUTLET (36) SEEPAGE INCREASED / MUDDY
DRAIN OUTFALLS SEEN No Yes Show location of drains on sketch and indicate amount and quality of discharge. (37) FLOW INCREASED / MUDDY (38) DRAIN DRY / OBSTRUCTED
 (39) OTHER

(34) The toe was found dry at this low reservoir stage, and possibly related to dry conditions this spring. Past inspections at higher reservoir stages have noted wet and muddy conditions along the downstream toe of the main dam. We have previously noted that the toe should be regraded in order to create positive drainage away from the toe.

CONDITIONS OBSERVED: Good **Acceptable** **Poor**

OUTLET

- PROBLEMS NOTED: (40) NONE (41) NO OUTLET FOUND (42) POOR OPERATING ACCESS (43) INOPERABLE
 (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET OPERATED DURING INSPECTION YES NO
INTERIOR INSPECTED (120) NO (121) YES (46) CONDUIT DETERIORATED OR COLLAPSED (47) JOINTS DISPLACED (48) VALVE LEAKAGE
 (49) OTHER pressurized conduits through embankment

- PRESSURIZED CONDUITS (2 x 12" DIA. CIPs) THROUGH EMBANKMENT
- NO UPSTREAM GUARD GATE ON SOUTHEAST OUTLET
- NO BLOWOFF VALVES FOR EMERGENCY DRAWDOWN

SEE 2014 INSPECTION REPORT FOR MORE DETAILS

CONDITIONS OBSERVED: Good Acceptable Poor

SPILLWAY

- PROBLEMS NOTED: (50) NONE (51) NO EMERGENCY SPILLWAY FOUND (52) EROSION WITH BACKCUTTING (53) CRACK - WITH DISPLACEMENT
 (54) APPEARS TO BE STRUCTURALLY INADEQUATE (55) APPEARS TOO SMALL (56) INADEQUATE FREEBOARD (57) FLOW OBSTRUCTED
 (58) CONCRETE DETERIORATED / UNDERMINED (59) OTHER see below

(51) Cell No. 2 (currently the only cell in use) needs to have a passive overflow spillway to prevent accidental overfilling. Overfilling this reservoir could be disastrous for this dam. A spillway needs to be engineered in accordance with State Dam Safety Rules and Regulations, and should be done along with rehabilitating the West Dam.
- Until a spillway is provided, we recommend at a minimum keeping the gate on the connector pipe to Cell No. 3 open. This will limit storage to around gage height 5 ft (2 ft below the blue paint mark).

CONDITIONS OBSERVED: Good Acceptable Poor

MONITORING

- EXISTING INSTRUMENTATION FOUND (110) NONE (111) GAGE ROD (112) PIEZOMETERS (113) SEEPAGE WEIRS / FLUMES
 (114) SURVEY MONUMENTS (115) OTHER
MONITORING OF INSTRUMENTATION (116) NO (117) YES PERIODIC INSPECTIONS BY: (118) OWNER (119) ENGINEER

- A gage rod is needed and should be tied to the existing reservoir stage-capacity table (dated 7/24/77).
- No existing instrumentation was found
- The dam should receive a thorough visual inspection BY THE OWNER at least 1x/3 months in accordance with Rule 15.2, 2-CCR 402-1. We previously provided a hard copy example inspection report for Town staff to use.

CONDITIONS OBSERVED: Good Acceptable Poor

MAINTENANCE AND REPAIRS

- PROBLEMS NOTED: (60) NONE (81) ACCESS ROAD NEEDS MAINTENANCE (62) LIVESTOCK DAMAGE
 (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE
 (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE (66) DETERIORATED CONCRETE - FACING, OUTLET SPILLWAY
 (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE (68) OTHER

SEE 2018 REPORT FOR A LIST OF REQUIRED MAINTENANCE ITEMS. OUR UNDERSTANDING IS THE OWNER'S ENGINEER (GMS Inc.) HAS PREPARED A REHABILITATION PLAN FOR THIS DAM (CELL NO. 2) THAT ADDRESSES ALL DEFICIENCIES; HOWEVER, THEY ARE ALSO LOOKING INTO THE ALTERNATIVE OF ABANDONING CELL NO. 2 AND REHABILITATING THE CELL NO. 1 DAM INSTEAD (last updated in 2017).

CONDITIONS OBSERVED: Good Acceptable Poor

Go to next page for Overall Conditions and Items Requiring Actions

OVERALL CONDITIONS

An UNSATISFACTORY RATING is assigned based on the poor condition of the West berm, general poor maintenance including trees on the main (South) dam, deteriorated upstream face concrete, and lack of a spillway. Water may not be stored higher than approximately 3 feet below the South Dam crest, which roughly corresponds to the blue paint mark maintained by the Town on the southwest outlet tower.

See 2014 SEO inspection report for more details and history on the dam.

PROGRESS ON COMPLIANCE (updated 2017):

- GMS prepared a rehabilitation plan and costs for the Cell No. 2 Dam. The Town has asked for Colorado Dam Safety requirements for rehabilitating Cell No. 1 as an alternative and then will decide how they want to proceed. Cell No. 1 is not currently used and there is no performance history on it; however, Colorado Dam Safety provided general rehabilitation requirements to GMS by phone and will follow-up by e-mail.

HAZARD CLASSIFICATION: Based on visual inspection Low Hazard classification is appropriate. No change is warranted at this time.

Based on this Safety Inspection and recent file review, the overall condition is determined to be:

(71) SATISFACTORY

(72) CONDITIONALLY SATISFACTORY

(73) UNSATISFACTORY

ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE - ORDINARY REPAIR - MONITORING

CLEAR TREES AND/OR BRUSH FROM

5/8/2020 - 5/8/2021 remove trees & roots from the dam; backfill with compacted clay soil

GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE

5/8/2020 - 5/8/2021a surface dam crest with aggregate and slope to drain toward the upstream slope

MONITOR

5/8/2020 - inspect the dam at least 1x/3 months pursuant to 2020 State Dam Safety Rule 13

ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO

PREPARE PLANS AND SPECIFICATIONS FOR REHABILITATION OF THE DAM

5/8/2020 - level control spillway (to prevent overfilling), rehab outlet conduits based on industry standards for pressurized conduits through an embankment dam, and rehab the dam's upstream slope

The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.

SAFE STORAGE LEVEL: RECOMMENDED AS A RESULT OF THIS INSPECTION

(101) FULL STORAGE

(102) CONDITIONAL FULL STORAGE

(103) RECOMMENDED RESTRICTION

(104) CONTINUE EXISTING RESTRICTION



3 FT. BELOW DAM CREST
FT. BELOW SPILLWAY CREST
FT. GAGE HEIGHT
NO STORAGE-MAINTAIN OUTLET FULLY OPEN

REASON FOR RESTRICTION

The dam has numerous structural and maintenance deficiencies, detailed in this report.

ACTIONS REQUIRED FOR CONDITIONAL FULL STORAGE OR CONTINUED STORAGE AT THE RESTRICTED LEVEL:

See **REQUIRED ACTIONS** above.

Engineer's
Signature

INSPECTED BY

Owner's
Signature

OWNER/OWNER'S REPRESENTATIVE

DATE: / /

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, OUTLET, SPILLWAY

<p>GOOD In general, this part of the structure has a near new appearance, and conditions observed in this area do not appear to threaten the safety of the dam.</p>	<p>ACCEPTABLE Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.</p>	<p>POOR Conditions observed in this area appear to threaten the safety of the dam.</p>
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CONDITIONS OBSERVED - APPLIES TO SEEPAGE

<p>GOOD No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.</p>	<p>ACCEPTABLE Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in seepage. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.</p>	<p>POOR Seepage conditions observed appear to threaten the safety of the dam. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment, i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage, or ponding appears to threaten the safety of the dam.</p>
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CONDITIONS OBSERVED - APPLIES TO MONITORING

<p>GOOD Monitoring includes movement surveys and leakage measurements for all dams, and piezometer readings for High hazard dams. Instrumentation is in reliable, working condition. A plan for monitoring the instrumentation and analyzing results by the owner's engineer is in effect. Periodic inspections by owner's engineer.</p>	<p>ACCEPTABLE Monitoring includes movement surveys and leakage measurements for High and Significant hazard dams; leakage measurements for Low hazard dams. Instrumentation is in serviceable condition. A plan for monitoring instrumentation is in effect by owner. Periodic inspections by owner or representative. OR, NO MONITORING REQUIRED.</p>	<p>POOR All instrumentation and monitoring described under "ACCEPTABLE" here for each class of dam, are not provided, or required periodic readings are not being made, or unexplained changes in readings are not reacted to by the owner.</p>
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CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

<p>GOOD Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.</p>	<p>ACCEPTABLE Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.</p>	<p>POOR Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam.</p>
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OVERALL CONDITIONS

<p>SATISFACTORY The safety inspection indicates no conditions that appear to threaten the safety of the dam, and the dam is expected to perform satisfactorily under all design loading conditions. Most of the required monitoring is being performed.</p>	<p>CONDITIONALLY SATISFACTORY The safety inspection indicates symptoms of structural distress (seepage, evidence of minor displacements, etc.), which, if conditions worsen, could lead to the failure of the dam. Essential monitoring, inspection, and maintenance must be performed as a requirement for continued full storage in the reservoir.</p>	<p>UNSATISFACTORY The safety inspection indicates definite signs of structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if the reservoir is used to full capacity. The dam is judged unsafe for full storage of water.</p>
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SAFE STORAGE LEVEL

<p>FULL STORAGE Dam may be used to full capacity with no conditions attached.</p>	<p>CONDITIONAL FULL STORAGE Dam may be used to full storage if certain monitoring, maintenance, or operational conditions are met.</p>	<p>RESTRICTION Dam may not be used to full capacity, but must be operated at some reduced level in the interest of public safety.</p>
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HAZARD CLASSIFICATION OF DAMS

<p>High hazard Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.</p>	<p>Significant hazard Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of human life is expected.</p>	<p>Low hazard Loss of human life is not expected, and damage to improved property is expected to be small, in the event of failure of the dam while the reservoir is at high water line.</p>
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NPH hazard - No loss of life or damage to improved property, or loss of downstream resource is expected in the event of failure of the dam while the reservoir is at the high water line.





