HORSESHOE IRRIGATION COMPANY

WATER MANAGEMENT AND CONSERVATION PLAN

FEBRUARY 2008

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SECTION I - DESCRIPTION OF THE DISTRICT

History

Spring City was settled in the late 1800's. The early residents constructed extensive ditch systems to divert and distribute water from Oak and Canal Creeks to flood irrigate established farm land. In 1934, Horseshoe Irrigation Company (Company) was created as a non-profit corporation to manage the established water-rights.

The Company was and remains a diversion company with very limited storage capacity; the unlined ditch distribution system was used exclusively up until the 1960's when several ditches were lined with concrete to enhance distribution and eliminate seepage.

Between 1934 and 1939, in cooperation with the U.S. Bureau of Reclamation, a trans-mountain water project was completed bringing additional water from the head of Black Canyon to flow into Oak Creek. This water is collected through constructed feeder canals and distributed through a constructed 1-mile tunnel. One of the purposes of this trans-mountain water was to create an approximately 400 acre-feet storage reservoir, called the Freeman Allred project, to allow for the retention of high spring run-off water to be used in the later summer months. Due to lack of funding, this storage facility was never constructed and the storage right has lapsed.

The Company's filed right for this trans-mountain water is 96 cubic feet per second (cfs) from April 1st to October 31st. Due to the lack of construction of the Freeman Allred project, in 1970 a contract was executed between the United States, Emery Water Conservation District, and the Company to restrict the flow through the tunnel to 27 cfs of water but to allow flow through the tunnel year round. A weir and restriction plate was installed at the tunnel inlet to restrict the flow year round to 27 cfs of water. This contract is renewable every 5 years.

In conjunction with this project, a feeder canal was also constructed at the head of Reeder Canyon to allow for an additional 25 cfs of water to flow into Canal Creek to be used during the water year.

Through assistance from the State of Utah's Division of Water Resource office, from 1976 to 1982 the Company installed 8 gravity feed pressure irrigation systems consisting of approximately 85 miles of underground PVC piping fed from 9 regulating ponds that are filled from diversion structures out of the Oak and Canal Creeks.

The Company is managed by a Board of seven Directors, one of which is appointed by the Board as President and one as Vice President. The Company also appoints annually a Secretary, a Treasurer, and a water-master for the proper operation and management of the Company.

The Company currently has 15,217 Class A water shares issued, which are the primary water-right, and an additional 7,515 Class B water shares issued, which constitute a secondary or high water-right.

Table 1-1
Open Contracts with the State of Utah

System	Loan Amount*	Payment	Balance**	Payoff Date
South Fields	$302,226	$11,357	$22,714	Dec 2008
N/F & Last Chance	$505,750	$18,131	$54,393	Dec 2009
Chimney	$374,266	$11,842	$71,050	Dec 2012
City	$366,001	$17,960	$153,142	March 2017

* All loans are non-interest bearing except the city loan which is a 3% annual interest bearing loan.
** As of May 2007

Location

Spring City is located in the central region of the state of Utah in the northern portion of Sanpete County. Elevation of irrigated lands in the district range from 5,500 to 6,200 feet. The project location is shown on the map on the following page.

Table 1-2
Size of the District

Municipal and Farm Land	Size (sq. miles)	Population Served	Irrigated Acres
Size in 1975	~ 8.2	~ 785	~ 5,800
Size in 1990	~ 8.2	~ 1,100	~ 5,550
Size in 2006	~ 8.2	~ 1,300	~ 5,820

Topography

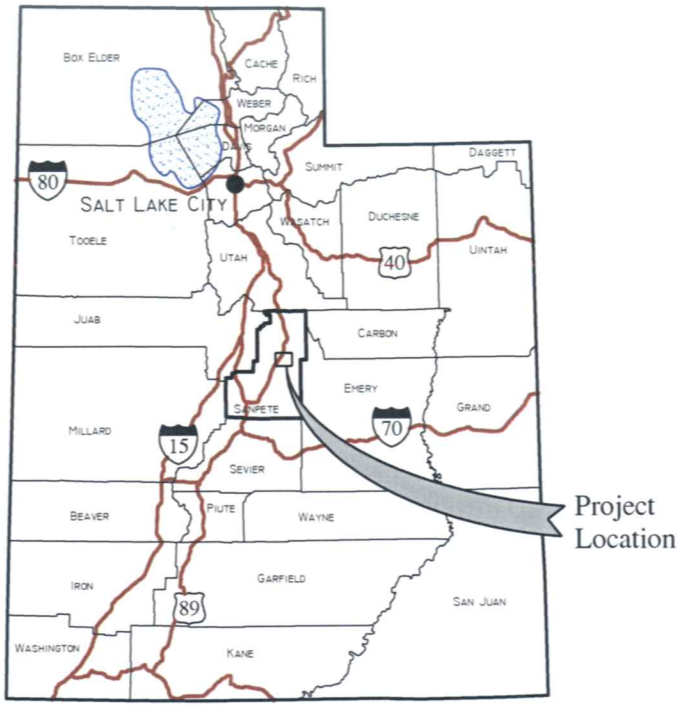
The general lay of irrigated land within the Company is flat to a moderate slope, between 3 and 5 percent, which has made it possible for the installation of gravity feed sprinkler systems.

Soils

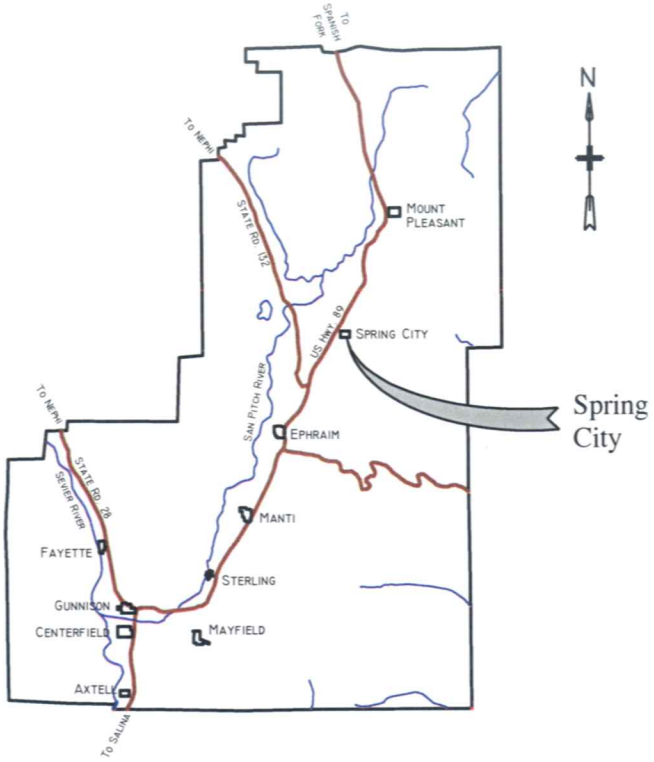
A detail of the soil types found within the Company's boundaries are listed in Appendix 2. This data was received from the NRCS office in Manti, Utah.

Table 1-3
Historical Irrigation Practices

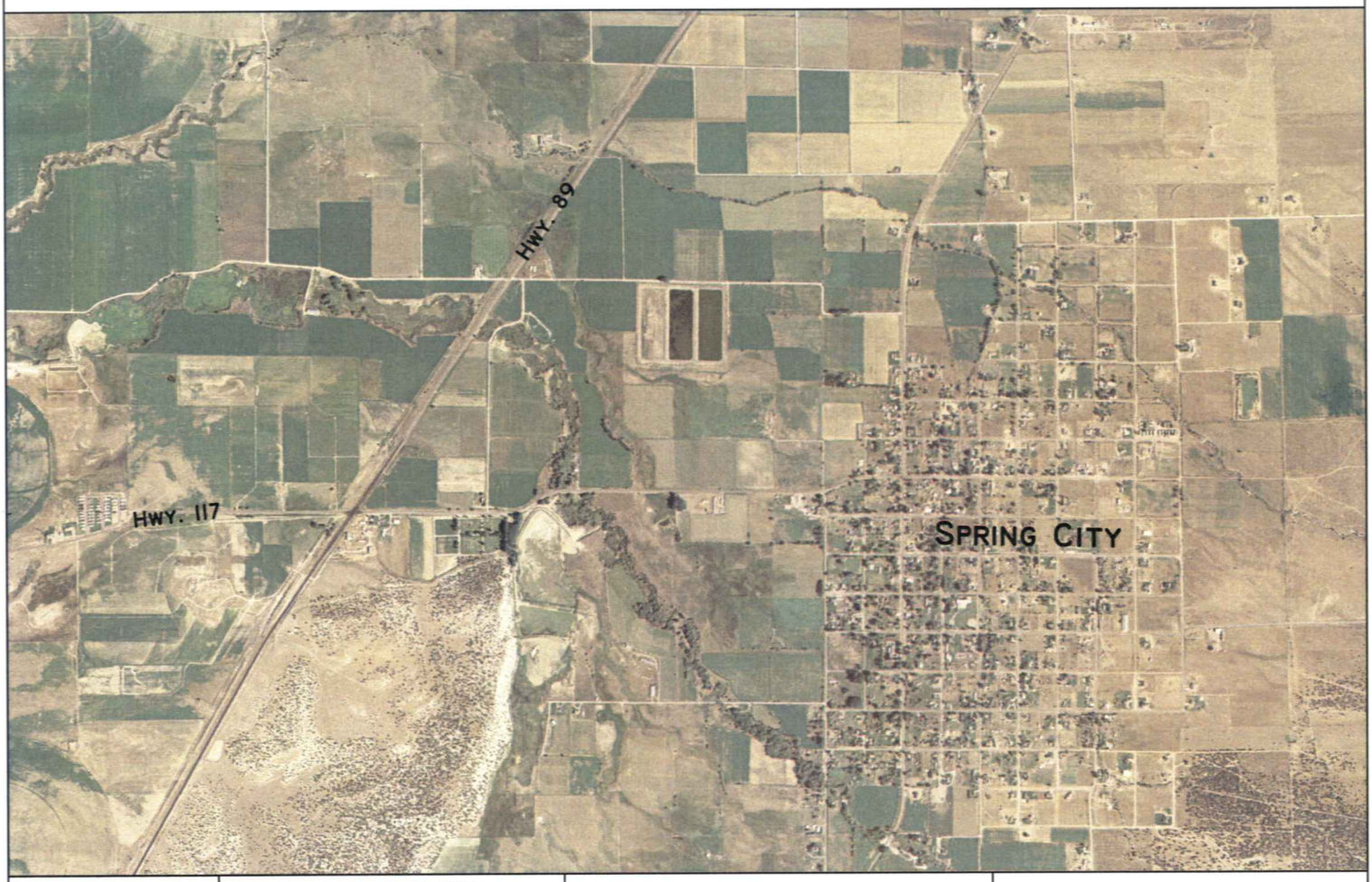
Irrigation Method	1975 Acres	1985 Acres	2006 Acres
Flood irrigated	~ 5,800	~ 1,500	~ 1,140
Pressure sprinkler system, agricultural	0	~ 3,570	~ 4,240
Pressure sprinkler system, municipal	0	~ 360	~ 440
Totals	~ 5,800	~ 5,430	~ 5,820



UTAH



SANPETE COUNTY



FRANSON CIVIL ENGINEERS

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SCALE:	1" = 200'

Fig-Location Map.dwg
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LAYOUT: Location Maps

HORSESHOE IRRIGATION COMPANY

WATER MANAGEMENT AND CONSERVATION PLAN

SPRING CITY AREA LOCATION MAP

Climate

Land served by the Company is relatively high in elevation, ranging from 5,500 to 6,200 feet above sea level, the climate is temperate, and the frost-free season is short, averaging about 125 days.

Table 1-4
Typical Climate Parameters

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Avg. precip. inch	0.94	1.05	1.23	1.14	1.14	0.69	0.69	0.81	1.07	1.12	0.98	0.99	11.84
Avg. min temp F	13.8	18.8	25.4	31.9	39.3	46.8	54.0	52.4	43.8	33.8	23.9	15.2	33.2
Avg. max temp F	36.0	41.3	50.4	59.1	70.0	81.3	89.6	87.2	77.7	65.4	48.8	37.5	62.0
Top of mountain avg. precip. inch	2.68	2.86	2.40	2.33	1.82	1.20	1.35	1.53	1.93	2.09	2.64	2.31	25.14

Storage Facilities

Currently the Company utilizes 9 small regulating ponds for feeding the pressure irrigation systems. These ponds range in storage capacity from 5 to 20 acre-feet of water.

District Diversion Points

As established in the Cox Decree, the Company has 17 legal points of diversion. Currently, the Company normally uses the following diversions for the distribution of water from Oak and Canal Creeks:

Oak Creek Diversions

A main concrete diversion structure and weir at the head of Oak Creek for diverting water into a pipeline that runs to the city hydroelectric plant. This weir can also be used to measure the amount of water flowing from Oak Creek.

A concrete divider that splits the water from Oak Creek into the main creek, that runs to several diversion structures, and an overflow canal that diverts Oak Creek water north of town during high flow.

A concrete diversion that allows for water to be diverted from the Oak Creek high water channel into an unlined ditch to transfer additional water to the North Fields pond.

A concrete divider for diverting water into a PVC pipeline for delivery to the Pete Hansen pond.

A concrete divider for diverting water into an unlined ditch for transferring water to the Last Chance pond.

A concrete weir that measures and diverts water into the City/South Fields pond.

A concrete diversion that diverts Oak Creek water into a PVC transmission line that feeds the 1st and 2nd north pond.

A concrete structure that splits the lower Oak Creek water into the upper Chimney pond and the North Fields' ditch that is used for flood irrigation of 3rd, 4th, and 5th north.

Canal Creek Diversions

Main diversion structure and weir at the head of canal creek for the purpose of measuring the amount of flow from Canal Creek. This structure is also used to divert water into a concrete pipeline and a high water ditch for distributing water to the Crawford pond and water used for flood irrigating range land south of town. This structure also diverts water into a concrete lined ditch distributing water to the Flat System pond and to the inlet to the PVC transmission line that carries water from Canal Creek to the 1st and 2nd north pond.

A concrete diversion structure that splits the water in the above mentioned ditch to the Flat pond and to the above mentioned transmission line.

A concrete structure that splits Canal Creek water into the City Creek and diverts the remaining Canal Creek water south and west of town.

A concrete divider that splits water from the lower Canal Creek canal into the Point Ditch.

A concrete structure that allows water to divert into a PVC pipe to transmit water to the Chimney Seeps pond.

Table 1-5
District Conveyance Facilities

Type of Conveyance Facility	Length, miles
Canals & laterals, lined with concrete	~ 5
Canals & laterals, lined with other materials	0
Pipelines	~ 85
Unlined channels (includes Black Canyon and Reeder ditches)	~ 45
Other (Tunnel)	1
Total	~ 126

SECTION II - INVENTORY OF WATER RESOURCES

Water Supplies

Table 2-1
District Water-rights or Entitlements

Source	Right or Entitlement Second/feet	Contract #	Contract or Right Restrictions
Oak & Canal Creeks	66.0	65-3363	April 1 through October 15
Oak & Canal Creeks	1.48	65-3364	April 1 through October 15
Oak & Canal Creeks	6.72	65-3365	April 1 through October 15
Oak & Canal Creeks	20.26	65-3366	April 1 through October 15
Oak & Canal Creeks	4.0	65-3368	October 15 through April 1
Oak & Canal Creeks	1.0	65-3367	Year round
Black Canyon	3.0*	93-3336	April 1 through October 31
Black Canyon	80.0*	93-995	April 1 through October 31
Black Canyon	3.0*	93-986	April 1 through October 31
Black Canyon	10.0*	93-983	May 1 through July 20
Reeder Canyon	15.0	93-971	March 1 through July 15
Reeder Canyon	10.0	93-956	March 1 through July 15
Total	220.46		Various

* Horseshoe Irrigation Company and Emery Water Conservation District have entered into a contractual agreement that allows for 27 cfs flow through the Spring City Tunnel year round under these water-rights.

SECTION III - DISTRICT WATER BUDGET

Because Horseshoe Irrigation is a diversion company with no current storage rights, we divert water to all users as it is available. As the Company is at the mercy of Mother Nature, our water budget varies greatly depending on the winter snow pack and the rate that it melts and runs off the mountain.

The Company's water year runs from April 1st to October 31st for agricultural crop usage; the remainder of the year the water available is only used for municipal use and stock watering.

Daily the water-master measures the amount of water flowing from each canyon creek and then fractionally diverts the water to each system use as dictated by the number of Class A shares assigned to each system.

For the pressure irrigation systems, during the spring there is usually not sufficient water flow for users' needs, so there are restrictions put into place to limit the amount of water-use to a certain gallon-per-minute (GPM)/per-share. As the water increases during late spring and summer, these restrictions are lifted and users are allowed to use as needed during high flow. During late summer and fall, use restrictions are again implemented to restrict the use to GPM/per-share.

For flood irrigated systems (Point Ditch, 3rd, 4th, and 5th North) the water available is assigned to those users on a scheduled delivery basis.

During high water flow, extra water available may be used by Class B water-users using flood irrigation practices.

Table 3-1
Class A Stock Allocation

System	Number of Class A Shares
Chimney	2,186
Crawford	1,406
Flat	1,183
Last Chance/Basin	998
Point	1,073
South Fields	1,896
City	2,132
Pete Hansen	275
1st/2nd North	3,008
North Field Ditches	958
Currently Unallocated	102

SECTION IV - LEGAL.

The Horseshoe Irrigation Company is a legal entity incorporated under the laws of the state of Utah for the purposes of managing and delivering water to shareholders of the Company in compliance with state water law. Copies of the Company's Articles of Incorporation, Bylaws, and Policies are available for review on their website: http://www.horseshoeirrigation.org.

The Company currently retains Shawn Draney from the law firm of Snow, Christensen & Martineau as legal counsel. Currently, the Company has no outstanding legal issues. The Company does, however, consult with legal counsel from time to time for advice.

The Company has two insurance policies in place. The first is a liability policy for the Company's operations. The second is a liability policy covering the Board of Directors and its officers while they are performing their duties. The Company also purchases a bond yearly for the Company treasurer covering his/her fiduciary responsibilities.

SECTION V - EXISTING WATER MANAGEMENT MEASURES AND PROGRAMS

Water Management Measures and Programs

Over the years, the Company has developed a proactive water management and conservation program. Several of the Company's water conservation policies and program elements are described in this document and in Company policies, which are available on http://www.horseshoeirrigation.org.

In acknowledgement of the Company's efforts and the "outstanding achievement in water efficiency and its leadership in the water conservation community", the Company was recently given the U.S. Bureau of Reclamation's "2007 Upper Colorado Regional Director's Water Conservation Award". This award is given to only one recipient per year.

Water Measurement and Accounting Procedures

All water for the Company's use comes from two main creeks that flow from Oak and Canal canyons. At the beginning of each water year, the Company secretary establishes a list of total Class A water shares assigned to each distribution system. This list is then used by the water-master to determine how much of the available water will be diverted to each system.

Each pressurized field system has a policy stipulating what size sprinkler-head nozzles must be used for distribution. These policies were put into place to create consistency of distribution, ease of monitoring water-use, conservation, and to help with pressure problems that several systems have.

As the water year progresses and the amount of available water becomes less than what is needed, the water-master puts water restrictions in place. These restrictions are posted at established locations on each system. These restriction notices state how many shares of Class A water it takes to run 1 head for a 24-hour period, and also indicates GPM/per-share.

For the City System, due to the variety and different types and sizes of distribution methods put into use over the years, establishing proper water-use in this system has become an increasingly difficult thing to manage. The water-master posts water-use signs with various examples of how many shares it takes to run different GPM heads. Unfortunately, the Company has a very hard time policing for overuse in this system.

After all Class A shareholders are served, any unused water within the Company’s water-rights may be used by Class B water-users.

Table 5-1
Districts Current Water Customers

	Number served	Acres served
M&I Customers	369	443
City Acres	17	103
1st and 2nd North	42	763
Last Chance	45	397
Pete Hansen	11	123
Flat	23	569
South Fields	69	642
Chimney	18	895
Crawford	45	442
3rd, 4th, 5th North - Flood Irrigated	20	~ 480
Point Ditch - Flood Irrigated	5	~ 400
Point Ditch - Sprinkled	3	300
Other - Flood Irrigated	5	~ 260

Water Pricing and Billing Practices

Annually in October, the Board of Directors sets the assessments for the forthcoming water year and sends assessment billings to water share-holders and land owners the first of November with a due date of December 1st. Delinquent assessments are assessed a late fee of $25, then an additional 2% per month delinquency. If assessments are not paid in full by February 15th, they are subject to a delinquent stock sale that, if necessary, is held in March to pay for the delinquent assessment. This procedure is spelled out in the Company's policy manual and follows Utah state statutes.

Water Education Program

In the past, the Company has, with limited success, held water-education meetings. The Company also sends out information in special mailings to share-holders explaining water-use challenges and use policies.

The Company would like to utilize better education measures in the future and intends to utilize programs available from the State of Utah's Division of Water Resources, the U.S. Bureau of Reclamation, and other agencies.

Water Conservation Coordinators

Each board member is assigned a water-use system to oversee and to assist the water-master in his duties of monitoring water-use. With the continued growth and strains on the use of available water during times of restriction, the Board of Directors, during the water years of 2004 and 2005, hired a water-use compliance officer. This program has proven to have some very

noticeable effect on water-user's use and conservation. Even though this program has had some success, the Company still has some additional challenges in this area.

Operation and Maintenance Program

The Board of Directors annually hires a water-master whose duties include water measuring, distribution, maintenance, and upkeep of the water distribution systems. The Board of Directors puts together a financial budget yearly to assist in shareholder assessment levying and for the proper financial management of the Company.

Use of Water Policies

The Board of Directors has established water-use and over-use policies that have been in effect since 2004. These policies have proven to be a useful tool in curtailing water over-use and assist in conservation measures. These policies can be viewed on the Company's web site at horseshoeirrigation.com.

Water Transfer Policies

The Board of Directors has developed a detailed water transfer policy that is available on the Company's web site at http://www.horseshoeirrigation.org.

SECTION VI - WATER MANAGEMENT ISSUES AND GOALS

The Board of Directors has developed the following list of issues and goals that it feels are imperative for the long-term success of the Company. Issues are first presented and discussed, with a goal for each issue listed at the end of the discussion. Section VII then presents "Candidate Measures" which have been identified by the Board of Directors to meet the goals listed below.

Issue I-1: Deteriorated and Outdated Water Diversion Dams and Other Project Structures

Diversion Structures

Several of the diversion structures utilized to divert water to each system pond are in need of repair and/or upgrade. As the demands on the systems have increased over the past 20 years, the ability of many of our current diversions to accurately measure and distribute the water has become inadequate.

The Company's management would like to upgrade as many of our diversion structures as possible to incorporate more accurate and automated water-measuring and reading devices. This will most likely be accomplished with grant money or by utilizing cost sharing from available programs.

The Company's current diversion structures and measuring devices are also very labor intensive for the water-master. Upgrading these structures to incorporate more automated and easier reading apparatuses will assist the Company long term.

Creek Crossings

Several creek crossings must be made by the Company's water-master to divert and measure water. These crossings should be upgraded to create a safer environment for crossing.

PRV Structures

The Company has several pressure-reducing stations that are concrete constructed and approximately 4-feet deep. There have been instances of domestic animals falling in with no ability to get out. Covers need to be installed at these stations to provide a safer environment for both people and animals.

➢ **Goal G-1: Bring existing diversion dams and other project structures to current technology and standards.**

Issue I-2: Lack of Adequate Storage and Regulation Capacity

Freeman-Allred Pond

As previously mentioned in this management plan, the Company at one time had the rights to build an approximately 400 acre-foot storage reservoir to store spring runoff for use later in the season during low water availability. The Company would now like to explore the feasibility of building this storage reservoir. As the Company has significant challenges with the current demand on the available water, it is believed that this could help solve many of these problems.

Pond Enlargements

As many of the regulating ponds were not originally constructed to the maximum capacity allowed for these types of ponds, management would like to look into the feasibility of enlarging as many of these ponds as possible. This would create more storage capacity and would help the Company with managing its total water-rights. This obviously is a long-term goal that would probably best be addressed along with the solutions to the City System capacity problems.

Relocating and Enlarging Crawford Pond

As this system experiences pressure problems through most of the water year, it has been suggested that the Company relocate this pond to a higher elevation to create better flow. This pond is one of the smallest ponds relative to its system demand and could be enlarged at the same time it is relocated.

It has also been suggested that the Crawford system be split into two systems with two ponds, with the second located at a higher elevation to relieve the pressure problems.

Relocating and Enlarging Chimney Pond

In 1980, when the Chimney system was put under a pressurized sprinkler system, there was a temporary pond built to get the system up and running. This pond was intended to be relocated to a higher elevation after the completion of the project. Due to lack of funding at project completion, and the fact that the temporary pond seemed to be working adequately, it was not relocated to its originally intended permanent location.

Since that time, due to additional system usage demands, there is a pressure problem on this system during peak flow. If the pond were relocated to a higher elevation as was originally intended, the system would function better during peak usage.

- **Goal G-2: Increase storage/regulating capacity within the system.**

Issue I-3: Deteriorating Conveyance Systems

Concrete-lined Canal on the Flat

This ditch is used to transfer water from the Canal Creek main diversion structure to the Flat pond and to the transmission line that moves Canal Creek water to the North Fields pond. This cement ditch has had several repairs in the last few years and is still in need of repairs as its condition continues to deteriorate. The best solution is to replace this ditch with underground PVC piping, which will eliminate the need for constant repair and will also eliminate water waste from evaporation and seepage.

Chimney System Flume Ditch

This PVC line is used to feed water to the Chimney system lower pump station pond. There appears to be leakage and damage to this underground pipe system. Initial investigation indicates that the best solution is to replace the lower portion of this line with new PVC pipe.

Last Chance System Open Ditch (Pond Inlet)

This open, unlined earthen ditch is approximately 1.3 miles long and feeds the Last Chance pond. To better conserve water, management would like to replace this unlined ditch with PVC pipe.

➢ **Goal G-3: Rehabilitate and Upgrade Deteriorating Conveyance Systems.**

Issue I-4: Unique Challenges within the City System

Due to the growth in the city that has occurred since the installation of its pressurized system, there have been extreme strains put on the system's capacity. With the field systems, the Company has had the ability to implement procedures and policies that have assisted in over-use problems. However, the City System has unique issues that have been very difficult to address.

With city water-users utilizing various types of watering equipment, ranging from drip systems to automatically controlled sprinkler systems, it is very difficult to measure and manage water-use and water over-use.

Another key concern deriving from an audit of the City System is that approximately 90 acres within the city boundaries, originally designed into the system, have never utilized water or paid an assessment. As the city continues to grow in population, owners of these previously vacant lots will request water. There is concern that with these additions, capacity and pressure problems could arise.

Several options have been discussed, ranging from installing an additional pond, dividing the current system that is fed from the city pond, and/or installing meters on each city lot user to better control and manage water-use.

Every option that has been discussed has very unique challenges. Management would like to collect as much input as possible before addressing this issue. There has been a committee of city share-holders established to help with developing some strategies and solutions to this problem.

- **Goal G-4: Develop a strategy for addressing the challenges within the City System.**

Issue I-5: Lack of Easements for Conveyance Facilities

When the Company installed the pressure irrigation systems, there were numerous miles of underground main feed lines installed without any record of easements. The Company has been advised by legal counsel to get prescriptive easements recorded on all underground lines that do not have risers coming off them to adequately establish their presence.

➢ **Goal G-5: Acquire prescriptive easements for all regulating ponds' main inlet and outlet piping where no easement exists.**

Issue I-6: Flood Irrigation – 3rd, 4th, and 5th North System

This is the last significant agricultural system that is still flood irrigated. The Company would like to put these lands under a pressurized irrigation system. The current challenge with this project would be to obtain funding through governmental programs to help with cost sharing of this project, as this system is primarily made up of small individually owned farms. This project would put an extreme burden financially on individuals and is hard to justify without some type of cost support. However, the Company sees this project as a very significant conservation goal as this land is one of the farthest systems to deliver water to and through canals and ditches, which results in major water loss due to seepage and evaporation.

➢ **Goal G-6: Explore feasibility of converting the 3rd, 4th, and 5th North System to a pressurized sprinkler system.**

Issue I-7: Improving Water Management

As discussed in Section V and other areas of the report, the Company has taken a progressive approach to managing and improving the project in recent years. This is evidenced, in part, by the efforts taken to plan and prepare this report. We would like to continue this progressive management approach and have identified several improvement goals which are presented in this section of the report.

Pressure Irrigation System Acreage Audits

During 2005, the Company began the process of completing an audit on all of our pressurized irrigation systems. The intent of this audit is, first, to assure that all acres utilizing a pressurized irrigation system are being assessed, and second, to collect data to be used to better manage each system.

This audit consisted of using GPS equipment to map out all agricultural land being watered by a sprinkler system and then downloading this information into a computer program to detail the acreage of each systems use.

For completing the City System, records were acquired from the county recorder's office showing land ownership. This information was used to complete the audit for the city lots part of that system.

Currently, we are approximately 80% compete on these audits and hope to finalize this project in the spring of 2008.

Completing these audits will give the Company's management the ability to see where each system stands in its feed capacity, resulting in better decisions regarding future improvements to each one.

Class B Stock Management

The Company has approximately 7,600 shares of outstanding Class B stock, with the ability to issue an additional 7,400 shares (up to 15,000 shares). This is a secondary or high water-right to be used by these share-holders when all Class A water is being utilized and there is excess water available within the Company's water-rights.

At this time the Company is managing its Class B water on a very limited basis. We allow all share-holders to use water as needed during high spring runoff and then restrict the water-use when there is not sufficient water to meet all the needs of the Class A share-holders.

The Company would like to establish policies and procedures to address Class B stock so it can be utilized as it was intended. It should also be noted that Class B stock is not currently being assessed by the Company due the lack of established policies for its use. The Company believes that this secondary water-right should be assessed in some way as it is recognized as a valid water-right, and that these stock-holders do currently have and utilize their voting rights on voting issues placed before share-holders.

Water Management and Conservation Program

As discussed in Section V of this report, the Board of Directors has developed a good water management program. The board would like to build upon this program and continue to make it a significant part of the overall management of the Company's water supply.

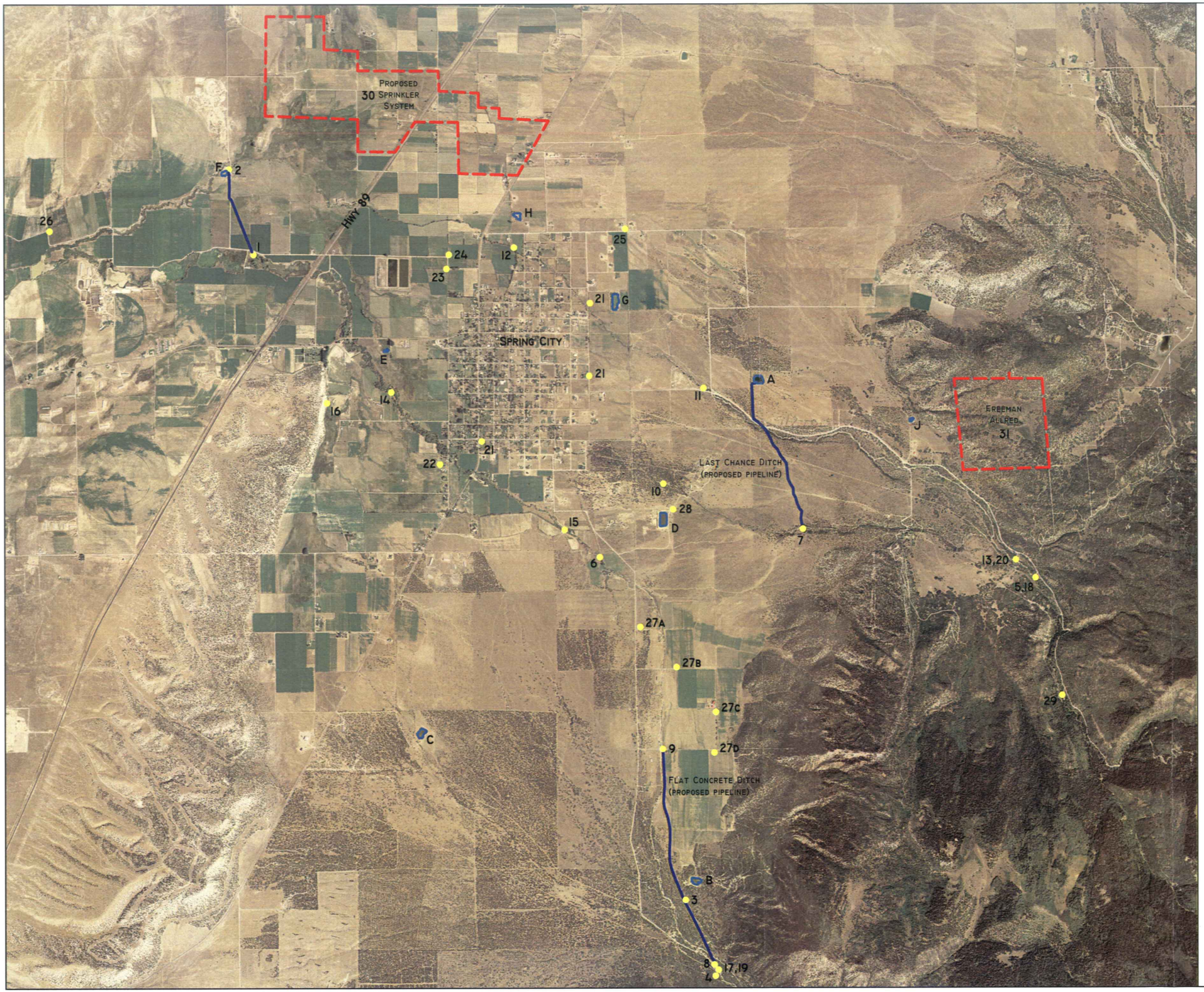
➢ **Goal-7: Continue proactive management for improved water management and conservation.**

Summary

The following table summarizes the issues and goals described above.

Table 6-1
Summary of Issues and Goals

Issues	Goals
I-1: Deteriorated and outdated water diversion dams and other project structures.	G-1: Bring existing diversion dams and other project structures to current technology and standards.
I-2: Lack of adequate storage and regulation capacity.	G-2: Increase storage/regulating capacity within the system.
I-3: Deteriorating conveyance systems.	G-3: Rehabilitate and upgrade deteriorating conveyance systems.
I-4: Unique challenges within the City System.	G-4: Develop a strategy for addressing the challenges within the City System.
I-5: Lack of easements for conveyance systems.	G-5: Acquire prescriptive easements for all regulating ponds' main inlet and outlet piping where no easement exists.
I-6: Flood Irrigation - 3rd, 4th, 5th North System.	G-6: Explore feasibility of converting the 3rd, 4th, and 5th North System to a pressurized sprinkler system.
I-7: Improving water management.	G-7: Continue proactive management for improved water management and conservation.



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Diversion Structure Rehabilitation

Priority	Name
1	Chimney Flume Ditch Diversion
2	Chimney Pump Pond Diversion
3	Flat Pond Diversion
4	Crawforth Diversion
5	Oak Creek High Water Diversion
6	Canal/City Creek High Water Diversion
7	Last Chance Diversion
8	Flat Concrete Ditch Diversion
9	North Fields Pond Transmission Line Inlet Diversion
10	North Fields Pond Transmission Line East Inlet Diversion
11	North Fields Oak Creek Diversion
12	Chimney Upper Pond/3rd, 4th, 5th North Ditch Diversion
13	Pete Hansen Diversion
14	Chimney Seeps Diversion (Sherm's Pond)
15	Point Ditch Diversion - Upper
16	Point Ditch Diversion - Lower
17	Canal Creek Main Diversion

Creek Crossing Upgrades

Priority	Name
18	Oak Creek High Water Diversion
19	Canal Canyon Main Diversion
20	Crossing to Access Pete Hansen Diversion

Pressure Reducing Valve Structures

Priority	Name
21	3 - City PRV
22	1 - South Fields PRV
23	North Fields 1st North
24	North Fields 2nd North
25	1 - Last Chance
26	1 - Chimney
27a-d	4 - Flat

Other Structures - No Need for Rehabilitation

Priority	Name
28	City Pond Diversion
29	Oak Creek Main Diversion
30	Proposed Sprinkler System
31	Freeman Allred Project

Ponds

Priority	Name
A	Last Chance Pond
B	Flat System Pond
C	Crawford System Pond
D	City Southfield Pond
E	Chimney Seeps Pond
F	Chimney Pump Pond
G	North Fields Pond
H	Chimney Upper Pond
J	Pete Hansen Pond

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PRINT DATE: Feb. 06, 2008

NO.	DATE	INITIL	REVISIONS DESCRIPTION

CHECKED:
REVIEWED:

HORSESHOE IRRIGATION COMPANY

HORSESHOE IRRIGATION SYSTEM PROJECT LOCATION MAP

JOB NO. SU.0000028

Hrshoe Irr Co-Loc Map (small).dwg
H:\CLIENTU-South Utah Area\Sanpete Co\Horseshoe Irrigation Company\Drawings

LAYOUT: Project Loc Map (11 x 17)

SHEET
OF

SECTION VII - CANDIDATE MEASURES

Water conservation, as defined in the U.S. Bureau of Reclamation's Guidebook, is "improved water management" or "more efficient water use". Good water management and conservation includes "protecting" as well as "conserving" – protecting the ability to deliver water by properly maintaining project facilities, rehabilitating old diversion and conveyance systems, and improving water measurement and accounting practices.

This section of the report identifies candidate measures for each of the goals identified in Section VI. Measures, activities, and tasks are all commonly used terms for actions that determine how a goal will be achieved. In this report, the term "candidate measure" is used. Each goal will have one or more candidate measures, as more than one might be required to achieve the goal. Following the description of the candidate measure are sections describing the anticipated "Projected Benefits", "Estimated Costs", and "Impacts or Constraints" associated with implementing the candidate measure. This information is carried over to Section VIII where each candidate measure is evaluated to determine which should be adopted for implementation. Please refer to Table 8-1 for a summary of the evaluation criteria.

Projected benefits include one or a combination of three elements. 1) "Water Conservation Efficiency" (WCE) is the degree to which implementation of the measure would improve the efficiency of the system and conserve water. 2) "Operation and Maintenance" (O&M) is the degree to which implementation would improve operation and maintenance efficiency or reduce costs. 3) "Safety and Liability" (S/L) is the degree to which implementation would affect the safety and/or liability of the structure.

Impacts or constraints are separated into two components. 1) "Environmental Impacts" (EI) is the degree to which implementation of the measure would impact environmental resources. This evaluation is preliminary and more analyses would be performed for each measure prior to implementation. 2) "Legal and/or Institutional Constraints" (L/IC) indicates the degree to which implementation would be contingent on agreements and/or approvals from others. Both of these components are rated separately. The rating criteria for both components ranges from a "-1" indicating a negative impact to a "3" which indicates a substantially positive impact or constraint. A "0" rating indicates no known impact or constraint, meaning the Association has full authority to proceed on its own without consultation or agreement with others.

Goal G-1: Bring Existing Diversion Dams and Other Project Structures to Current Standards

Most of the water diversion structures within the system were constructed over 40 years ago and are approaching, or have exceeded, their design life. Many of these facilities also lack the ability to adequately measure and distribute water. Furthermore, several structures also have safety concerns. Aging water facilities limit management opportunities. Bringing existing facilities into current standards will substantially improve the Company's ability to operate them in a more efficient and cost-effective manner.

Operating and maintaining the Company's structures is also very labor intensive for the water-master. Upgrading the structures, to incorporate more automated and easier reading devices, would assist the Company long term.

CM-1. Rehabilitate and Upgrade Diversion Structures

The Board of Directors has selected those diversion structures listed in Table 7-1 for rehabilitation. Rehabilitation will in some cases be extensive, to the point of reconstruction. The rehabilitation will ensure the proper function and structural integrity of the diversion structures. Rehabilitation will also include automation for remote operation, and the addition of flow measurement stations. Table 7-1 shows, for each measure, the degree of rehabilitation anticipated.

Each structure will require an individual design. In Table 7-2, the break down of the cost estimates for each structure can be found.

Table 7-1
Diversion Structure Rehabilitation

Name	Size	Str[1]	Auto[2]	Msrmt[3]	Priority
Chimney flume ditch diversion	S	3	Yes	Yes	1
Chimney pump pond diversion	S	3	Yes	Yes	2
Flat pond diversion	M	1	Yes	Yes	3
Crawford diversion	M	2	Yes	Yes	4
Oak Creek main diversion	L	1	Yes	Yes	5
Oak Creek high water diversion	L	2	No	No	6
Canal/City Creek high water diversion	M	3	Yes	Yes	7
Last Chance	M	3	Yes	Yes	8
Flat concrete ditch diversion	L	1	Yes	Yes	9
North fields pond transmission line inlet diversion	S	1	Yes	Yes	10
North fields pond transmission line east inlet diversion	L	1	Yes	Yes	11
1st & 2nd North pond high water ditch diversion (Oak Creek)	L	1	Yes	Yes	12
3rd,4th,5th, Chimney upper pond diversion	L	3	Yes	Yes	13
Pete Hansen Diversion	M	1	Yes	Yes	14
Chimney seeps diversion (Sherm's pond)	M	3	Yes	Yes	15
Point Ditch diversion – upper	M	2	Yes	Yes	16
Point Ditch diversion – lower	L	1	No	Yes	17

[1] Structural Improvements – "1" Minor, "2" Significant, "3" Major
[2] Add Automation – "Yes" or "No"
[3] Add Measurement – "Yes" or "No"

Projected Benefits

Rehabilitating the diversion structures would reduce operation and maintenance costs, extend facility life, improve safety, and greatly improve the accuracy of water measurement and distribution. These improvements would conserve water by reducing water lost to seepage and evaporation, and by delivering water more precisely and accurately to the users.
WCE: "+"; O&M: "+++"

Estimated Costs

Table 7-2
Diversion Structure Rehabilitation Costs

Name	Struct[1]	OnMsr[2]	ReMsr[3]	ReCtr[4]	Total [5]
Chimney flume ditch diversion	$6,000	$2,500	$4,000	$3,000	$15,500
Chimney pump pond diversion	$6,000	$2,500	$4,000	$3,000	$15,500
Flat pond diversion	$3,000	$2,500	$4,000	$3,000	$12,500
Crawford diversion	$6,000	$2,500	$4,000	$6,000	$18,500
Oak Creek main diversion	$4,500	$2,500	$4,000	$9,000	$20,000
Oak Creek high water diversion	$15,000	-	-	-	$15,000
Canal/City Creek high water diversion	$10,000	$2,500	$4,000	$6,000	$22,500
Last Chance	$10,000	$2,500	$4,000	$9,000	$25,500
Flat concrete ditch diversion	$4,500	$2,500	$4,000	$9,000	$20,000
North fields pond transmission line inlet diversion	$1,800	$2,500	$4,000	$3,000	$11,300
North fields pond transmission line east inlet diversion	$4,500	$2,500	$4,000	$9,000	$20,000
1st & 2nd North pond high water ditch diversion (Oak Ck)	$4,500	$2,500	$4,000	$9,000	$20,000
3rd,4th,5th Chimney upper pond diversion	$15,000	$2,500	$4,000	$9,000	$30,500
Pete Hansen diversion	$3,000	$2,500	$4,000	$6,000	$15,500
Chimney seeps diversion (Sherm's pond)	$10,000	$2,500	$4,000	$6,000	$22,500
Point Ditch diversion – upper	$6,000	$2,500	$4,000	$6,000	$18,500
Point Ditch diversion – lower	$4,500	$2,500	$4,000	-	$11,000
Totals	**$114,300**	**$40,000**	**$64,000**	**$96,000**	**$314,300**
				Rounded	**$315,000**

[1] Structural Improvement Costs
[2] Onsite Measurement Costs
[3] Add for Remote Measurement Costs
[4] Add for Remote Controlling Costs
[5] This cost includes engineering and contingencies

Environmental Impacts

Rehabilitating diversion structures would have short-term impacts associated with reconstructing the diversion structures. All land surface disturbances would be confined to the area immediately around the diversion structure and on small adjacent staging areas. Impacted lands would be re-graded and re-vegetated, as needed, to restore them to natural conditions. A U.S. Army Corps of Engineers "dredge and fill" permit (Section 404 of the Clean Water Act) may be required. If required, conditions of the permit would be carefully followed.
EI: "1" (Minor); L/IC: "1" (Minor)

CM-2. Upgrade Creek Crossings

Safety and liability are concerns at several creek crossings within the system. These crossings must be made by the Company's water-master to divert and measure water. These crossings would be upgraded to create a safer environment for crossing. The Board of Directors has identified those crossings shown in Table 7-3 for upgrade.

Table 7-3
Creek Crossing Upgrades

Priority	Location
1	Oak Creek high water diversion
2	Crossing to access Pete Hansen diversion
3	Canal canyon main diversion

The upgrade would consist of standard metal grate catwalks, which would be equipped with a hand rail. For the catwalks on the diversion structures, the grate will be bolted to the concrete. For an open crossing, small footings will be poured and the grate will be bolted to the footing to insure a stable crossing. On long crossings, a pier may be used in the canal to reduce costs by cutting the span in half.

Projected Benefits
Upgrading creek crossings would improve safety and reduce liability. *S/L: "++"*

Estimated Costs

Table 7-4
Man Crossing Costs

Diversion Location	Catwalk Cost	Concrete Costs	Engineering/ Installation	Total Costs
Oak Creek high water diversion	$ 5,000	N/A	$ 1,500	$ 6,500
Canal canyon main diversion	$ 9,000	$ 610	$ 3,000	$12,610
Crossing to access Pete Hansen diversion	$11,000	$ 915	$ 3,500	$15,415
Totals	**$25,000**	**$ 1,525**	**$ 8,000**	**$34,525**
			Rounded	**$35,000**

As shown in Table 7-4, the total estimated cost for the man crossings is $35,000. This cost includes furnishing the steel, manufacturing, engineering, installation, and contingencies. The cost estimates on the steel were obtained from Sanpete Steel Company. The price on the manufacturing of the bridge was combined with the PRV lids, a candidate measure listed below, for bulk cost savings. These prices are subject to change.

Environmental Impacts
Implementation of this measure may have minor short-term impacts associated with construction of the crossings over the canals/streams. All land surface disturbances would be confined to the area immediately around and adjacent to the crossing. These disturbed lands would be re-graded and re-vegetated as needed to restore them to their natural conditions.
EI: "1" (Minor); L/IC: "1" (Minor)

CM-3. Upgrade PRV Structures

The Company has several pressure reducing valve (PRV) stations that are concrete constructed and approximately 4-feet deep. Covering these structures to increase safety and reduce liability is a high priority for the Company. The Board of Directors has identified those PRV structures listed in Table 7-5 for upgrade.

Table 7-5
Pressure Reducing Valve Structures

Priority	Location
1	3 City PRV
2	1 Last Chance
3	1 South Fields PRV
4	1 Chimney
5	North Fields 2nd north
6	North Fields 1st north
7	4 Flat PRV

Upgrade would consist of manufacturing steel grates to cover each PRV vault. The covers will be hinged on one side and lift open; there will also be an option to lock the covers.

Projected Benefits
Implementing this measure would improve safety, reduce liability, and extend the life of the facility.
S/L: "++"

Estimated Costs
The cost to have the lids manufactured, and installed per 4'x 8'lid is approximately $2,000 with a hinged access and option to lock. Total cost of covering the seven PRV vaults is therefore $24,000.

Environmental Impacts
Implementation would have minor short-term impacts associated with constructing the improvements on-site. All land surface disturbances would be confined to the area immediately around the PRV structures and would be re-graded and re-vegetated, as needed, to restore them to their natural conditions.
EI: "1" (Minor); L/IC: "1" (Minor)

Goal G-2: Increase Storage/Regulating Capacity within the System

The Company has experienced significant challenges with current demand on available water. Additional storage would allow more efficient use of existing water-rights by delivering more water to users to meet later-season needs. Sediment has decreased original capacity in most ponds; others are too small and need to be enlarged.

CM-4. Investigate Feasibility of Constructing New Storage (Freeman-Allred Pond)

As previously mentioned, the Company at one time intended to build an approximate 400 acre-foot storage reservoir to store spring runoff for use later in the season during low water availability. The Company would now like to explore the feasibility of building this storage reservoir. As the Company has significant challenges with the current demand on the available water, it is believed that this could help solve many of these problems.

This candidate measure therefore would consist of a study by an engineering contractor to explore the feasibility of constructing a 400-700 acre-foot Freeman-Allred pond. The first step in the analysis would be to evaluate water-rights to determine feasibility of reinstating the storage right once held by the Company. The analysis would also investigate the feasibility of partnering with Chester Irrigation Company to enlarge storage capacity. Once data is gathered and a preferred design approach is selected, the contractor would then prepare feasibility-level designs and cost estimates.

Projected Benefits

The primary benefit of this action will be to provide information that will help determine the feasibility of adding new storage to the system. The study is a first step in potentially implementing a project that could significantly improve the efficient management and delivery of water, thus conserving water. It is difficult to quantify benefits at this time.
WCE: "0", if implemented "++"

Estimated Costs

The cost of an engineering study for the Freeman-Allred pond is estimated at $15,000.

Environmental Impacts

There would be no environmental impacts associated with the study. The study would identify any proposed actions and evaluate potential environmental impacts from implementing those actions.
EI: "0" (None); L/IC: "0" (None)

CM-5. Rehabilitate Existing Regulating Ponds

As mentioned in Section VI, many of the settling ponds were not originally constructed to the maximum capacity allowed for these types of ponds. Management would like to look into the feasibility of enlarging as many of these as possible. Each pond would be evaluated on its own to determine what would be done. However, Table 7-6 below indicates the Board of Director's current concept and priority.

Table 7-6
Regulating Pond Rehabilitation

Name	Objective	Priority
Crawford	Relocate and Enlarge	1
Chimney Upper	Relocate and Enlarge	2
Chimney Seeps	Enlarge	3
North Fields	Enlarge	4
Pete Hansen	Enlarge	5
Last Chance	Enlarge	6
Flat	Enlarge	7

The maximum allowable size for a pond with an embankment, not requiring formal submission of plans to the state of Utah, is 20 acre-feet. The Company proposes enlarging each pond listed in Table 7-6 to hold 20 acre-feet of water. Restrictions and opposition may be met due to property ownership issues, and other unforeseen complications.

Projected Benefits

Enlarging existing regulating ponds would create more storage capacity for the system and would help the Company better manage its total water-rights.
WCE: "++"; O&M: "++"

Estimated Costs

A lump sum has been used to estimate the cost of each pond. The costs shown include engineering and contingencies. Relocating a pond will incur larger fees than a pond enlargement. Each pond will be engineered during the design phase of the project and more accurate costs will be assigned. Costs for the ponds are shown below in Table 7-7.

Table 7-7
Regulating Pond Rehabilitation Costs

Name	Objective	Cost[1]
Crawford	Relocate and Enlarge	$120,000
Chimney Upper	Relocate and Enlarge	$120,000
Chimney Seeps	Enlarge	$60,000
North Fields	Enlarge	$60,000
Pete Hansen	Enlarge	$60,000
Last Chance	Enlarge	$60,000
Flat	Enlarge	$60,000
Total		$540,000

[1]All costs include engineering and contingencies.

Environmental Impacts

Relocating and enlarging regulating ponds would have short-term impacts associated with construction activities. Constructing new ponds in previously undisturbed areas could potentially have the most environmental impacts. An environmental analysis should be prepared for these new areas prior to initiating any construction activity. All land surface disturbances would be confined to the area within the pond, areas immediately adjacent to the perimeter of the pond, and on small adjacent staging areas. Impacted lands would be re-graded and re-vegetated, as needed, to restore them to natural conditions. A U.S. Army Corps of Engineers "dredge and fill" permit (Section 404 of the Clean Water Act) may be required. If required, conditions of the permit would be carefully followed.

EI: "2" (Moderate); L/IC: "1" (Minor)

Goal G-3: Rehabilitate and Upgrade Deteriorating Conveyance Systems

CM-6. Concrete-Lined Canal on the Flat

This candidate measure consists of replacing approximately 2 miles of open ditch with pipe. It is estimated that the first mile (5,280 feet) will be 15-inch pipe to the first major turnout and the second mile (5,280 feet) will be 12-inch.

Projected Benefits

This measure would reduce seepage and evaporation losses from the deteriorating canal and reduce future maintenance costs. It is estimated that water losses in the ditch are currently 20 to 30 percent. Piping this section would essentially eliminate these loses.

WCE: "++"; O&M: "+"; S/L: "+"

Estimated Costs

The price per foot of furnished and installed 15-inch pipe is approximately $18 per linear foot, or a total of $95,040 (5,280 ft X $18). The price for 12-inch pipe furnished and installed is approximately $15 per linear foot, or $79,200 (5,280 ft X $15). Adding 25 percent for engineering and contingency brings the total cost to about $217,800, rounded to $218,000. PVC pipe costs are variable and fluctuate with the price of oil; therefore this cost is subject to change.

Environmental Impacts

Replacing the canal with pipe would have minor short-term impacts associated with installing the pipe. All land surface disturbances would be confined to the canal area and small staging areas adjacent to the canal. These areas would be re-graded and re-vegetated, as needed, to restore them to their natural condition. Construction would take place during the early spring or late fall when there would be no water in the canal.

EI: "1" (Minor); L/IC: "1" (Minor)

CM-7. Chimney System Flume Ditch

This candidate measure consists of replacing approximately 1,200 feet of existing 12-inch PVC pipe, that currently feeds water to the Chimney System lower pump station pond, with new PVC pipe. The existing pipe appears to be leaking and may be damaged. This measure would reduce water lost to seepage and reduce future maintenance costs.

Projected Benefits

This measure would reduce seepage losses from the deteriorated PVC pipe and reduce future maintenance costs.

WCE: "++"; O&M: "+"

Estimated Costs

The cost of 12-inch PVC furnished and installed is approximately $15 per linear foot, or $18,000 (1,200 feet X $15). Including an estimated 25 percent for engineering and contingencies, the total cost is estimated at $22,500, rounded to $23,000.

Environmental Impacts
Replacing the existing pipe with new pipe would have minor short-term impacts associated with removing and discarding the old pipe and installing the new pipe. All land surface disturbances would be confined to the canal area and small staging areas adjacent to the canal. These areas would be re-graded and re-vegetated, as needed, to restore them to their natural condition. Construction would take place during the early spring or late fall when there would be no water in the canal.
EI: "1" (Minor;, L/IC: "1" (Minor)

CM-8. Last Chance System Open Ditch (Pond Inlet)

This candidate measure consists of replacing approximately 1.2 miles of open ditch with pipe. The existing canal feeds the Last Chance System pond. It is estimated that the pipe is currently carrying 9 cfs of water.

Projected Benefits
This measure would reduce water loss from seepage and evaporation. It is estimated that water losses would be reduced by about 30 to 40 percent.
WCE: "++"; O&M: "+"; S/L: "+"

Estimated Costs
The cost of the PVC Pipe furnished and installed is $18 per linear foot, or about $114,000. Including an estimated 25 percent for engineering and contingencies, the total cost is estimated at $142,600, rounded to $145,000.

Environmental Impacts
Replacing the canal with pipe would have minor short-term impacts associated with installing the pipe. All land surface disturbances would be confined to the canal area and small staging areas adjacent to the canal. These areas would be re-graded and re-vegetated, as needed, to restore them to their natural condition. Construction would take place during the early spring or late fall when there would be no water in the canal.
EI: "1" (Minor); L/IC: "1" (Minor)

Goal G-4: Develop a Strategy for Addressing the Challenges within the City System

As mentioned in Section VI, growth within the city has created unique challenges for the City System. These are in part, the result of the various types of watering equipment being used, agricultural fields being developed into residential use, and approximately 90 acres that were originally designed into the system but have never used water or paid an assessment that will likely request water as they are developed. The present system has about 2130 shares of water for approximately 550 acres.

The Board of Directors has selected three candidate measures to deal with these challenges. First, the Board would like to continue ongoing efforts to find solutions to these various issues in the form of a "strategy plan". Second, the Board would like to install meters within the City System to assist in understanding and managing use within the system. Third, they would like to investigate the feasibility of separating the City/South Field pond into two systems with two ponds, one for each system.

CM-9. Develop a Plan for Dealing with City System Use Issues.

This candidate measure consists of developing a plan for dealing with the various City System issues. The plan would be prepared with public input, particularly stakeholders and beneficiaries that would be affected by the proposed activities. The plan would identify the issues, list activities or measures that would help mitigate the issues, and then adopt those for implementation. The document would be a "working" document that could easily be updated as additional information is gathered.

This document will be prepared by the Company as a continuation of past efforts. Prior to preparing the document, the Company will gather as much information as possible from stakeholders and the public.

Projected Benefits

The primary benefit of this measure would be to help assess the feasibility of making changes within the City System. The study is a first step in potentially implementing a project that could conserve a significant quantity of water by implementing a much more efficient water management program for the City System. The strategy plan itself would not yield conservation benefits but would lead to significant benefits if elements of the plan are implemented.
WCE: "0", if implemented "++"; O&M: "+"

Estimated Costs

Costs (staff time and materials) are estimated at $7,000.

Environmental Impacts

There would be no environmental impacts associated with preparing the plan. If the plan proposes specific actions, it would evaluate any potential environmental impacts from implementing those actions.
EI: "0" (None); L/IC: "0" (None)

CM-10. Install Meters within the City System

Without water measurement, it is difficult to manage a water system properly. With meters installed at every connection, water-users can be held responsible for their individual water consumption. The potential for water conservation is significantly increased.

This candidate measure would consist of adding a small "smart meter" to each connection in the system. The meters are economical and provide accurate flow data. Currently each residence has a 1.5-inch stub valve installed off the main line. The new metering system would include an irrigation box, a meter, and installation.

Projected Benefits

It is difficult to quantify water saved, but installing meters throughout the city is expected to yield substantial water conservation benefits.

WCE: "+++"; O&M: "+"

Estimated Costs

Costs for the system would be broken down as follows; $150 per meter, $25 per irrigation box and $100 installation fee per connection. This would bring the total per connection to $275. There are approximately 450 connections. The total cost for the metering system would be approximately $123,750, rounded to $125,000.

Environmental Impacts

The majority of areas where new meters would be installed are next to existing turnout valves which would result in minimal disturbance of the area. Land disturbances would be graded and re-vegetated to restore them to their original condition.

EI: "1" (Minor); L/IC: "1" (Minor)

CM-11. Investigate Feasibility of Separating City/South Field Pond System into Two Ponds, One for Each system

One option, being considered by the Board of Directors to address City System challenges, is to construct an additional pond and split the system so that both the City and South Field Systems would have their own ponds and delivery systems. This would increase capacity and help with the strains on the City System demands and would assist in the management of usage challenges.

This candidate measure consists of an engineering feasibility analysis of the system. The first of three steps would be to gather data and evaluate the feasibility of separating the system through modeling the two separated sections in order to evaluate flows and pressures in the systems. Data would be in two categories, preliminary design data and data from the users which would identify public issues and concerns. The second step would be to formulate a plan based on the data gathered in the first step. The third step would be to prepare a preliminary design and cost estimate for the plan formulated in step 2.

Projected Benefits

The primary benefit of this measure would be to help determine the feasibility of making this change within the City System. The study is a first step in potentially implementing a project that could conserve a significant quantity of water by implementing a much more efficient water management program for the City System. The study itself would not yield conservation benefits but would lead to significant benefits if the proposal is implemented.
WCE: "0", if implemented "++"; O&M: "+"

Estimated Costs

Cost of the feasibility study for splitting the system is estimated at $15,000.

Environmental Impacts

There would be no environmental impacts associated with the study. The study would identify any proposed actions and evaluate potential environmental impacts from implementing the actions.
EI: "0" (None); L/IC "0" (None)

Goal G-5: Acquire Prescriptive Easements for all Regulating Ponds' Main Inlet and Outlet Piping Where no Easement Exists

As mentioned in Section VI, when the Company installed the pressure irrigation systems there were numerous miles of underground main feed lines installed without any record of easements. The Company has been advised by legal counsel that it should get prescriptive easements recorded on all underground lines, that do not have risers coming off them, to adequately establish their presence.

CM-12. Acquire Necessary Easements

This candidate measure consists of land surveying, preparing legal descriptions, and recording easements for all regulating ponds' inlet and outlet lines. Those conveyance facilities shown and prioritized in Table 7-8 have been identified as needing easements.

Table 7-8
Prescriptive Easements

Name Conveyance Facility	Priority
Flat system pond inlet and outlet lines	1
North Fields pond transition line	2
North Fields pond outlet line	3
City/South Fields Pond outlet lines	4
Chimney seeps pond inlet and outlet lines	5
Chimney upper pond inlet and outlet lines	6
Pete Hansen inlet and outlet lines	7
Last Chance pond inlet and outlet lines	8
Crawford pond inlet and outlet lines	9

Projected Benefits

Benefits of this measure include assurance that necessary right-of-way for water conveyance facilities are protected in perpetuity. This is critical to ensuring viable water delivery to shareholders.

WCE: "0"; O&M: "+"; S/L: "+++"

Estimated Costs

The costs for locating, documenting, and recording the prescriptive easements are estimated to be approximately $15,000.

Environmental Impacts

No environmental impacts or legal and institutional constraints are anticipated with this measure.

EI: "0" (None); L/IC: "0" (None)

Goal G-6: Explore Feasibility of Converting the 3rd, 4th, and 5th North System to a Pressurized Sprinkler System.

The 3rd, 4th, and 5th North System is the last significant agricultural system that is still flood irrigated. The Company would like to put these lands under a pressurized irrigation system. Converting to a pressure system would be a significant water conservation measure. The land lies a significant distance from the source, resulting in considerable water loss to seepage and evaporation from its conveyance through the open unlined ditches. Also, on-farm efficiencies would be greatly improved from pressurized sprinklers over flood irrigation.

The primary constraint to the project is funding. To what level would current water-users support the project? The system is primarily made up of small individually owned farms and costs of the project would create an extreme financial burden on those individuals, unless some cost-share support could be secured. The challenge therefore, would be in obtaining cost-share funding through some governmental program or entity.

CM-13. Determine User Interest and Support for Pressurized Sprinkler System.

This candidate measure consists of conducting a study among stakeholders and beneficiaries to determine water-user interest and support for converting the system from flood irrigation to a pressurized sprinkler system. The study would first gather data, such as: constraints to conversion, anticipated costs, potential cost-share opportunities, benefits of conversion, examples from other conversions, etc. This data would be condensed into a "paper" that would be made available to affected water-users and other interested stakeholders. Meetings, surveys, or other stakeholder interest survey means would be used to assess interest in the proposal.

This document and stakeholder survey could be prepared by the Company or through an engineering consultant hired by the Company.

Projected Benefits

The benefit of this action will be to help assess the feasibility of making changes within the 3rd, 4th and 5th North System. The study is the first step in potentially implementing a project that could conserve a significant quantity of water, as a much more efficient water management program is developed for the 3rd, 4th and 5th North System. It is difficult to quantify benefits at this time.

WCE: "0", if implemented "+++"; O&M: "0", if implemented "++"

Estimated Costs

Cost of the study is estimated at $4,000.

Environmental Impacts

There would be no environmental impacts associated with the study. If the study indicates support for the project, future action would move to CM-14 below.

EI: "0" (None); L/IC "0" (None)

CM-14. Determine Cost Feasibility for Conversion to Pressurized Sprinkler System.

After receiving a positive response from CM-13 above, this conservation measure would consist of a feasibility study performed by an engineering contractor selected by the Board of Directors. This study would gather design data, evaluate alternative solutions, and prepare feasibility-level designs and cost estimates.

Projected Benefits

The engineering study would be the first stem to implementing the conversion to a pressurized sprinkler system. If implemented, the conversion would yield significant water conservation benefits.

WCE: "0", if implemented "+++"; O&M: "0", if implemented "++"

Estimated Costs

Cost of the feasibility study is estimated at $12,000.

Environmental Impacts

There would be no environmental impacts associated with the study. The study would identify any proposed actions and evaluate potential environmental impacts from implementing those actions.

EI: "0" (None); L/IC "0" (None)

Goal G-7. Establish Management Procedures for Improved Water Management and Conservation

CM-15. Complete Pressure Irrigation System Acreage Audits

During 2005, the Company began the process of completing an audit of all of our pressure irrigation systems. The intent of this audit is, first, to assure that all acres utilizing a pressure irrigation system are being assessed, and second, to collect data to be used to better manage each system.

This audit consists of using GPS equipment to map out all agricultural land being watered by a sprinkler system and then downloading this information into a computer program to detail the acreage of each systems use. Currently, approximately 80% of the audit is complete.

Projected Benefits
Completing the audits will give the Company's management the ability to see where each system stands in its feed capacity and will therefore facilitate informed decisions regarding management of, and future improvements to, each system. Although improving management improves efficiency, it is difficult to quantify water saved from implementing this measure.
WCE: "++"; O&M: "+"

Estimated Costs
Costs (staff time and materials) are estimated at $2,000.

Environmental Impacts
Implementing this measure would cause no environmental impacts and would not have any legal or institutional constraints.
EI: "0" (None;, L/IC: "0" (None)

CM-16. Establish Procedures for Better Management of Class B Water Use

The Company has approximately 7,600 shares of outstanding Class B stock, with the ability to issue an additional 7,400 shares (up to 15,000 shares). This is a secondary or high water-right to be used by these share-holders when all Class A water is being utilized and there is excess water available within the Company's water-rights.

The Company would like to establish policies and procedures to address Class B stock so it can be utilized as it was intended. It should also be noted that Class B stock is not currently being assessed by the Company due the lack of established policies for its use. The Company believes that this secondary water-right should be assessed in some way as it is a valid water-right and is a benefit to stockholders who use it.

Projected Benefits
Implementing this measure would improve the Company's ability to manage its water-rights and is expected to yield significant water conservation benefits.
WCE: "++"

Estimated Costs
Costs (staff time and materials) are estimated at $5,000.

Environmental Impacts
Better management of the Company's Class B stock is not expected to have any measurable impacts to environmental resources or have legal or institutional constraints.
EI: "0" (None); L/IC: "0" (None)

CM-17. Update Water Conservation Program

As mentioned in Section V, the Company currently has an effective water management program that includes policies and procedures that help guide their water management decisions. This program has been very effective in the past and the Board of Directors would like to continue to improve the program to make it even more effective in the future.

Included in the existing program are policies and procedures for water measurement and accounting, water pricing and billing, water education, use of water, water transfers, and operation and maintenance. The Board of Directors would like to improve current measures and add new ones, as appropriate. Among these additional improvements would be better procedures for dealing with City System use issues (Goal-4), improved procedures for accounting and assessing Class B stock (CM-16), and others.

Projected Benefits
Implementing this measure would improve the Company's ability to manage its water-rights and is expected to yield measurable water conservation benefits.
WCE: "+"

Estimated Costs
Costs (staff time and materials) are estimated at $5,000.

Environmental Impacts
Better management of the Company's water-rights through improved water conservation is not expected to have any measurable impacts to environmental resources or have legal or institutional constraints.
EI: "0" (None); L/IC: "0" (None)

Summary

The goals and candidate measures described above are summarized in Table 7-9.

Table 7-9
Summary of Goals and Candidate Measures

Goal	Candidate Measure
G-1. Bring existing diversion dams and other project structures to current standards.	CM-1. Rehabilitate and upgrade diversion structures CM-2. Upgrade creek crossings. CM-3. Upgrade PRV structures.
G-2. Increase storage/regulating capacity within the system.	CM-4. Investigate feasibility of constructing new storage (Freeman-Allred pond). CM-5. Rehabilitate existing regulating ponds.
G-3. Rehabilitate and upgrade deteriorating conveyance systems.	CM-6. Concrete-lined canal on the Flat CM-7. Chimney System flume ditch CM-8. Last Chance System open ditch (pond inlet).
G-4. Develop a strategy for addressing the challenges within the City System.	CM-9. Develop a plan for dealing with City System use issues. CM-10. Install meters within the City System. CM-11. Investigate feasibility of separating City/South Field pond into two systems with two ponds, one for each system.
G-5. Acquire prescriptive easements for all regulating ponds' main inlet and outlet piping where no easement exists.	CM-12. Acquire necessary easements.
G-6. Explore feasibility of converting the 3rd, 4th, and 5th North System to a pressurized sprinkler system.	CM-13. Determine user interest and support for pressurized sprinkler system. CM-14. Determine cost feasibility for conversion to pressurized sprinkler system.
G-7. Continue proactive management for improved water management and conservation.	CM-15. Complete pressure irrigation system acreage audits. CM-16. Establish procedures for better management of Class B water-use. CM-17. Update water conservation program.

SECTION VIII – CANDIDATE MEASURE EVALUATION

Each of the candidate measures identified in Section 7 is brought forward to this section and evaluated against a set of evaluation criteria to determine which should be adopted into the implementation plan.

Evaluation Criteria

Each of the candidate measures will be evaluated based on three factors: 1) Projected Benefits, 2) Impacts or Constraints, and 3) Cost.

Projected Benefits

Water Conservation Efficiency (WCE) is the degree to which implementation of the measure would improve the efficiency of the system and conserve water. Operation and Maintenance (O&M) is the degree to which implementation would improve operation and maintenance efficiency or reduce costs. Safety and Liability (S/L) is the degree to which implementation would affect the safety and/or liability of the structure.

The criteria for each of the three categories of benefits range from a "-" rating which indicates a negative benefit to a "+++" which indicates a substantially positive benefit. A "0" rating indicates no benefit or an unknown benefit. An example of a "+" benefit would be a measure that adds overall efficiency, but no specific water conservation improvement can be quantified. Whereas a "++" or a "+++" rating would indicate some quantifiable conservation amount would be anticipated in addition to the overall efficiency improvement.

Impacts or Constraints

Impacts or constraints include "Environmental Impacts (EI)", and "Legal and Institutional Constraints (L/IC)". The criteria range from a "-1" indicating a negative impact to a "3" which indicates a substantially positive impact. A "0" rating indicates no known impact. The ratings, in addition to portraying the degree of anticipated impact, also indicate the degree of control the Association has with respect to implementation. For example, a "0" rating indicates full control by the Association to implement the measure without needs for outside permits or approvals. A "3", on the other hand, would indicate a measure that has significant public interest and could require numerous permits and approvals.

Cost

Appraisal-level costs have been estimated for each of the measures. These are capital costs for design and construction only, and do not include costs of financing, or other soft costs.

Summary

Table 8-1 summarizes the evaluation criteria ratings.

Table 8-1
Evaluation Criteria Summary

Factor	Negative	No Change	Positive		
			Minor	Moderate	Substantial
Projected Benefits • Water Conservation Efficiency • Operation and Maintenance • Safety and Liability	--	0	+	++	+++
Potential Impacts or Constraints • Environmental • Legal and Institutional	-1	0	1	2	3

Candidate Measure Evaluation

Table 8-2 summarizes the evaluation of each of the candidate measures against the evaluation criteria mentioned above.

Table 8-2
Candidate Measure Evaluation Summary

Candidate Measure	Projected Benefits			Potential Impacts		Costs ($)
	WCE	O&M	S/L	EI	L/IC	
CM-1. Rehabilitate and upgrade diversion structures	+	+++	0	1	1	315,000
CM-2. Upgrade creek crossings.	0	0	++	1	1	35,000
CM-3. Upgrade PRV structures.	0	0	++	1	1	24,000
CM-4. Investigate feasibility of constructing new storage (Freeman-Allred pond).	0/++	0	0	0	0	15,000
CM-5. Rehabilitate existing regulating ponds.	++	++	0	2	1	540,000
CM-6. Concrete-lined canal on the Flat	++	+	+	1	1	218,000
CM-7. Chimney System flume ditch	++	+	0	1	1	23,000
CM-8. Last Chance System open ditch (pond inlet).	++	+	+	1	1	145,000
CM-9. Develop a plan for dealing with City System use issues.	0/++	+	0	0	0	7,000
CM-10. Install meters within the City System.	+++	+	0	1	1	125,000
CM-11. Investigate feasibility of separating City/South Field pond into two systems with two ponds, one for each system.	0/++	+	0	0	0	15,000
CM-12. Acquire necessary easements.	0	+	+++	0	2	15,000
CM-13. Determine user interest and support for pressurized sprinkler system.	0/+++	0/++	0	0	0	4,000
CM-14. Determine cost feasibility for conversion to pressurized sprinkler system.	0/+++	0/++	0	0	0	12,000
CM-15. Complete pressure irrigation system acreage audits.	++	++	0	0	0	2,000
CM-16. Establish procedures for better management of Class B water-use.	++	++	0	0	0	5,000
CM-17. Update water conservation program.	+	++	0	0	0	5,000
Total Estimated Cost of All Measures						**1,505,000**

* WCE Water Conservation Efficiency
* O&M Operation and Maintenance
* S/L Safety and Liability
* EI Environmental Impacts
* L/IC Legal and/or Institutional Constraints

SECTION IX – IMPLEMENTATION PLAN

Based on the evaluation described in Section VIII and summarized in Table 8-2, the Board of Directors selected all 17 candidate measures for implementation. The schedule and cost of implementation is shown in Table 9-1.

Table 9-1
Implementation Plan

Schedule	Adopted Measure	Cost
2008	CM-3. Upgrade all seven PRV structures	$24,000
	CM-7. Chimney System flume ditch	$23,000
	CM-13. Determine user interest and support for pressurized sprinkler system 3rd, 4th, 5th North	$4,000
	CM-15. Complete pressure irrigation system acreage audits.	$2,000
	Total 2008	**$53,000**
2009	CM-1. Rehabilitate/upgrade diversion structures: Chimney flume ditch, Chimney flume pond, Flat pond, Crawford, Oak Creek main, Oak Creek high water, Canal/City Creek high water, Last Chance	$145,000
	CM-4. Investigate feasibility of constructing new storage (Freeman-Allred pond).	$15,000
	CM-9. Develop a plan for dealing with City System use issues.	$7,000
	CM-11. Investigate feasibility of separating City/South Field pond into two systems with two ponds, one for each system.	$15,000
	CM-12. Acquire necessary easements.	$15,000
	CM-14. Determine cost feasibility for conversion to pressurized sprinkler system 3rd, 4th, 5th North.	$12,000
	Total 2009	**$209,000**
2010	CM-1. Rehabilitate/upgrade diversion structures: Flat concrete ditch, North fields pond transition lines inlet (both), 1st & 2nd North pond high water diversion (Oak Creek), 3rd,4th,5th Chimney upper pond, Pete Hansen, Chimney seeps diversion (Sherms pond), Point ditch upper and lower	$170,000
	CM-2. Upgrade creek crossings: Oak Creek high water, access to Pete Hansen diversion.	$22,000
	CM-5. Rehabilitate existing regulating ponds: Crawford	$120,000
	CM-6. Pipe concrete-lined canal on the Flat	$218,000
	CM-8. Last Chance System open ditch (pond inlet).	$145,000
	CM-10. Install meters within the City System.	$125,000
	CM-16. Establish procedures for better management of Class B water-use.	$5,000
	Total 2010	**$805,000**
2011	CM-2. Upgrade creek crossings: Canal canyon main diversion	$13,000
	CM-5. Rehabilitate existing regulating ponds: Chimney upper, Chimney seeps	$180,000
	Total 2011	**$193,000**
2012	CM-5. Rehabilitate existing regulating ponds: North Fields, Pete Hansen, Last Chance, Flat.	$240,000
	CM-17. Update water conservation program.	$5,000
	Total 2012	**$245,000**
Total Program Cost of All Measures		**$1,505,000**

Monitoring and Evaluation

Monitoring and evaluation of the implementation plan will occur in two ways. First, the Board of Directors will review progress on an annual basis. The prior year's progress will be evaluated and plans for the coming year formalized. The implementation plan portion of this report will be modified, as necessary, to reflect changes in the plan.

Monitoring and evaluation will also occur once every five years with the update of this Water Management and Conservation Plan. The Board of Directors will evaluate progress, re-assess needs, and modify the plan based on the most current information at the time.

Appendix 1
Photographs of Company Facilities

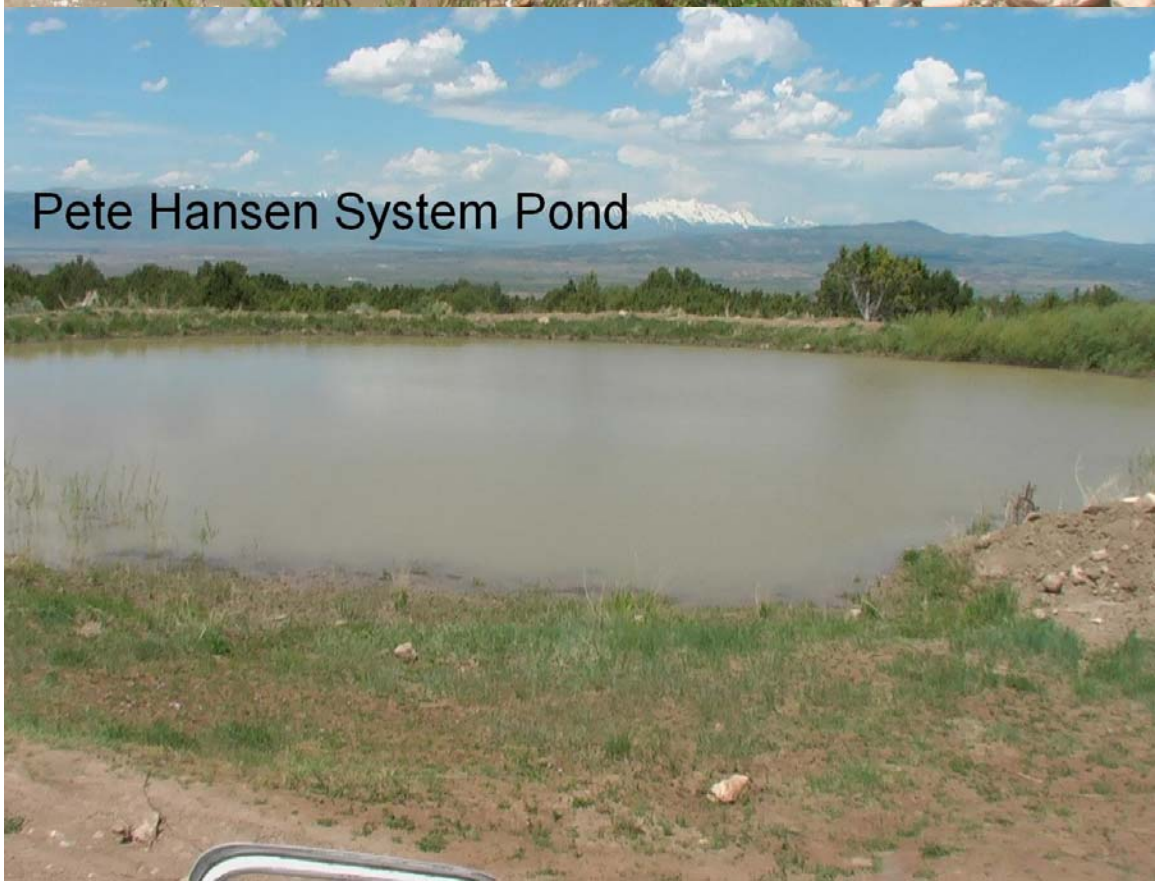

Oak Creek Diversion Structure


Oak Creek


Oak Creek High Water Diversion


Oak Creek Diversion Crossing


Pete Hansen Diversion


Pete Hansen System Pond


Pete Hansen Diversion Crossing


Last Chance Diversion


Last Chance System Pond


1st & 2nd North Systems Pond


1st & 2nd North Pond, High
Water Ditch Diversion


City Pond diversion

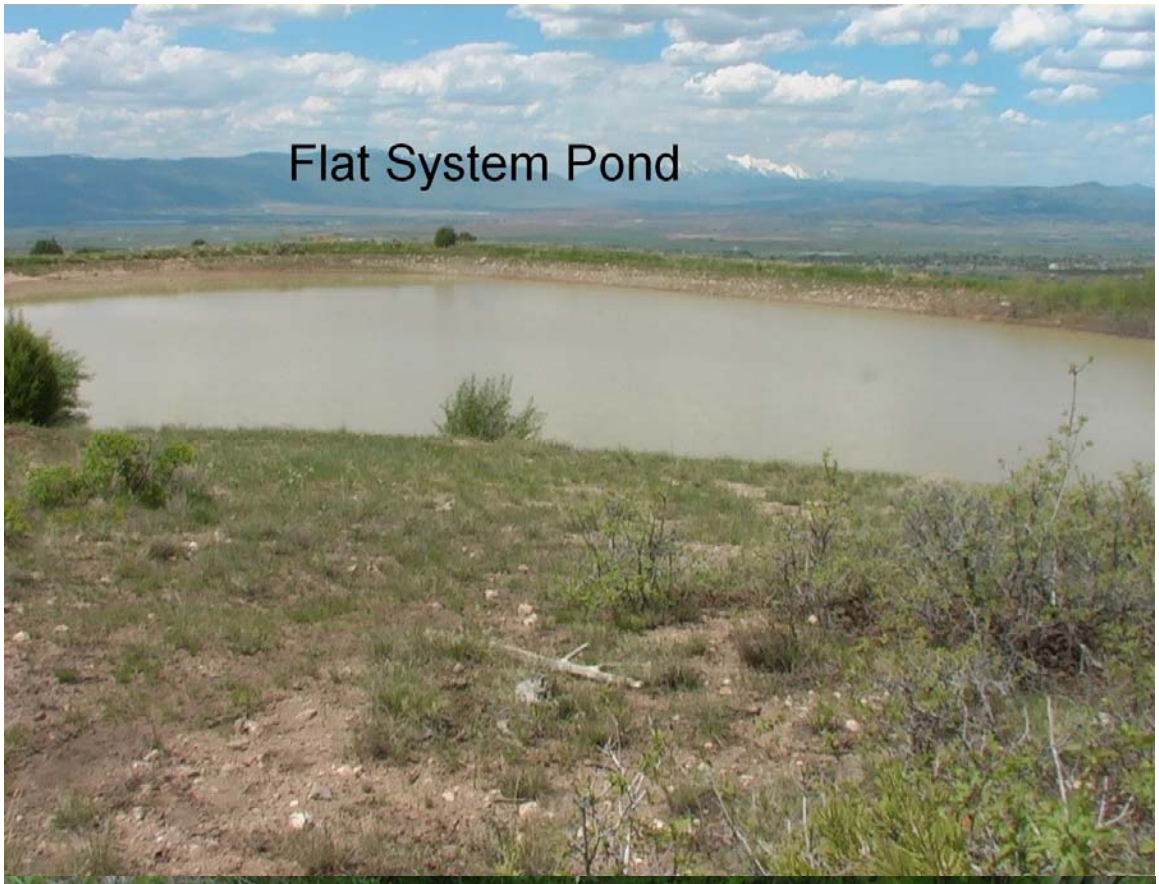

City/South fields pond

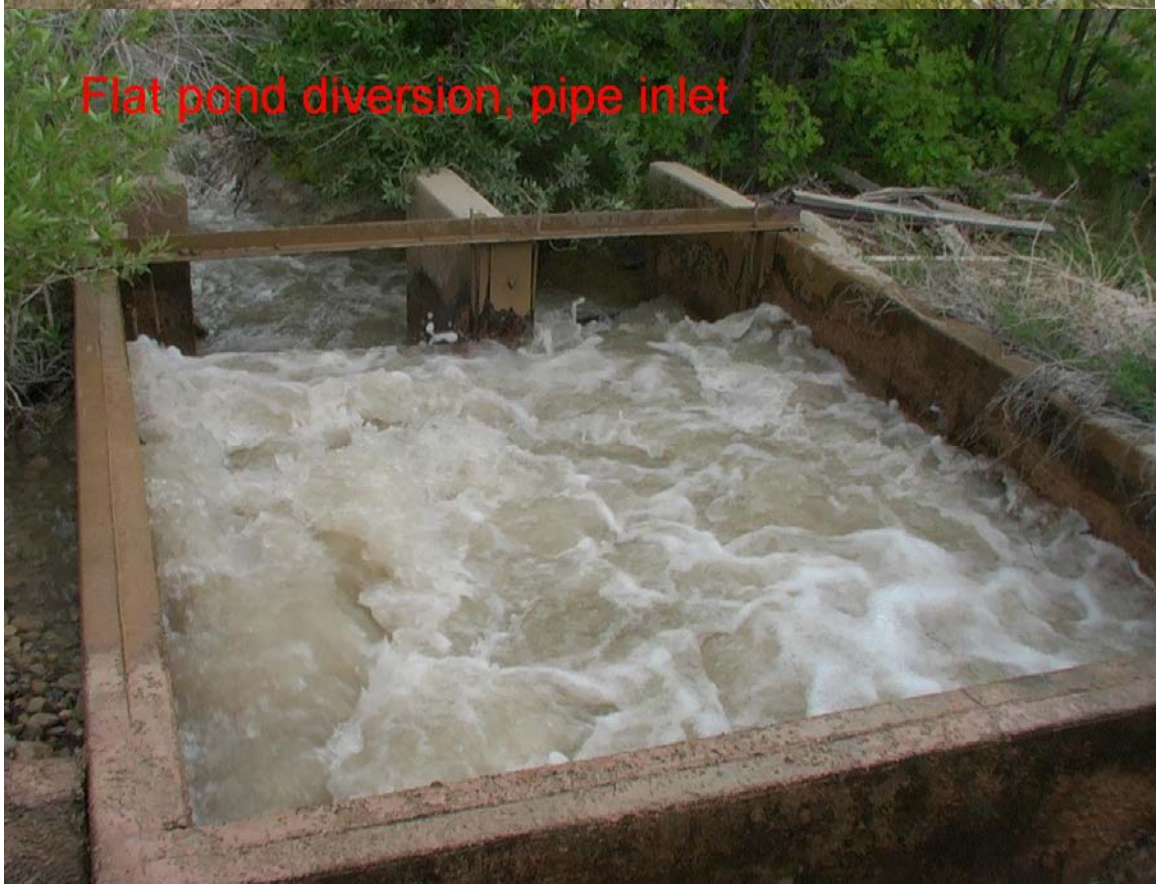

Canal Creek Diversion Structure


Canal Creek Diversion Crossing

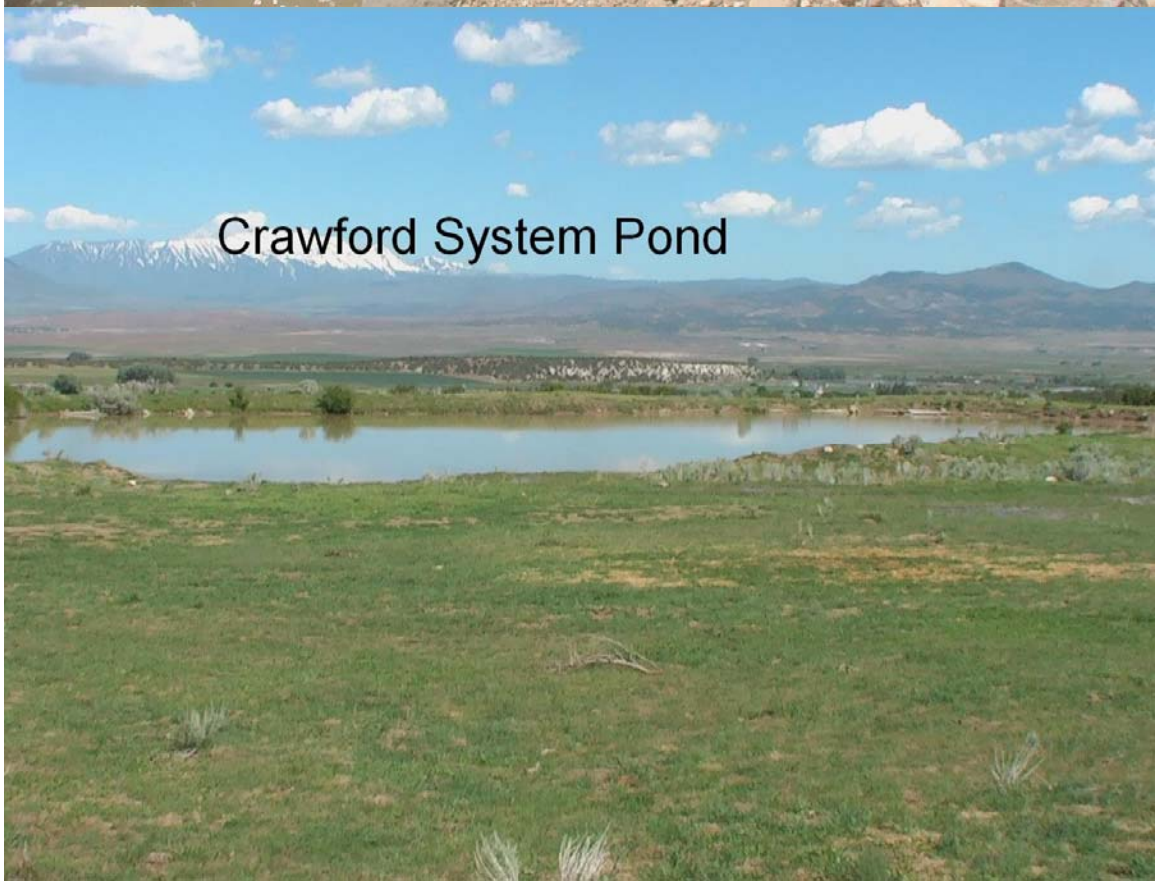

Flat system diversion at canal
Also Feeds Transmission line


Concrete Ditch To Flat Pond


Flat System Pond


Flat pond diversion, pipe inlet


Crawford System Diversion


Crawford System Pond


Transmission Line Diversion

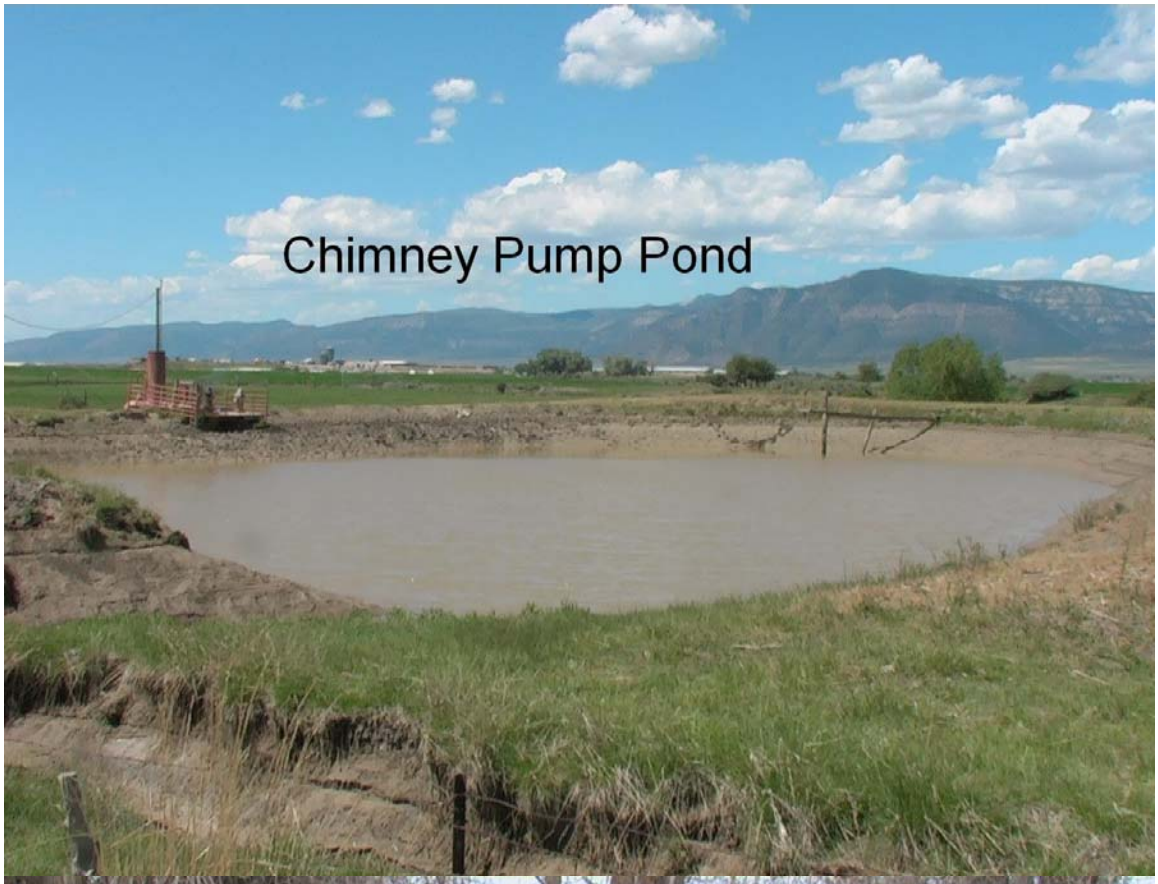

Lower Transmission line
Diversion


Chimney upper Pond &
North Field Ditch Diversion


Chimney Upper Pond


Point Ditch Lower Diversion


Canal Creek High Water Diversion

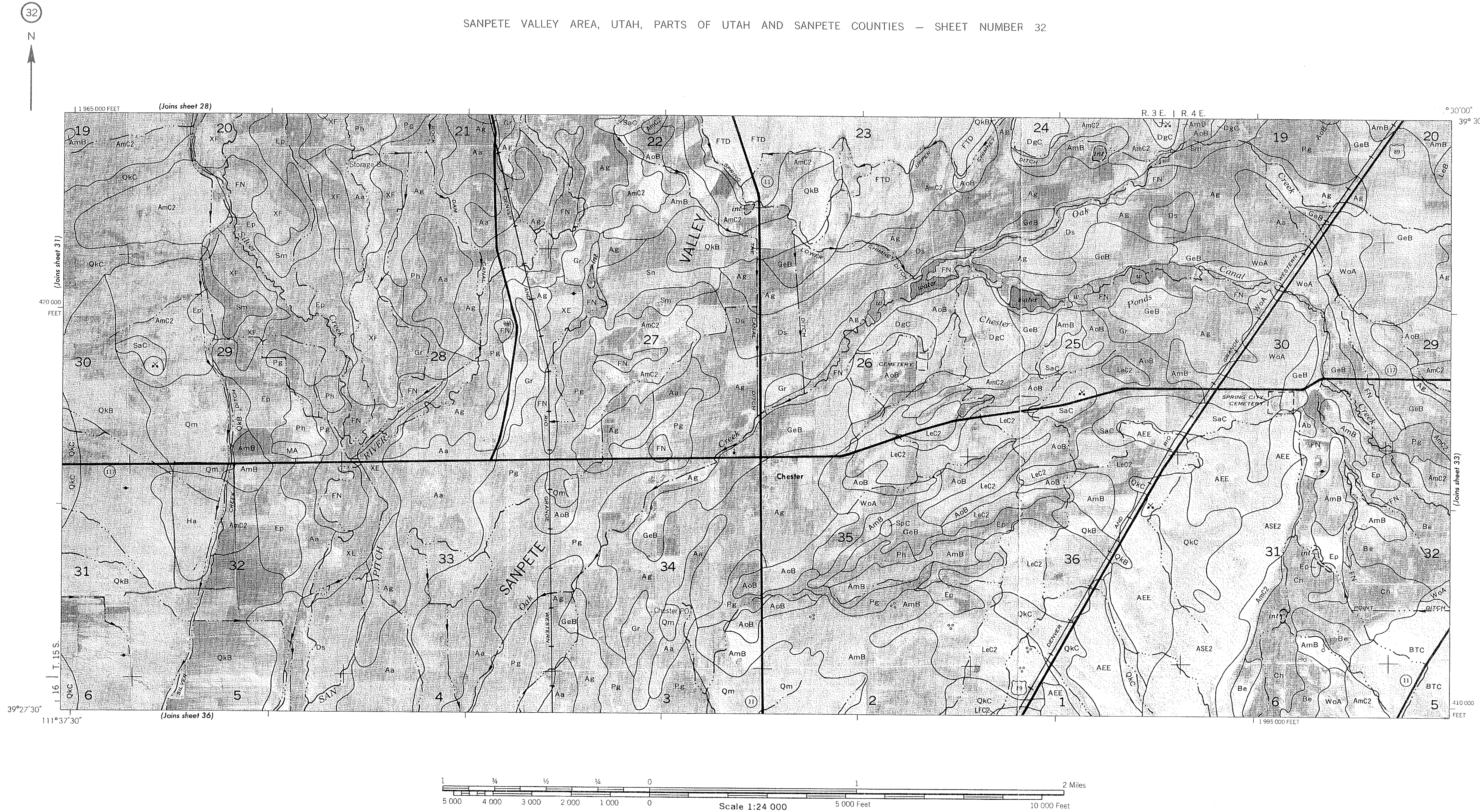

Chimney Pump Pond


Point Ditch Upper Diversion


Chimney Seeps Pond Diversion


Chimney Seeps pond

Appendix 2
Soil Type Listings


N
(Joins sheet 28)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 36)
R. 3 E. | R. 4 E.
T. 15 S.
16
39° 30′00″
39°27′30″
111°37′30″
1 965 000 FEET
420 000 FEET
410 000 FEET
1 995 000 FEET
Chester
Chester P.O.
SANPETE
VALLEY
SAN PITCH RIVER
SPRING CITY CEMETERY
CEMETERY
Storage Bin
Oak Creek
Chester Ponds
Canal
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet
Scale 1:24 000

N

111° 30'00"

39° 30'00"

R. 4 E. | R. 5 E.

(Joins sheet 29)

2 035 000 FEET

420 000 FEET

(Joins sheet 34)

(Joins sheet 32)

410 000 FEET

2 000 000 FEET

T. 15 S. | T. 16 S.

39°27'30"

111° 22'30"

(Joins sheet 37)

Spring City

CEMETERY

Water Tank

Powerhouse

Gaging Station

Creek

Canal

DITCH

RACE

CHANCE

POINT

ALLRED

Freeman Meadow

Allred

MANTI-LASAL NATIONAL FOREST

NATIONAL FOREST BOUNDARY

SOIL SURVEY LIMIT OF

AmB AmC2 Ag AoB BTC Be BUD2 CNC DCD DFF DKD FRE2 GeB LeB LGE LKG LLE MHG MKG MLD MoC PDC Pg QkC SSD TGG TSD ToB ToC WoA ZTE

1 ¾ ½ ¼ 0 1 2 Miles

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet 10 000 Feet

Scale 1:24 000

GUIDE TO MAPPING UNITS

[Wildlife groups are described on pages 116 and 117]

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site Page	Wildlife suitability group Number
Aa	Abcal silty clay loam---	11	-------	--	Vw-2	97	Wet Meadows	113	3212
Ab	Abcal silty clay loam, strongly saline-------	11	-------	--	VIIw-28	100	Salt Meadows	107	4424
Ac	Abcal-Cache complex-----	11	-------	--	VIIw-28	100	Salt Meadows	107	4424 4434
ADG	Adel silt loam, 40 to 80 percent slopes--------	11	-------	--	VIIe-H	99	High Mountain Loam	104	3141
AEE	Amtoft flaggy loam, 8 to 30 percent slopes-----	12	-------	--	VIIs-S	100	Semi-desert Shallow Loam	109	4343
AFG2	Amtoft-Rock outcrop complex, 30 to 60 percent slopes, eroded--------	12	-------	--	VIIs-S	100	Semi-desert Shallow Loam	109	4343
Ag	Anco silty clay loam----	13	IIIw-2	96	-------	---	----------	---	2121-I 2121
AHD	Ant Flat stony loam, 8 to 25 percent slopes--	14	-------	--	VIe-M	98	Mountain Loam	106	2141
AHE2	Ant Flat stony loam, 25 to 40 percent slopes, eroded----------	14	-------	--	VIe-M	98	Mountain Loam (Oak)	106	2141
AkC	Ant Flat loam, low rainfall, 4 to 8 percent slopes----------	14	-------	--	IIIe-U	96	Upland Loam	110	2141
ALD	Ant Flat-Borvant complex, 4 to 25 percent slopes----------	14	-------	--	VIs-U	99			
	Ant Flat soil-------	--	-------	--	-------	---	Upland Loam	110	2141
	Borvant soil--------	--	-------	--	-------	---	Upland Shallow Hardpan (Juniper-Pinon)	111	3242
AmB	Arapien fine sandy loam, 1 to 2 percent slopes-	15	IIe-2	95	VIIe-S	99	Semi-desert Limy Loam	108	1141-I 3342
AmC2	Arapien fine sandy loam, 2 to 5 percent slopes, eroded----------	15	IIIe-2	95	VIIe-S	99	Semi-desert Limy Loam	108	1141-I 3342
AmD2	Arapien fine sandy loam, 5 to 10 percent slopes, eroded--------	15	IVe-2	97	VIIe-S	99	Semi-desert Limy Loam	108	3342
AnB	Arapien fine sandy loam, saline-alkali, 1 to 2 percent slopes--------	16	-------	--	VIIw-28	100	Alkali Bottoms	104	4434
AoB	Arapien fine sandy loam, wet, 1 to 2 percent slopes----------	16	IIIw-2	96	VIw-2	98	Semi-wet Meadows	110	2121-I 2121
ApC2	Arapien clay loam, gravelly subsoil, 2 to 5 percent slopes, eroded----------	16	IIIe-2	95	VIIe-S	99	Semi-desert Limy Loam	108	1141-I 3342
ARD	Arapien-Calita complex, 2 to 15 percent slopes----------	16	-------	--	IVe-UZ	97	Upland Loam	110	3242

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site Page	Wildlife suitability group Number
ASE2	Atepic shaly clay loam, 10 to 30 percent slopes, eroded	17	-------	--	VIIs-U	101	Upland Shallow Shale (Juniper-Pinon)	112	4343
ATF	Atepic very cobbly silty clay loam, 8 to 40 percent slopes	17	-------	--	VIIs-U	101	Upland Shallow Shale (Juniper-Pinon)	112	4343
AUF	Atepic clay loam, red variant-Rock outcrop complex, 30 to 50 percent slopes	18	-------	--	VIIs-S	100	Semi-desert Shallow Loam	109	4343
AV	Atepic-Badland association	18							
	Atepic soil	--	-------	--	VIIs-U	101	Upland Shallow Shale (Juniper-Pinon)	112	4343
	Badland	--	-------	--	VIIIe-E	101	-------	---	----
BA	Badland	18	-------	--	VIIIe-E	101	-------	---	----
BCE	Bagard very stony clay loam, 10 to 40 percent slopes	19	-------	--	VIIs-U	101	Upland Stony Loam (Juniper-Pinon)	112	3242
BDE	Bagard-Sanpitch complex, 8 to 40 percent slopes	19	-------	--	VIIs-U	101	Upland Stony Loam (Juniper-Pinon)	112	3242
Be	Beek silty clay loam	20	IIIw-2	96	VIw-2	98	Semi-wet Meadows	110	2121-I 2121
BFD	Bezzant cobbly loam, 4 to 25 percent slopes	21	IVs-24	97	VIs-U	99	Upland Stony Loam	111	3242
BGE	Bezzant stony loam, 25 to 40 percent slopes	21	-------	--	VIs-U	99	Upland Stony Loam	111	3242
BH	Bezzant-Gappmayer-Rock land association, very steep	21							
	Bezzant soil	--	-------	--	VIIIe-X	101	-------	---	----
	Gappmayer soil	--	-------	--	VIIIe-X	101	-------	---	----
	Rock land	--	-------	--	VIIIs-X	101	-------	---	----
Bm	Billings silty clay loam	22	IIIe-25	96	VIIIe-S	99	Semi-desert Loam	109	1141-I 3342
BnB	Birdow very fine sandy loam, 2 to 4 percent slopes	22	IIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
BnC	Birdow very fine sandy loam, 4 to 8 percent slopes	23	IIIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
BoB	Birdow silt loam, 2 to 4 percent slopes	23	IVs-24	97	-------	--	-------	---	1141-I
BRD2	Borvant cobbly loam, 8 to 25 percent slopes, eroded	23	-------	--	VIIs-U	101	Upland Shallow Hardpan (Juniper-Pinon)	111	3242

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site Page	Wildlife suitability group Number
BSE2	Borvant-Bagard complex, 10 to 40 percent slopes, eroded	24	-------	--	VIIs-U	101	-------	---	3242
	Borvant soil	--	-------	--	-------	---	Upland Shallow Hardpan (Juniper-Pinon)	111	
	Bagard soil	--	-------	--	-------	---	Upland Stony Loam (Juniper-Pinon)	112	
BTC	Borvant-Doyce complex, 2 to 10 percent slopes	25	-------	--	VIs-U	99	-------	---	3242
	Borvant soil	--	-------	--	-------	---	Upland Shallow Hardpan (Juniper-Pinon)	111	
	Doyce soil	--	-------	--	-------	---	Upland Loam	110	
BUD2	Borvant-Lodar complex, 8 to 25 percent slopes, eroded	25	-------	--	VIIs-U	101	-------	---	3242
	Borvant soil	--	-------	--	-------	---	Upland Shallow Hardpan (Juniper-Pinon)	111	
	Lodar soil	--	-------	--	-------	---	Upland Shallow Loam (Juniper-Pinon)	112	
BVG	Bradshaw very stony loam, 60 to 80 percent slopes	26	-------	--	VIIIe-X	101	-------	---	3242
CaB	Calita loam, 2 to 4 percent slopes	27	IIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
CaC	Calita loam, 4 to 8 percent slopes	27	IIIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
Cb	Canburn silty clay loam	28	-------	--	Vw-2	97	Wet Meadows	113	3212
CcB	Centerfield silty clay loam, 1 to 2 percent slopes	28	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
CcC2	Centerfield silty clay loam, 2 to 5 percent slopes, eroded	29	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
CDG	Cheadle very flaggy silt loam, 40 to 70 percent slopes	29	-------	--	VIIs-M	100	Mountain Shallow Loam	107	3242
Ch	Chipman silty clay loam	30	-------	--	Vw-2	97	Wet Meadows	113	3212
Cm	Chipman complex	30	-------	--	Vw-2	97	Wet Meadows	113	3212
CNC	Clegg loam, 3 to 10 percent slopes	31	-------	--	IIIe-M	96	Mountain Loam	106	2141
CoC	Collard gravelly sandy loam, 4 to 8 percent slopes	32	IVs-24	97	VIs-U	99	Upland Stony Loam	111	3242-I 3242
CRD	Collard stony sandy loam, 4 to 20 percent slopes	32	-------	--	VIs-U	99	Upland Stony Loam (Juniper-Pinon)	112	3242

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site Page	Wildlife suitability group Number
CsC	Crestline fine sandy loam, 2 to 5 percent slopes	33	------	--	VIe-S	98	Semi-desert Loam	109	3342
CU	Cryoborolls	33	------	--	VIIe-H	99	High Mountain Stony Loam (Aspen)	105	3141
DAG	Daybell gravelly silt loam, 40 to 70 percent slopes	34	------	--	VIIe-H	99	High Mountain Stony Loam (Aspen)	105	3141
DBG	Daybell-Flygare association, very steep	34	------	--	------	---	------	---	3141
	Daybell soil	--	------	--	VIIe-H	99	High Mountain Stony Loam (Aspen)	105	
	Flygare soil	--	------	--	VIIs-HC	100	------	---	
DcD	Deer Creek stony silt loam, 6 to 30 percent slopes	35	------	--	VIe-U	98	Upland Loam	110	2141
DED	Deer Creek stony silt loam, high rainfall, 6 to 25 percent slopes	35	------	--	VIe-M	98	Mountain Loam (Oak)	106	2141
DEE	Deer Creek stony silt loam, high rainfall, 25 to 40 percent slopes	36	------	--	VIe-M	98	Mountain Loam (Oak)	106	2141
DFF	Deer Creek-Mower complex, 25 to 50 percent slopes	36	------	--	VIe-M	98	------	---	2141
	Deer Creek soil	--	------	--	------	---	Mountain Loam (Oak)	106	
	Mower soil	--	------	--	------	---	Mountain Shallow Loam	107	
DgC	Denmark gravelly loam, 2 to 5 percent slopes	37	------	--	VIIs-S	100	Semi-desert Shallow Loam	109	4343
DhD	Donnardo cobbly loam, 4 to 16 percent slopes	38	------	--	VIs-U	99	Upland Stony Loam	111	3242
DKD	Donnardo very stony loam, 4 to 16 percent slopes	38	------	--	VIIs-U	101	Upland Stony Loam (Juniper-Pinon)	112	3242
DLD	Donnardo bouldery loam, 4 to 16 percent slopes	38	------	--	VIIs-U	101	Upland Stony Loam	111	3242
DoB	Doyce loam, 2 to 4 percent slopes	39	IIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
DoC	Doyce loam, 4 to 8 percent slopes	39	IIIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
DrB	Doyce loam, wet, 2 to 4 percent slopes	39	IIe-2	95	------	---	------	---	1141-I
Ds	Dyreng silty clay	40	IIIw-2	96	------	---	------	---	1141-I

Map symbol	Mapping unit	Described on page	Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Wildlife suitability group Number
Dy	Dyreng silty clay, strongly saline	40	-------	--	VIIw-28	100	Alkali Bottoms	104	4424
Ep	Ephraim silty clay loam-	41	IIIw-2	96	VIw-2	98	Semi-wet Meadows	110	2121-I 2121
FN	Fluvaquents	41	-------	--	Vw-2	97	Wet Meadows	113	3212
FOD	Fontreen cobbly loam, 4 to 20 percent slopes	43	-------	--	VIs-U	99	Upland Stony Loam (Juniper-Pinon)	112	3242
FRE2	Fontreen very cobbly loam, 20 to 40 percent slopes, eroded	43	-------	--	VIIs-U	101	Upland Stony Loam (Juniper-Pinon)	112	3242
FRG2	Fontreen very cobbly loam, 40 to 70 percent slopes, eroded	43	-------	--	VIIs-U	101	Upland Stony Loam (Juniper-Pinon)	112	3242
FSD2	Fontreen-Borvant complex, 4 to 25 percent slopes, eroded	43	-------	--	VIs-U	99	----------	---	3242
	Fontreen soil	--	-------	--	-------	---	Upland Stony Loam (Juniper-Pinon)	112	
	Borvant soil	--	-------	--	-------	---	Upland Shallow Hardpan (Juniper-Pinon)	111	
FTD	Freedom-Amtoft complex, 2 to 30 percent slopes	44	-------	--	VIe-S	98			
	Freedom soil	--	-------	--	-------	---	Semi-desert Loam	109	1141-I 3342
	Amtoft soil	--	-------	--	-------	---	Semi-desert Shallow Loam	109	4343
GeB	Genola loam, 0 to 2 percent slopes	46	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
GeC2	Genola loam, 2 to 5 percent slopes, eroded	46	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
GeD2	Genola loam, 5 to 10 percent slopes, eroded	46	IVe-2	97	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
GkB	Genola loam, alkali, 0 to 2 percent slopes	46	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
GOF2	Gothic stony loam, 25 to 40 percent slopes, eroded	47	-------	--	VIe-H	98	High Mountain Loam	104	3141
Gr	Green River loam	48	IIIw-2	96	VIw-2	98	Semi-wet Meadows	110	2121-I 2121
Gu	Gullied land	48	-------	--	VIIIe-E	101	----------	---	----
Ha	Harding silt loam	49	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
HED	Harkers silt loam, 6 to 25 percent slopes	49	-------	--	VIe-M	98	Mountain Loam (Oak)	106	2141
HKE	Harkers stony silt loam, 25 to 40 percent slopes	49	-------	--	VIe-M	98	Mountain Loam (Oak)	106	2141

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Wildlife suitability group Number
KcB	Keigley silty clay loam, 2 to 4 percent slopes-	50	IIe-2	95	IVe-UZ	97	Upland Loam	110	1141-I 3242
KEG	Kitchell gravelly loam, 40 to 70 percent slopes----------	51	------	--	VIIs-HC	100	----------	---	3141
KM	Kitchell-Mower association----------	51							
	Kitchell soil-------	--	------	--	VIIs-HC	100	----------	---	3141
	Mower soil----------	--	------	--	VIs-M	99	Mountain Stony Loam	107	2141
Kp	Kjar peaty silt loam----	52	------	--	VIIw-28	100	Salt Meadows	107	4424
LdB	Linoyer very fine sandy loam, 1 to 2 percent slopes----------	53	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
LdC2	Linoyer very fine sandy loam, 2 to 5 percent slopes, eroded--------	53	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
LeB	Lisade loam, 1 to 2 percent slopes----------	54	IIe-2	95	VIIe-S	99	Semi-desert Limy Loam	108	1141-I 3342
LeC2	Lisade loam, 2 to 5 percent slopes, eroded---	54	IIIe-2	95	VIIe-S	99	Semi-desert Limy Loam	108	1141-I 3342
LFC2	Lisade-Sanpete complex, 2 to 5 percent slopes, eroded--------	54	-------	--	VIIe-S	99	----------	---	3342
	Lisade soil---------	--	-------	--	-------	--	Semi-desert Limy Loam	108	
	Sanpete soil--------	--	-------	--	-------	---	Semi-desert Stony Loam	109	
LGE	Lizzant very cobbly loam, 20 to 40 percent slopes ----------	55	-------	--	VIs-M	99	Mountain Stony Loam	107	3342
LHD	Lizzant stony loam, 4 to 20 percent slopes-----	55	-------	--	VIs-M	99	Mountain Stony Loam	107	3242
LKG	Lizzant very stony loam, 40 to 60 percent slopes----------	55	-------	--	VIIs-M	100	Mountain Stony Loam	107	3242
LLE	Lizzant-Clegg complex, 3 to 40 percent slopes--	55	-------	--	VIs-M	99			
	Lizzant soil--------	--	-------	--	-------	--	Mountain Stony Loam	107	3242
	Clegg soil----------	--	-------	--	-------	--	Mountain Loam	106	2141
LMF	Lizzant-Mower complex, 25 to 60 percent slopes----------	55	-------	--	VIIs-M	100	Mountain Stony Loam	107	3242
LNE	Lizzant-Sedwell complex, 5 to 40 percent slopes----------	55	-------	--	VIs-M	99			
	Lizzant soil--------	--	-------	--	-------	---	Mountain Stony Loam	107	3242
	Sedwell soil--------	--	-------	--	-------	---	Mountain Loam (Oak)	106	2141

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site Page	Wildlife suitability group Number
LOF	Lizzant-Kitchell association, steep	56							
	Lizzant soil	--	-------	--	VIIs-M	100	Mountain Stony Loam	107	3242
	Kitchell soil	--	-------	--	VIIs-HC	100	-------	---	3141
LRE	Lodar very channery loam, 8 to 40 percent slopes	56	-------	--	VIIs-U	101	Upland Shallow Loam (Juniper-Pinon)	112	3242
LSG	Lodar-Fontreen complex, 40 to 70 percent slopes	57	-------	--	VIIs-U	101	-------	---	3242
	Lodar soil	--	-------	--	-------	---	Upland Shallow Loam (Juniper-Pinon)	112	
	Fontreen soil	--	-------	--	-------	---	Upland Stony Loam (Juniper-Pinon)	112	
LTE	Lodar-Rock outcrop complex, 8 to 40 percent slopes	57	-------	--	VIIs-U	101			
	Lodar soil	--	-------	--	-------	---	Upland Shallow Loam (Juniper-Pinon)	112	3242
	Rock outcrop	--	-------	--	-------	---	-------	---	4444
LTG	Lodar-Rock outcrop complex, 40 to 70 percent slopes	57	-------	--	VIIs-U	101			
	Lodar soil	--	-------	--	-------	---	Upland Shallow Loam (Juniper-Pinon)	112	3242
	Rock outcrop	--	-------	--	-------	---	-------	---	4444
LUE	Lundy channery silt loam, 5 to 40 percent slopes	57	-------	--	VIs-M	99	Mountain Shallow Loam	107	3242
MA	Manassa-Mellor complex	58	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
MbC	Manila loam, 3 to 10 percent slopes	59	-------	--	IIIe-M	96	Mountain Loam (Oak)	106	2141
McB	Mayfield shaly loam, 2 to 5 percent slopes	60	-------	--	VIIe-S	99	Semi-desert Loam	109	3342
McB2	Mayfield shaly loam, 2 to 5 percent slopes, eroded	60	-------	--	VIIe-S	99	Semi-desert Loam	109	3342
Md	Mellor silt loam	61	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
Me	Mellor silt loam, leached surface	61	-------	--	VIe-S	98	Semi-desert Loam	109	3342
MfC	Moroni silty clay, 2 to 8 percent slopes	61	IIIe-25	96	IVe-UZ	97	Upland Clay	111	1141-I
MGD	Moroni-Atepic complex, 2 to 30 percent slopes	61	-------	--	IVe-UZ	97			
	Moroni soil	--	-------	--	-------	---	Upland Clay	111	3242
	Atepic soil	--	-------	--	-------	---	Upland Shallow Shale (Juniper-Pinon)	112	4343

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site Page	Wildlife suitability group Number
MHG	Mortenson silt loam, 40 to 70 percent slopes--	62	-------	--	VIIs-HC	100	----------	---	3141
MKG	Mortenson-Skylick association, very steep---	62	-------	--	-------	---	----------	---	3141
	Mortenson soil------	--	-------	--	VIIs-HC	100	----------	---	
	Skylick soil--------	--	-------	--	VIIe-H	99	High Mountain Loam (Aspen)	105	
MLD	Mortenson fine sandy loam, thin solum variant, 8 to 30 percent slopes----------	63	-------	--	VIIs-HC	100	----------	---	3141
MmC	Mountainville very stony sandy loam, 2 to 8 percent slopes--------	65	-------	--	VIIs-U	101	Upland Stony Loam	111	3242
MnC	Mountainville very stony loam, cool, 3 to 10 percent slopes--------	65	-------	--	VIs-M	99	Mountain Stony Loam	107	3242
MoC	Mountainville-Doyce complex, 2 to 8 percent slopes----------	65	-------	--	VIIs-U	101	----------	---	3242
	Mountain soil-------	--	-------	--	-------	---	Upland Stony Loam	111	
	Doyce soil----------	--	-------	--	-------	---	Upland Loam	110	
MrD	Mountainville cobbly fine fine sandy loam, hardpan variant, 4 to 20 percent slopes--------	66	-------	--	VIs-U	99	Upland Stony Loam	111	3242
MSD	Mower clay loam, 5 to 30 percent slopes--------	67	-------	--	VIs-M	99	Mountain Stony Loam	107	2141
MTD	Mower stony clay loam, 5 to 30 percent slopes--	67	-------	--	VIs-M	99	Mountain Stony Loam	107	2141
MUF2	Mower very stony loam, 25 to 50 percent slopes, eroded--------	67	-------	--	VIIs-M	100	Mountain Stony Loam	107	3242
MVE	Mower-Lundy complex, 5 to 40 percent slopes--	67	-------	--	VIs-M	99			
	Mower soil----------	--	-------	--	-------	---	Mountain Stony Loam	107	2141
	Lundy soil----------	--	-------	--	-------	---	Mountain Shallow Loam	107	3242
ObC	Obrast clay loam, low rainfall, 2 to 8 percent slopes----------	68	-------	--	IIIe-U	96	Upland Clay	111	3242
OCD	Obrast silty clay, 4 to 25 percent slopes-----	68	-------	--	VIe-M	98	Mountain Clay	106	2141
ODD	Obrast silty clay, shale substratum, 8 to 25 percent slopes--------	68	-------	--	VIe-M	98	Mountain Clay	106	2141
PaC	Pavant loam, 4 to 8 percent slopes----------	69	-------	--	VIIs-U	101	Upland Shallow Hardpan (Juniper-Pinon)	111	3242

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PDC	Pavant-Doyce complex, 2 to 8 percent slopes	70	-------	--	VIs-U	99	----------	---	3242
	Pavant soil	--	-------	--	--------	--	Upland Shallow Hardpan (Juniper-Pinon)	111	
	Doyce soil	--	-------	--	--------	--	Upland Loam	110	
Pe	Peteetneet peat	70	-------	--	Vw-2	97	Wet Meadows	113	3212
Pg	Poganeab silt loam	71	-------	--	Vw-2	97	Wet Meadows	113	3212
Ph	Poganeab silt loam, strongly saline-alkali	71	-------	--	VIIw-28	100	Salt Meadows	107	4424
Pk	Poganeab silt loam, high lime variant	72	-------	--	Vw-2	97	Wet Meadows	113	3212
PRF	Pritchett stony fine sandy loam, 30 to 70 percent slopes	72	-------	--	VIIe-H	99	High Mountain Loam	104	3141
PTE	Pritchett silt loam, 20 to 40 percent slopes	72	-------	--	VIe-H	98	High Mountain Loam (Aspen)	105	3141
QkB	Quaker silty clay loam, 1 to 2 percent slopes	73	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
QkC	Quaker silty clay loam, 2 to 5 percent slopes	73	IIIe-2	95	VIe-S	98	Semi-desert Loam	109	1141-I 3342
Qm	Quaker and Mellor soils	73	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
RaC	Rapho gravelly fine sandy loam, 2 to 5 percent slopes	74	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	3342
RaD	Rapho gravelly fine sandy loam, 5 to 10 percent slopes	74	IVe-2	97	VIIe-S	99	Semi-desert Loam	109	3342
RlB	Ravola loam, 1 to 2 percent slopes	75	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
RlC	Ravola loam, 2 to 5 percent slopes	75	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
RlC2	Ravola loam, 2 to 5 percent slopes, eroded	75	-------	--	VIIe-S	99	Semi-desert Loam	109	3342
RO	Rock land	76	-------	--	VIIIs-X	101	----------	---	4444
SaC	Sanpete gravelly fine sandy loam, 2 to 5 percent slopes	76	IVs-24	97	VIIs-S	100	Semi-desert Stony Loam	109	3242-I 4343
SbD2	Sanpete cobbly fine sandy loam, 5 to 10 percent slopes, eroded	76	-------	--	VIIs-S	100	Semi-desert Stony Loam	109	4343
ScE2	Sanpete stony fine sandy loam, 5 to 30 percent slopes, eroded	77	-------	--	VIIs-S	100	Semi-desert Stony Loam	109	4343
SDE	Sanpitch very stony loam, 8 to 40 percent slopes	77	-------	--	VIs-U	99	Upland Stony Loam (Juniper-Pinon)	112	3242

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SEE	Sanpitch-Obrast complex, 8 to 40 percent slopes	78	-------	--	VIIs-U	101	----------	---	3242
	Sanpitch soil	--	-------	--	-------	---	Upland Stony Loam (Juniper-Pinon)	112	
	Obrast soil	--	-------	--	-------	---	Upland Clay	111	
SFD	Sanpitch loam, red variant, 10 to 30 percent slopes	78	-------	--	VIs-U	99	Upland Stony Loam (Juniper-Pinon)	112	3242
SH	Shaly colluvial land	79	-------	--	VIIs-S	100	Semi-desert Shallow Loam	109	4343
Sm	Shumway silty clay loam	80	-------	--	Vw-2	97	Wet Meadows	113	3212
Sn	Shumway silty clay loam, drained	80	IIIw-2	96	-------	---	----------	---	2121-I
SoD2	Sigurd cobbly fine sandy loam, 5 to 10 percent slopes, eroded	81	-------	--	VIIs-S	100	Semi-desert Stony Loam	109	3242-I 4343
SpC	Sigurd gravelly loam, 1 to 5 percent slopes	81	IVs-24	97	VIIs-S	100	Semi-desert Stony Loam	109	3242-I 4343
SrB	Skumpah silt loam, 1 to 2 percent slopes	82	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
SrC2	Skumpah silt loam, 2 to 5 percent slopes, eroded	82	-------	--	VIIs-S8	100	Semi-desert Alkali Flats	108	4434
SSD	Skylick silt loam, 4 to 30 percent slopes	83	-------	--	VIe-H	98	High Mountain Loam (Aspen)	105	3141
SSF	Skylick silt loam, 30 to 70 percent slopes	83	-------	--	VIIe-H	99	High Mountain Loam (Aspen)	105	3141
StB	Snake Hollow gravelly fine sandy loam, 2 to 4 percent slopes	84	IIe-2	95	VIe-U	98	Upland Loam	110	1141-I 3242
TGG	Tingey-Rock outcrop complex, 40 to 70 percent slopes	85	-------	--	VIIs-M	100			
	Tingey soil	--	-------	--	-------	---	Mountain Loam (Oak)	106	3141
	Rock outcrop	--	-------	--	-------	---	----------	---	4444
TGH	Tingey-Rock outcrop complex, 70 to 80 percent slopes	85	-------	--	VIIIe-X	101			
	Tingey soil	--	-------	--	-------	---	Mountain Loam (Oak)	106	3141
	Rock outcrop	--	-------	--	-------	---	----------	---	4444
ToB	Toehead silt loam, 2 to 4 percent slopes	86	IIIe-3	95	IIIe-U	96	Upland Loam	110	2141-I 2141
ToC	Toehead silt loam, 4 to 8 percent slopes	86	IIIe-3	95	IIIe-U	96	Upland Loam	110	2141-I 2141
TSD	Toehead silt loam, thin surface variant, 4 to 20 percent slopes	86	-------	--	IIIe-U	96	Upland Loam	110	2141

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TT	Torrifluvents and Torriorthents, stony--	87	--------	--	VIIs-S	100	Semi-desert Stony Loam	109	3342
TVD	Toze gravelly loam, 4 to 25 percent slopes-----	87	--------	--	VIe-H	98	High Mountain Loam	104	3141
WAC	Wales loam, 2 to 8 percent slopes----------	88	--------	--	IVe-UZ	97	Upland Loam	110	3242
WcA	Wales silty clay loam, low rainfall, 0 to 2 percent slopes--------	88	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
WcB	Wales silty clay loam, low rainfall, 2 to 5 percent slopes--------	88	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I
WDE	Wallsburg very stony loam, 20 to 40 percent slopes----------	89	--------	--	VIIs-M	100	Mountain Shallow Loam	107	3242
WEG	Wallsburg-Rock outcrop complex, 40 to 70 percent slopes----------	89	--------	--	VIIs-M	100			
	Wallsburg soil-----	--	--------	--	--------	---	Mountain Shallow Loam	107	3242
	Rock outcrop-------	--	--------	--	--------	---	----------	---	4444
WGD	Watkins Ridge stony loam, high rainfall, 4 to 25 percent slopes----------	90	--------	--	VIe-M	98	Mountain Loam	106	2141
WhB	Watkins Ridge silt loam, 1 to 6 percent slopes-	90	IIIe-3	95	IIIe-U	96	Upland Loam	110	2141-I 2141
WoA	Woodrow silty clay loam, 0 to 2 percent slopes-	91	IIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
WoC2	Woodrow silty clay loam, 2 to 5 percent slopes, eroded----------	91	IIIe-2	95	VIIe-S	99	Semi-desert Loam	109	1141-I 3342
XE	Xerofluvents and Fluvaquents----------	91	--------	--	VIw-2	98	Semi-wet Meadows	110	2121
XF	Xerofluvents and Fluvaquents, saline---	91	--------	--	VIIw-28	100	Alkali Bottoms	104	4424
YHE	Yeates Hollow stony silt loam, 20 to 40 percent slopes----------	92	--------	--	VIs-M	99	Mountain Stony Loam	107	3242
ZSE	Zeesix stony silt loam, 8 to 40 percent slopes----------	93	--------	--	VIe-H	98	High Mountain Loam	104	3141
ZTE	Zeesix-Toze complex, 4 to 40 percent slopes--	93	--------	--	VIe-H	98	High Mountain Loam	104	3141

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