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Preliminary Design Report for the Hidden Meadows Appraisal Study

14 June 2004

Prepared for

Washoe-Storey Conservation District
1201 Terminal Way, Suite 222
Reno, NV 89502

K/J Project No. 047012.00

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Section 1: Background

1.1 Project Introduction

The Hidden Meadows Appraisal Study prepared by Kennedy/Jenks Consultants for the Washoe-Storey Conservation District (WSCD) is focused on providing a conceptual design for the rehabilitation of the common area parcel adjacent to Steamboat Creek in the Hidden Meadows Subdivision (Figure 1). The 28.34 acre common area parcel (#051-680-01) is currently under the ownership of Hidden Meadows Company, Ltd. This parcel is bordered to the north and west by the Steamboat Creek, to the south by private homeowners, and to the southwest and east by Washoe County. The University of Nevada Agricultural Experiment Station (UNR Farms) lies to the north and west of the common area parcel. Portions of the UNR Farms property adjacent to the open space parcel are to be leased to the City of Reno.

This appraisal study has been funded by a grant from the Bureau of Reclamation and aims to provide a preliminary design that is in compliance with the Steamboat Creek Restoration Plan. The vision statement of the Restoration Plan reads:

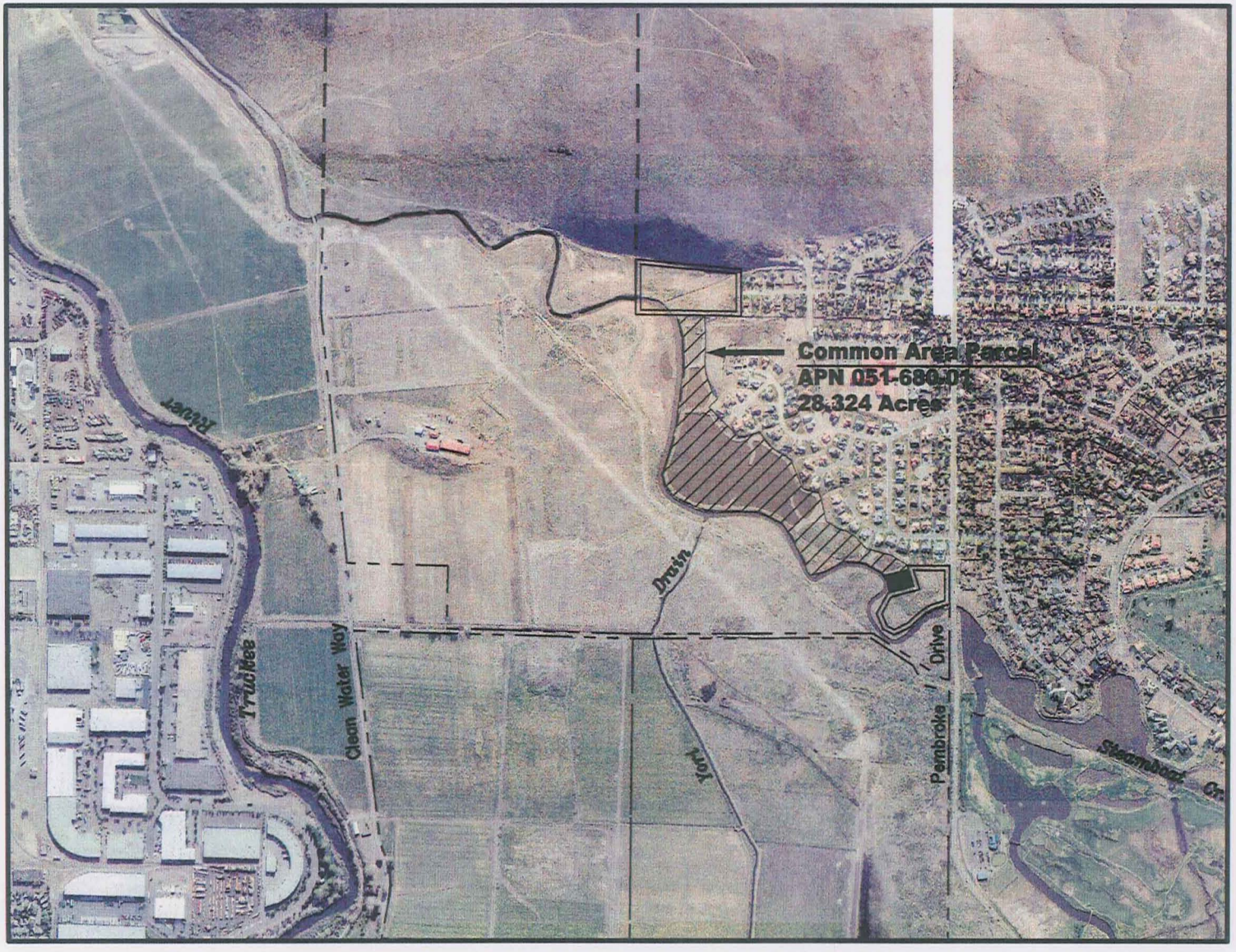
> *The Steamboat Creek Restoration Plan is a community-wide, cooperative effort to restore, enhance, and preserve the Steamboat Creek Watershed (Codega, 1996).*

Five project goals were identified and include in the Steamboat Creek Restoration Plan: 1) Improvement of water quality in Steamboat Creek, 2) restoration of Steamboat Creek to a sustainable condition, 3) reestablishment of appropriate wildlife habitat for each individual stream reach, 4) reestablishment of appropriate vegetation along individual stream reaches, and 5) stream restoration in conjunction with recreation in areas designated for public access (Codega, 1996). The Restoration Plan divided Steamboat Creek into 15 reaches with each having its own unique priorities, recommended BMPs, vegetation strategies, channel type, and water quality concerns. The Hidden Meadows/ University Farms reach identified in the Plan extends upstream from Clean Water Way to Pembroke Drive. This reach is considered to be a high priority for restoration activities due to water quality concerns. The Hidden Meadows common area parcel is located adjacent to Steamboat Creek along this reach.

The Hidden Meadows/University Farms reach, which as been designated as medium/high priority for restoration activities within the Steamboat Creek Restoration Plan, has steep, high, and very unstable banks. The Restoration Plan suggests a Rosgen C5 channel type for this reach. This type of channel would have a W/D ratio of >12, a sinuosity >1.4 and a slope <0.02 and would appear as a broad valley with terraces that would provide for a gradation of riparian habitat types. The elevations associated with the various flood plain terraces will allow for periodic over-bank flooding to support the vegetation communities.

1.1.1 Project History

An Existing Conditions Memorandum summarizing the site history, environmental conditions, and available datasets was prepared for the WSCD and has been attached to this report as Appendix A.



Legend

- UNR PARCELS
- DIERMODY PARCELS
- SIERRA PACIFIC POWER COMPANY PARCEL
- WASHOE COUNTY PARCELS

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Washoe–Storey Conservation District
Hidden Meadows Appraisal Study

Site Map

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Figure 1

1.1.2 Site History

In late 1994, the Hidden Meadows subdivision was developed under the ownership of Hidden Meadows Limited. The developer originally planned to use the common area parcel as a borrow pit for building material during construction and planned to create a park or wetlands with the parcel upon completion of construction. However, the borrow pit in the common area parcel filled with water, thereby prohibiting the creation of a park area.

For a more detailed discussion of the site and project history refer to the Existing Conditions Memorandum in Appendix A.

1.2 Issues of Concern

A number of concerns and issues exist regarding the current configuration and status of the pond located within the open space parcel of the Hidden Meadows subdivision. Vector control issues, the liability of open waters, water quality concerns, as well as an unpleasant odor emanating from the pond are only a few of the many environmental and social issues surrounding the existence of the pond. In addition to the issues within the open space parcel, surrounding land owners, existing projects, and future land use projects must be considered. A few of the more contentious issues involving the ponds and the surrounding area will be discussed in the following sections.

1.2.1 Odor and Vector Control

Due to the current configuration of the ±17 acre pond located within the common area parcel, odor and vector control issues are of concern. The pond is relatively shallow with depths ranging between 3 and 9 feet. Although winds from the southwest agitate the majority of the water surface, the current configuration of the pond allows for pockets of water to become stagnant. These pockets are marked by low dissolved oxygen content and are suspected to be the primary source of the unpleasant odors.

The mission of the Vector-Borne Diseases Program, which is overseen by the Washoe County District Health Department, is to protect the public's health and well being through the prevention of human disease, discomfort, annoyance, and economic loss caused by vector species and vector-borne disease agents. To inhibit the growth and development of mosquito larvae in the standing water on the Hidden Meadows common area parcel, Washoe County District Health imposed a bond upon the developer for mosquito abatement, slope stabilization in the borrow area, and for the construction of an access road around the pond to allow for maintenance and vector control. In response to the bond requirements, the banks were steeply sloped, rip-rap was installed along the perimeter of the pond to prohibit the growth of vegetation at the water surface, and a perimeter access road was constructed.

The Hidden Meadows Homeowner Association (HMHOA) has filed a number of complaints with the Washoe County District Health Department about odor and vector control issues in the common area parcel (Pacini, 2004). In response to the complaints, the developer installed a sprinkler system along half of the southern bank of the pond in September 2003. The system was used to agitate the water surface during the early morning and evening hours to disrupt and prevent the development of midge larvae. In early 2004, the installation of a SolarBee aeration unit was discussed by the HMHOA and the developer. However, aeration units will only provide only a temporary solution to the problem.

1.2.2 Mercury in the Steamboat Watershed

During Comstock mining, mercury was used in the Steamboat Creek Watershed to amalgamate gold and silver from the ore bodies. It has been estimated that waste tailings from four mills in Washoe Valley have released more than 40 tons of mercury to the Steamboat Creek watershed. The mercury concentrations in Steamboat Creek have been determined to be approximately 15 to 53 times higher than the natural background level of 1 to 3 ng/L (Blum, 2001). Although the presence of mercury in its elemental form does not tend to be toxic, mercury in a methylated form is toxic and has the ability to bioaccumulate. The presence of sulfate-reducing bacteria in anaerobic wetland environments may be responsible for the increased levels of methyl mercury (MeHg) on floodplains and in wetlands due to the bacteria's ability to methylate elemental mercury (Hg^0). For this reason particular attention has been paid with respect to the development and location of emergent wetland environments which may promote anaerobic conditions.

1.2.3 Water Quality

1.2.3.1 Steamboat Creek

Steamboat Creek is considered by many to be the most polluted tributary of the Truckee River and, as such, much attention has been given to the water quality of this creek. The 13.71 mile reach extending from Rhodes Road, in Steamboat Valley, to the confluence of the Truckee River has been listed on Nevada's 2002 303(d) List of Impaired Water bodies for arsenic, boron, iron, and mercury (Hg). Although Steamboat Creek has not been assigned a Total Maximum Daily Load (TMDL), the Truckee River at Lockwood has been listed for total nitrogen (TN), total phosphorus (TP), and total dissolved solids (TDS) (NDEP). Therefore, in order to protect the water quality of the Truckee River and to ensure that existing TMDLs are not exceeded, any work done in or around Steamboat Creek must not cause an increase in listed pollutant concentrations.

The cities of Reno and Sparks are interested in the water quality of the Truckee River as well as the water quality in Steamboat Creek. The outfall of the Truckee Meadows Water Reclamation Facility (TMWRF) enters Steamboat Creek close to the confluence with the Truckee River. Due to discharge permit conditions, the cities look positively upon projects which improve the water quality in Steamboat Creek.

Pyramid Lake is the receiving water body for the Truckee River. Therefore, the Pyramid Lake Paiute Tribe (PLPT) has historically been concerned with water quality issues and fish habitat in the Truckee River. The PLPT promotes populations of the Lahontan Cutthroat Trout (LCT), a fish named on the U.S. Fish and Wildlife Threatened Species List, and the Cui-ui, an Endangered Species. Since Steamboat Creek has been identified as a major source of nitrogen and suspended sediments and is the single largest source of mercury in the Truckee River watershed, the PLPT is concerned about projects that may increase pollutant levels, and impact the aquatic habitat of the Truckee River and Pyramid Lake. The remobilization of mercury (Hg) from old floodplain deposits and paleochannel sinks are of particular concern to the PLPT in regards to floodplain restoration and wetland development projects.

1.2.3.2 Common Area Parcel

The presence of groundwater containing naturally high concentrations of metals, the direct discharge of stormwater runoff into the pond, the potential for septic system influenced shallow groundwater, and the proximity of the pond to Steamboat Creek have raised concerns regarding water quality of the Hidden Meadows open space parcel. In April 2002, the Truckee Meadows Reclamation Facility (TMWRF) analyzed a set of discrete samples from the Hidden Meadows ponds (at the time of sampling three small ponds were in existence) and Steamboat Creek to determine if effluent from area septic systems was leaching into the three ponds (Table 1). The samples were analyzed for total phosphorus (TP), nitrate ($N0_3^-$), and ammonia (NH_4^+). Results demonstrate that the ponds contain a higher concentration of total phosphorus than the Creek but much lower concentrations of nitrate and ammonia. This suggests that area septic systems are not leaching into the ponds (TMWRF, 2002).

Table 1. Results from water quality sampling (mg/L) by the Truckee Meadows Water Reclamation Facility, April 2002

Site	Total Phosphorus	Nitrate	Ammonia
Steamboat	0.23	0.29	0.06
Hid. Val. Lake 1	0.26	0.01	<0.02
Hid. Val. Lake 2	0.40	0.02	<0.02
Hid. Val. Lake 3	0.38	0.01	<0.02

1.2.3.3 Yori Drain

The water quality of the Yori Drain differs from that of Steamboat Creek and the pond located in the open space parcel due to the origin of its flows. Yori Drain waters originate as stormwater runoff, agricultural drain waters diverted from the Truckee River and from dry weather urban runoff. This water quality is much more variable than that of Steamboat Creek and many of the underlying water quality impairments found in Steamboat Creek such as high boron and TDS are not present to the same degree in the Yori Drain outflow (http://ndep.nv.gov/bwqp/sb18.html).

NDEP has identified the beneficial uses of this water as "recreation not involving contact with the water" (http://ndep.nv.gov/bwqp/sb18.html). As part of the NDEP water quality monitoring program along Steamboat Creek, the agency has collected bimonthly water samples from 1994 through 2002 (http://ndep.nv.gov/bwqp/sb18.html). The samples indicate high levels of nutrients and pollutants. Huffman and Associates have also been collecting water quality samples from the Yori Drain. Monthly variation in water quality data is apparent in the samples collected by Huffman and Associates during 1994 and 1995.

1.2.3.4 Mercury Sampling

On March 16, 2004, Kennedy/Jenks Consultants collected three samples from the pond to be analyzed for total mercury. The samples were sent to the University of Nevada, Reno to be analyzed under the supervision of professor Mae Gustin. Concentrations of total mercury (unfiltered) in ng/L were as follows: 9.66, 19.19 and 20.04 (Table 2). These values appear to be elevated compared to natural background levels. However, Mae Gustin noted that samples of filtered mercury collected during that week in the Mira Loma reach of Steamboat Creek and at Clean Water Way were 18 ng/L and 9 ng/L respectively. At that time, concentrations of total mercury (unfiltered) in Steamboat Creek were ~250 ng/L. The berm dividing Steamboat Creek from the pond acts as a barrier to sediment particles while allowing dissolved constituents to slowly infiltrate into the pond. Due to the similarity between filtered mercury concentrations in the creek and total mercury concentrations in the pond, results indicate that the pond likely contains Creek water as well as shallow groundwater. The mercury samples from the pond reflect mercury concentrations similar to the filtered stream samples due to the transfer of creek water through the earthen berm separating the pond from the creek.

Table 2. Mercury sampling from Steamboat Creek and the Hidden Meadows open space parcel, March 2004

	Total Mercury, ng/L	Filtered Mercury, ng/L
Pond1	9.66	—
Pond 2	19.19	—
Pond 3	20.04	—
Mira Loma	~250	18
Clean Water Way	~250	9

1.2.3.5 Water Quality Comparison

In May 2004, Kennedy/Jenks Consultants collected surface water samples from the Yori Drain, Steamboat Creek, and the pond within the common area parcel to compare water quality concentrations. Results indicate that concentrations of ammonia (NH_4^+), nitrates (NO_3^-), and nitrites (NO_2^-) are below detection limits for all three source waters. However, although total kjeldahl nitrogen (TKN) is similar between the Yori Drain and Steamboat Creek waters, the pond exhibits higher concentrations of this combined nitrogen parameter (Table 3 and Appendix B). Total Phosphorus (TP) concentrations for the three source waters are very similar. TDS, arsenic, and boron concentrations are orders of magnitude higher in the pond than in the Yori Drain and Steamboat Creek waters. Water quality in the pond is believed to be influenced by the shallow groundwater system, Steamboat Creek infiltration, stormwater runoff, and evapoconcentration.

Table 3. Water Quality Results from May 2004			
Parameter	Yori Drain	Steamboat Creek	Pond/Common Space Area
Ammonia Nitrogen	0.05	<0.05	<0.05
BOD	<6	9.6	14
Nitrate-N	<1	<1	<1
Nitrite-N	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen	0.79	0.90	4.0
Total Phosphorus	0.22	0.37	0.30
TDS	213	397	6375
Fecal Coliform	>100	199	5
Arsenic	0.0076	0.13	0.36
Boron	0.1	3.2	63.5
Iron	0.72	0.84	0.07

1.3 Related Projects

Due to the environmental impairments present in the Steamboat Creek Watershed much recent attention has been focused on developing projects to mitigate many of the existing water quality, channel stability, and habitat problems. Several projects are currently underway, most of which are in the conceptual development stages. This section presents a brief overview of several of these proposed and existing projects.

1.3.1 Confluence Project

"The U.S. Army Corps of Engineers (USACE) under sponsorship by the Washoe-Storey Conservation District in conjunction with the University of Nevada, Reno and City of Reno are collaboratively conducting a large restoration feasibility study on Steamboat Creek from Clean Water Way to the confluence of the Truckee River. The proposed project on this 80-acre site is the active restoration of 1.1 miles of Steamboat Creek to a more naturally functional lotic riparian area. Currently, the creek is a straightened, incised channel. Incision up to 12 feet has caused destabilization of the banks, causing dehydration of the historic riparian floodplain and significant sediment pollution. The conceptual design for the new channel is a single threaded, low-gradient, meandering channel."
http://www.spk.usace.army.mil/civ/SteamboatCreek/documents.html)

In an effort to reconnect this stream to its floodplain, the conceptual plan is such that over-bank flooding will access a 500-foot wide riparian floodway during periods of bank full flow. Restoration will be accomplished by excavating a new channel and floodplain through the alfalfa fields to the west of the current creek. The channel length will be increased from 5767.65 ft to approximately 9,520 ft and the sinuosity will be altered from 1.1 to 1.8 (Blum, 2004). The channel invert elevation of Steamboat Creek will be increased approximately 4 feet to match the invert elevation at Pembroke Bridge, which will raise the Steamboat Creek influenced shallow groundwater table.

The proposed Confluence Project has been designated as a Section 206 ecosystem restoration project on Steamboat Creek. The project proposes to establish riparian habitat as well as improve water quality by avoiding bank erosion, encouraging the deposition of fine sediments, storing of nutrients and by promoting denitrification (USACE, 2001).

Recent funding constraints have forced the USACE to postpone their efforts on this project until a later date. Meanwhile the project stakeholders have been looking for additional sources of funding to allow the project to move forward. After the preliminary study has been completed, a more detailed design will follow. It will be important to the success of the Hidden Meadows project that Confluence Project constraints are taken into consideration in the design and implementation of any modification of the Hidden Meadows common area parcel and surrounding environment.

1.3.2 Airport Mitigation Wetlands

In the early 1990's, the Airport Authority of Washoe County was granted permission to fill an area of wetlands on the Reno-Tahoe International Airport in order to upgrade airport facilities and expand the runways. Permission was granted under the condition that the wetlands would be mitigated at a ratio of 2 acres created for every 1 acre lost. The U.S. Army Corps of Engineers (USACE) issued a permit for the construction of 9.28 acres of mitigation wetlands. The site selected for the airport mitigation wetlands is located at the University of Nevada, Reno Agricultural Experiment Station (UNR Farm) in Reno, Nevada. The site encompasses 10.13 acres along the Steamboat Creek and is located between Clean Water Way and Pembroke Drive. The mitigation site has been designed as a mixture of wetlands and open water/riverine habitat.

Extensive work has been done at the Airport Mitigation Wetlands to understand the complex interaction of water quality, soils, and successful establishment of wetland vegetation. As required under a 404 permit administered by the USACE, water quality samples have been collected monthly from Steamboat Creek at the Airport Mitigation Wetland site since the mid 1990's. Total nitrogen (TN), total kjeldahl nitrogen (TKN), total phosphorus (TP), ortho phosphorus (PO_4), pH, total suspended solids (TSS), total dissolved solids (TDS), boron, arsenic, temperature, flow, conductivity, and dissolved oxygen have been monitored. In addition, groundwater elevations have been monitored using 22 piezometers and 3 deeper wells within the wetland sites and in the upland area to the west of Steamboat Creek. Soils samples were collected to aid in the selection of appropriate vegetation types. Results have demonstrated that the soils at the airport mitigation wetland sites are hydric or tend toward being hydric. Due to a very low amount of organic matter and the high boron concentrations present in the soils, soil amendments were added to the site in 1996 and the plant species list was amended (Huffman & Associates, 1996).

1.3.3 Yori Drain

The Yori Drain, which originates near Virginia Lake, collects and transports stormwater flows from urbanized areas of Reno and discharges into Steamboat Creek across from the Hidden Meadows common area parcel. Excess stormwater exits Virginia Lake through the "Glory Hole" and flows in a box culvert along Yori Ave. Flows enter an open ditch south of the Costco shopping center where they split into a north and south branch of the drain. The north branch collects stormwater and irrigation flows from the Reno/Tahoe Airport, the commercial centers west of McCarran Blvd. and UNR Farms.

Flow measurements for the Yori Drain are very limited. Neither the USGS nor the Water Masters Office have been regularly monitoring flows in the Yori Drain. Staff gage measurements from the 1980's and early 1990's provide the only flow data for this drainage. Due to the changing nature of water consumption for irrigation purposes and the increase in urban runoff, the historic flow data is of limited use under current conditions. Observation of the flow during the spring of 2004 indicates that the base flow of the Yori Drain fluctuates between 2 and 4 cfs.

Section 2: A Multi-Stakeholder Restoration Plan

2.1 Stakeholder Process

To provide the most appropriate project design for the area, Kennedy/Jenks Consultants gathered input from a number of entities. In early February 2004, Kennedy/Jenks Consultants held three separate stakeholder meetings to gather input and to better understand existing issues and concerns. Based upon the stakeholders' original input, Kennedy/Jenks Consultants developed five alternative designs (Appendix C). These alternative designs were presented to the stakeholders at a workshop to gather their opinions and preferences. The alternatives were then presented to the WSCD board members for the determination of a preferred alternative. This preliminary design report discusses in detail the preferred alternative (Option 2: Steamboat Creek Realignment, Appendix C) as decided upon by the WSCD board and designed by Kennedy/Jenks Consultants.

2.2 Project Description

The proposed restoration plan for the Hidden Meadows open space parcel provides for increased channel conveyance and stability for Steamboat Creek, habitat diversity, floodplain storage, and recreational benefits. The project will aim to reconnect Steamboat Creek to its floodplain by realigning the channel through the open space parcel. A series of stormwater treatment devices will be included in the design to treat stormwater runoff from the Hidden Meadows subdivision before it enters Steamboat Creek. In addition, the Yori Drain will be reconfigured to include a water quality treatment wetland system that will assimilate nutrients from urban runoff.

This project incorporates a number of stakeholders and entities. Potential parties to this project include the Washoe-Storey Conservation District, Washoe County, City of Reno, the Hidden Meadows Company, the University of Nevada, Reno, the Airport Authority of Washoe County, and Dermody Family/UNR Property as well as non-land holding stakeholders. The completed project will hopefully be a Washoe County park amenity providing environmental education, recreation, open space, habitat, floodplain storage and water quality enhancements.

2.3 Defining the Preferred Alternative

During the development and evolution of this project, additional restoration opportunities have presented themselves. The additional restoration opportunities may include the incorporation of a constructed water quality treatment wetland system along approximately 1,000 feet of the Yori Drain immediately adjacent to Steamboat Creek; a programmatic level plan to address Tall Whitetop (TWT) infestation and abatement; incorporation of a wetland/riparian restoration effort on lands held by Washoe County, Dermody Family/UNR parcel, UNR Farms and Hidden Meadows Company; stabilization and restoration of stream banks along the UNR Farms property adjacent to Steamboat Creek within the project reach; and incorporation of a recreational trail system that will link the upper Steamboat watershed with the Truckee River trail system.

This project has a diversity of stakeholders, each with their own primary interest. The project has been loosely defined, with respect to individual stakeholder requirements in order to facilitate a final design that does not exclude any potential stakeholder, while defining the project objectives in such a manner as to achieve the majority of the objectives of all of the stakeholders.

The physical features presented in the preferred alternative address the following critical issues:

- Stream channel stabilization and the redevelopment of the natural form and function of the stream–floodplain interaction.
- Riparian and wetland habitat enhancement which emphasizes habitat diversification and natural means of vector control.
- Flood conveyance, storage and attenuation capacity that protect residents and infrastructure while supporting the goals of the Community Flood Coalition.
- Water quality treatment of the Yori Drain waters to support downstream environmental quality and aid in the reduction of pollutant loading to the Truckee River.
- Support sediment transport and flow characteristics required by downstream restoration efforts.
- Provide ancillary environmental benefits such as a reduction in thermal and TDS loading by means of shading, habitat improvements for critical terrestrial, aquatic and amphibian species, and esthetic improvements.
- The development of urban open space, environmental education and park and train facilities.

These design objectives are reflected in various elements of the preliminary design. Some of the aforementioned objectives will be presented in this preliminary design report while others will need to be more fully addressed during final design efforts.

2.4 Design

The proposed design for the Hidden Meadows open space parcel is intended to develop a naturally functioning stream and floodplain. This design encompasses the development of 7,500 lineal feet of base flow channel within a 52 acre accessible floodplain to support a diversity of habitats, vegetation and stormwater treatment and erosion control best management practices. The main channel of Steamboat Creek would carry a base flow of 15 – 20 cfs and will exhibit bank full conditions at approximately 60 cfs. The topographical design for the area near the Airport Mitigation Wetlands allows for approximately 50% of the 1.5 year flow to leave the base flow channel to support the hydrology required by the existing Airport Mitigation wetland habitat.

The proposed plan reflects many of the design elements recommended in the Steamboat Creek Restoration Plan but also takes into account the existing infrastructure, vertical and horizontal design constraints and opportunities for expanded water quality treatment and habitat enhancement.

The configuration presented in this preliminary design allows for the inclusion of a trail and bike path system. The trail system will have access points at the upper and lower end of the project and will act as a link within the proposed greater community bike trail system between the Truckee River and the upper Steamboat Creek system. The development of educational kiosks suitable for community and school age environmental education and stewardship programs could also be included with the trail system.

The vegetation planning components are addressed in Appendix G by Western Botanical Services. The general concept of the vegetation design is to prove riparian grasslands supported by willow and shrub environments along the floodplain of Steamboat Creek. This periodically wetted floodplain will transition the surrounding upland vegetation into the wetted channel of Steamboat Creek. The vertical stratification of plant communities should be placed to maximize establishment with respect to Tall Whitetop (TWT) control. A separate effort for TWT, which will focus on soil and hydrologic conditions should be included. The opportunity to combat TWT infestation through natural competition by native species should be promoted.

Stormwater BMP's should be applied to address area wide urban stormwater runoff from the Hidden Meadows subdivision. The proposed BMP's include a sand filter system to capture the leading edge of the stormwater polutigraph prior to entering Steamboat Creek. This stormwater quality treatment is broadly supported and the treatment of urban runoff is important for the long term ecological health of the Truckee and Steamboat systems.

Appendix D contains a set of 1"=40' scale drawings of the preliminary design. The drawing set is provided to demonstrate the type of final design sheets and topographic configuration that would be required under the proposed design. Although this drawing set is not a complete design set it should be used a starting point for final design. The topography presented in this preliminary design set reflects the HEC-RAS modeling discussed in this section.

2.4.1 Hydraulic Modeling

HEC-RAS 3.1.1 (U.S. Army Corps of Engineers, http://www.hec.usace.army.mil/software/hec-ras/hecras-download.html) was used to model the proposed realignment of Steamboat Creek through the open space parcel of the Hidden Meadows subdivision. The purpose of this modeling effort was to build a basic model of the proposed channel realignment and to demonstrate that FEMA designated water surface elevations for a 100 year event would not be exceeded under the proposed configuration. Water surface elevations for low flow conditions as well as the 1, 1.5, 2, 5, 10, 25, 50, and 100 year flood events were determined. Model output results are presented in Appendix E and summarized in Section 2.4.1.2. It is important to note that this model was developed at a preliminary design level and will need to be refined during final design to optimize the hydraulic performance of the system.

2.4.1.1 Model Development

Ten cross sections were developed in the HEC-RAS 3.1.1 model for Steamboat Creek extending from the channel invert at Pembroke Bridge (south) to a bend in the creek approximately 1,800 ft. downstream (north) of the Hidden Meadows common area parcel (Figure 2). The cross sections displayed in the model were created based upon the proposed channel alignment as designed in Land Development Desktop 3 and from survey data collected by Kennedy/Jenks Consultants in May 2004. Levees were used in the model to ensure that HEC-RAS did not convey flows into the Yori Drain or into the proposed stormwater treatment basins until a given bank elevation was exceeded. Manning's n values of 0.028 were assigned to channel areas and 0.04 to overbank areas. These values were based upon HEC-RAS suggested values for natural channels with no rifts or deep pools and for floodplains covered in high grasses. The HEC-RAS default expansion and contraction coefficients of 0.1 and 0.3 were not altered. Refinements of the roughness coefficients and other modeling variables should be included in a sensitivity analysis of the completed model during final design.

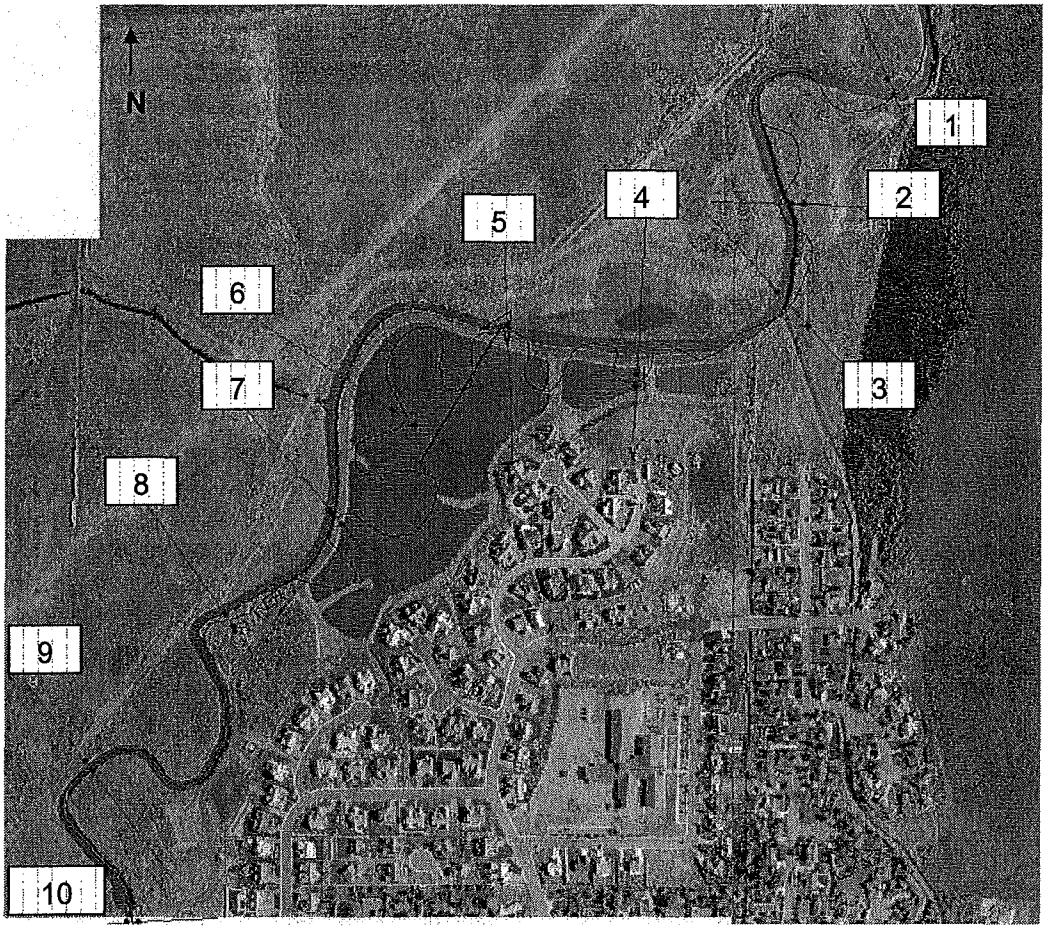

Figure 2. HEC-RAS cross section locations.

The U.S. Geological Survey (USGS) provided the annual peak flow frequency analysis for Steamboat Creek as measured at Clean Water Way (the closest long-term gaging station to the project site). This analysis, which was computed using peakfq, was based on 9 years of data (Appendix F). Peak flow data from 1994–1996 and 1998–2003 were used in the analysis. Although peak flow data had been collected at this site prior to 1994, the USGS did not use this data in their analysis due to issues of reliability and control. The flood frequencies were determined based upon annual exceedance probabilities. Table 4 lists the USGS flood frequencies and peak stream discharges that were applied to the HEC-RAS model for Steamboat Creek at Hidden Meadows.

Table 4. USGS Annual Peak Flow Frequency Analysis for Steamboat Creek at Clean Water Way.

Flood Frequency	Peak Discharge, cfs
1-Year	60 cfs
1.5-Year	261 cfs
2-Year	359 cfs
5-Year	689 cfs
10-Year	983 cfs
25-Year	1,451 cfs
50-Year	1,876 cfs
100-Year	2,374 cfs

A steady flow analysis was performed for the project reach. Flows in the model were initiated at the channel invert of the Pembroke Bridge (XS 10). A mixed flow regime was chosen for this model to allow for the transitioning between supercritical and subcritical flow. The upstream and downstream channel slopes, which are used to calculate normal depth, were set to 0.0002 ft/ft.

2.4.1.2 Model Results

The FEMA Flood Insurance Rate Map for Washoe County, Nevada and Incorporated Areas with an effective date of September 30, 1994, set the 100-year base flood elevation to 4,392 feet (NAVD 1929). Adjusted to the NAVD 1988, this elevation is 4395.49 ft. Preliminary modeling efforts have demonstrated that improvements to the Hidden Meadows open space parcel will not cause an increase in the flood elevations within this reach. Results in Table 5 indicate that the 100-year flood event could be expected to reach approximately 4,388 ft ±1 ft.

Model results indicate that during the 1 year flow event (60 cfs at Clean Water Way) flows will exhibit bank full conditions through most of the restored reach. Although the flows generally remain within the channel, the model predicts that water will begin to spread out near the northeastern portion of the Airport Mitigation Wetland site and will inundate this area.

Table 5. HEC-RAS Model Results of Water Surface Elevations at Various Flood Flows									
		Flood Frequency							
Cross Section ID #	Low Flow	1-Yr	1.5-Yr	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
XS10	4382.03	4382.34	4383.64	4384.17	4385.47	4386.31	4387.43	4388.29	4389.12
XS9	4380.47	4381.38	4382.88	4383.35	4384.48	4385.26	4386.29	4387.07	4387.78
XS8	4380.42	4381.27	4382.71	4383.18	4384.35	4385.16	4386.28	4387.15	4387.95
XS7	4380.41	4381.24	4382.68	4383.15	4384.33	4385.15	4386.30	4387.17	4387.97
XS6	4380.41	4381.23	4382.67	4383.14	4384.32	4385.14	4386.30	4387.17	4387.97
XS5	4380.40	4381.21	4382.66	4383.13	4384.32	4385.14	4386.29	4387.16	4387.96
XS4	4380.39	4381.20	4382.66	4383.13	4384.31	4385.13	4386.28	4387.15	4387.95
XS3	4380.37	4381.19	4382.64	4383.11	4384.29	4385.11	4386.26	4387.13	4387.93
XS2	4380.33	4381.15	4382.61	4383.09	4384.27	4385.09	4386.24	4387.11	4387.90
XS1	4380.22	4381.04	4382.52	4382.99	4384.17	4384.98	4386.12	4386.98	4387.77

Although the preliminary HEC-RAS modeling effort currently exhibits several warnings and notes, they do not indicate any critical problems with the proposed design. The warning in the current model indicates that a hydraulic jump will occur between cross sections 9 and 10. This hydraulic jump is believed to occur in the creek close to XS 10, where a grade control structure has been added to protect the creek against further headcutting. The Steamboat Creek channel invert elevation 78 feet downstream of the Pembroke Bridge is 4.2 ft lower than the channel invert at the bridge. This difference in elevation may be responsible for the hydraulic jump indicated in the model. Future efforts would include a cross section 9.9 which would be located a few feet downstream of the grade control structure. This cross section could be based upon survey data collected by Kennedy/Jenks Consultants in May 2004. Other warnings and notes within the current model indicate that additional cross sections should be added to the model to address conveyance ratio issues.

2.4.1.3 Additional Model Efforts for the Final Design

The HEC-RAS model created as part of the Hidden Meadows Appraisal Study represents an initial and preliminary modeling effort. In order to produce a more refined hydraulic model, additional cross sections should be incorporated into the model. A sensitivity analysis of all aspects of this model should also be performed. To produce a final design, it is anticipated that HEC-RAS would be applied to refine the proposed channel geometry through an iterative approach. The model would be used to optimize channel geometry, conveyance, and floodplain elevations. Preliminary design channel geometry should be modified to provide the optimal level of sediment transport as required by downstream entities and the model would verify that FEMA flood elevations for a 100-year flood would not be exceeded.

2.4.2 Stormwater Treatment

The purpose of this section is to discuss the methodology and assumptions that were used in the preliminary design of sand filter detention basins to treat storm water runoff from the Hidden Meadows and Hidden Valley subdivisions. Treatment of the urban runoff produced by the subdivisions will help to ensure the success of the proposed adjacent wetlands and creek modifications as well as improve the water quality of discharges to Steamboat Creek.

2.4.2.1 Design Assumptions

Figure 3 indicates the assumed drainage basin boundaries for the sand filter detention basins proposed for this project. Drainage basin boundaries have been assumed based on aerial photography of the area taken in 2002 and information supplied in various hydrology studies of the Hidden Meadows development (SEA, Inc., 1995 and 1996; Summit Engineering, 2001; Shaw Engineering, 2002). Actual drainage basin boundaries may differ significantly if the existing underground storm drain system in one assumed drainage basin actually transfers storm water to a different drainage basin. The existing hydrology studies noted above do not provide sufficient detail to be able to determine the alignment, extent, direction of flow, and drainage area of the as-built storm drain system. Additional information such as pipe sizes and alignments, catch basin locations, pipe and manhole rim and invert elevations, and contributing areas will need to be obtained prior to final design.

In addition, the percentage of impervious area for each drainage area was estimated based on the 2002 aerial photograph of the area. For drainage areas WS1 and WS2, the amount of developed impervious area that was assumed was based on existing development in the area. More accurate estimations of impervious areas (e.g. roof tops, concrete sidewalks and patios, street surfaces, etc.) should be obtained once the storm drain system and contributing drainage areas are further refined.

2.4.2.2 Water Quality Design Criteria

Sand filter detention basins are considered volume-based Best Management Practices (BMPs). BMP fact sheet TC-41 (Appendix G) (Kennedy/Jenks Consultants, 2004) provides additional information about sand filter detention basins, including a diagrammatic example of a typical installation. The primary method of pollutant removal for volume-based BMPs is the extended detention of a specific water quality volume so that suspended sediments and associated adsorbed pollutants have sufficient time to settle and collect in the basin and/or in the voids of

Legend

ASSUMED WATERSHEDS BOUNDARIES

PIPE OUTFALLS

N

0 300 600

Kennedy/Jenks Consultants

Washoe–Storey Conservation District
Hidden Meadows Appraisal Study

Assumed Drainage Basin Boundaries

K/J 047012.00
June 2004

Figure 3

I:\047012.00_HIDDEN_MEADOWS\PRODUCTS\EXISTING CONDITIONS MEMO\MAPS\FIGURE3.DWG

the permeable materials in the BMP. Sand filter detention basins are designed to capture, detain, slowly drain and filter storm water prior to discharge to the storm drain system. An under drain system slowly dewaters the basin so that standing water is drained from the basin within 48 hours. Depending on the depth to groundwater, the location relative to existing or proposed structures and the infiltration capacity of the native soils, a liner can be placed beneath the under drain system to prevent seepage of filtered storm water into underlying soils.

The water quality volume detained in a sand filter detention basin represents the runoff volume produced by the most frequently occurring rainfall/runoff events. Per the Structural Controls Design Manual (Kennedy/Jenks, 2004), volume-based storm water treatment controls in the Truckee Meadows should be designed using the Water Quality (WQ_V) method.

$$WQ_V = [(P)(R_V)(A)]/12$$

$$R_V = 0.05 + 0.009I$$

Where: WQ_V = water quality volume (ft^3)

P = the 90th percentile precipitation depth (0.60 inches)

R_V = watershed runoff coefficient

I = percent of watershed impervious area

A = drainage area (ft^2)

12 = units conversion constant

The watershed runoff coefficient (R_V) in the WQ_V method is based on a regression equation developed from precipitation data for a number of relatively small urban drainages distributed throughout the U.S. The 90th percentile precipitation depth (P) is based on an analysis of local long-term hourly precipitation data for the Reno Tahoe International Airport and has been determined to be 0.60 inches.

Table 6 provides the preliminary detention volumes (WQv) based on the assumed watersheds presented on Figure 3. As noted previously, these volumes may change once additional information about the storm drain system and the drainage areas is obtained. As noted on BMP fact sheet TC-41(Appendix G), the following design criteria should be applied:

- The maximum depth of the basin above the sand filter surface should be 3 feet.
- Basin side slopes should not exceed 4H:1V.
- The minimum sand filter surface area (A_S in ft^2) at the base of the basin should be determined using $A_S = WQ_V / 3$ ft
- The bottom of the sand filter basin should be lined with 18 inches of sand (ASTM C-33) overlying a 9-inch gravel layer (AASHTO No. 8).
- Collectors under drainpipes should have a minimum slope of 0.5 percent.
- The under drainpipes should have a minimum diameter of 6 inches and should be composed of perforated schedule 40 PVC.
- An emergency spillway capable of conveying the over flow from a larger storm event (the 5-year up to the 100-year peak flow) should be incorporated into the design.

Table 6. Design Criteria for Hidden Meadows Storm Water Treatment Controls						
Drainage Areas						
ID	(ft^2)	(acres)	% imp	R_V	WQ_V (ft^2)	A_S (ft^2)
WS-1	215,708	4.95	40	0.41	4,422	1,474
WS-2	887,439	20.37	40	0.41	18,192	6,064
WS-3	112,397	2.58	45	0.46	2,557	852
WS-4	74,663	1.71	30	0.32	1,195	398
WS-5	1,985,771	45.59	50	0.50	49,644	16,548
WS-6	91,357	2.10	40	0.41	1,873	624
WS-7	435,704	10.00	40	0.41	8,932	2,977
WS-8	772,444	17.73	40	0.41	15,835	5,278

2.4.2.3 Additional Data Requirements for Final Stormwater Design

The level of stormwater treatment design presented in this preliminary design report reflects the existing information available. The use of this information for the preliminary BMP sizing should be revisited in the final design phase due to known contradictions in some of the existing as-built information. A great level of scrutiny should be placed on determining the contributing areas, peak flow and total volume of the leading edge of the stormwater polutigraph for the 2 year, 24-hour storm event.

The vertical distance between the Stormwater BMP's and the groundwater is less than the recommended minimum distance, therefore a slight modification of the BMP design using an under drain, should be detailed in the final design in an effort to minimize the residence time of standing water in the sand filters to limit vector insect breeding habitat.

2.4.3 Yori Drain

Incorporation of the Yori Drain into the Hidden Meadows common area parcel rehabilitation project will improve water quality within the Steamboat Creek and Truckee River by developing a constructed treatment wetland upstream of Steamboat Creek. This portion of the overall project may also allow for additional sources of funding.

The current outfall of the Yori Drain into Steamboat Creek is located on UNR Farms property across from the Hidden Meadows common area parcel. The current configuration of the Yori Drain does not allow for water quality treatment due to the confined nature of the flow system. The outfall structure of the Yori Drain is marked by a 6 ft diameter reinforced concrete pipe which has an invert that lies 2.8 ft higher than the existing invert elevation of Steamboat Creek.

2.4.3.1 Yori Drain Design

To enhance the local groundwater table and support the hydrology of the existing Airport Wetland Mitigation sites, the proposed design for the Yori Drain wetland system would remove the 6 ft diameter reinforced concrete pipe and relocate the Yori Drain outfall. The footprint of the proposed wetland will be approximately 1,000 ft by 200 ft with variable geometry, vegetation, and water surface elevations. The use of a plug flow (fully mixed flow) hydraulic design will ensure that uniform treatment occurs by eliminating short circuiting of the flow path. The wetland would be designed to convey anticipated peak flow conditions while maintaining the hydraulic characteristics required to minimize vegetation disturbance and sediment transport.

Proper design of the Yori Drain water quality wetlands system would minimize the potential for mercury methylation by limiting sedimentation from Steamboat Creek. The amount of sedimentation contributing to the potentially anaerobic wetland environment in the Yori Drain will be limited by prohibiting frequent flooding events from inundating the area. Over bank conditions which will occur on a relatively frequent basis (<2 years) will not inundate the permanent wetland habitat supported by the Yori Drain due the elevated invert of the Yori Drain with respect to Steamboat Creek. This approach optimizes the benefits of wetland habitats on the water quality of Yori Drain while limiting the exposure of these habitats to mercury laden sediments transported by periodic Steamboat Creek flooding. However, this design is susceptible to allowing some sedimentation of wetland environments during > 5-year flood events. The long term accumulation of mercury laden sediments will be minimal because these wetlands have a non-mercury contaminated water source as their principal water supply.

2.4.3.2 Yori Drain Hydraulic Modeling

The proposed Yori Drain wetlands have not been modeled in HEC-RAS as part of the preliminary design. The proposed modifications to Yori Drain are not expected to diminish the cross sectional conveyance area of the drain, and thereby theoretically should not diminish the conveyance capacity. Final design efforts will need to address flow volume and velocities to optimize the design of this treatment reach in order to minimize scour, erosion and disturbance to inundated vegetation.

In addition to using HEC-RAS for hydraulic design, Kennedy/Jenks Consultants proposes the use of PreWET to predict the removal efficiency of the wetland system under a given configuration and to optimize the hydraulic retention time (HRT). PreWET is an Army Corps of Engineers wetland modeling software that relies on 1st order rate of decay calculations to estimate changes in water quality through a wetland treatment system.

Preliminary results demonstrate that by assuming a flow rate of 4 cfs, a layout with dimensions of 1,000 ft by 200 ft, and a mean depth of 18" with fully mixed flow, the HRT for the proposed wetland is slightly longer than one day. This configuration can be modified with respect to anticipated inflow rate and available footprint to optimize the HRT for treatment of the constituents of concern.

The design of the wetland treatment system should be optimized in the final design phase to emphasize nutrient reduction, through denitrification and sedimentation, and should be optimized for a hydraulic retention time that maximizes treatment while limiting evapoconcentration.

2.4.4 Grade Control Structure

Due to the modification of the channel invert of Steamboat Creek at the downstream limit of the proposed project footprint, a grade control structure should be included in the final design. The recommended type of grade control is a natural "roughened channel" section comprised of course materials. These materials should be stable during high flows and should allow for an approximate 18 – 24 inch lowering of the channel invert elevation to match the existing downstream channel invert elevation.

Prior to downstream restoration efforts this grade control structure will arrest head cutting and provide transitional stability for this project. It is anticipated that future downstream restoration and channel modifications will elevate the channel invert to match the restored Hidden Meadows reach. The hydraulic performance of this grade control structure should be evaluated in detail to ensure that the scour potential of the transition is minimized.

2.4.5 Issues in design

The design approach presented herein for Hidden Meadows considered the design, habitat, and geomorphologic parameters set forth in the preliminary planning of the Confluence Project. Further discussion with Confluence Project designers will be required to ensure the ability of dovetailing the Hidden Meadows channel realignment with the Confluence reach. The conceptual design of the Confluence Project proposes raising the channel approximately 4 feet throughout the entire reach downstream of Pembroke Bridge. This concept could not be entirely supported in the Hidden Meadows preliminary design due to conflicts with the outfall elevation of Yori Drain and the elevation of the Airport Mitigation Wetland sites. The preliminary design for the Hidden Meadows open space parcel presented in this report proposes a channel elevation increase of approximately 18 inch to 24 inch throughout most of the Hidden Meadows reach.

The presence of mercury and methyl mercury in Steamboat Creek was considered during the preliminary design for the restoration of the Hidden Meadows common area parcel. The majority of materials to be used in the construction of a wetland system in the Hidden Meadows open space parcel will originate outside of the Steamboat Creek floodplain. Thus, the imported fill material will not contain the high levels of mercury found along the banks and floodplain of the Creek. Although mercury laden sediments may be deposited over time within the project reach by Steamboat Creek, the concentration of mercury at the site will be far below the ambient concentrations found elsewhere within the Steamboat Creek watershed.

2.5 Vegetation

Kennedy/Jenks Consultants contracted Western Botanical Services to provide a vegetation and planting plan for the preliminary design of the Hidden Meadows open space parcel. Included in this plan is a discussion of special considerations for dealing with tall whitetop (TWT), poor soil quality, and other issues likely to be experienced when undertaking vegetative restoration efforts along Steamboat Creek. During the final design phase of this project, the vegetation plan will be refined with respect to plant types, depth to water, erosion control, BMP's, irrigation and monitoring. Appendix H presents the Preliminary Design Vegetation Report produced by Western Botanical Services for the Hidden Meadows Appraisal Study Preliminary Design Report.

2.6 Pond Dewatering

Due to the high concentrations of arsenic, boron and TDS in the pond waters of the common area parcel, dewatering of the property during construction will require a temporary NPDES discharge permit from the Nevada Department of Environmental Protection (NDEP). Based on calculations using the existing ground survey of the ponds prior to inundation and the Kennedy/Jenks Consultants survey of the water surface of the pond, it is anticipated that the pond currently contains approximately 100 acre-feet (32.5 million gallons) of impounded water. A number of options may exist for the dewatering of the project area during construction. The options may include discharging directly into Steamboat Creek, applying the pond waters as a source of dust control or land applying the waters. Discharging the waters into Steamboat Creek may prove to be more time and resource intensive than land application due to the higher degree of monitoring and control that would be required. Final design efforts should address permitting and methodology of pond dewatering and the potential beneficial uses of that water within the project. Negotiations with NDEP should be supported by the water quality data collected by Kennedy/Jenks Consultants and presented in Section 1.2.3.5.

2.7 Irrigation

Artificial irrigation will be needed for initial vegetation establishment and for ongoing vegetation maintenance. Irrigation water for the proposed channel realignment and Yori Drain projects could be supplied from effluent discharge. Since TMWRF treatment plant discharges its effluent into Steamboat Creek, the use of effluent throughout the Hidden Meadows site should be an acceptable practice. The close proximity of the reuse pipeline will allow for a pressurized effluent distribution to occur on both sides of Steamboat Creek throughout the project reach.

The opportunity to use reuse water for the establishment on ongoing support of this project will greatly enhance to probability for vegetation success and a rapid establishment of the desired vegetation. Several irrigation management requirements will need to be adhered to for the use of this water source, and a reuse irrigation plan along with consultation with NDEP will be required in the final design. Consultation with the Cities of Reno and Sparks will determine the volume and configuration of the reuse distribution system.

2.8 Opinion of Probable Cost

The total area of this project is approximately 52 acres including 11 acres that are part of the Airport Mitigation Area and will not be significantly disturbed during this project.

The numbers used for estimating the various aspects of construction were obtained both from experience with similar projects and from RS Means Heavy Construction Cost Data, 2004 Edition. The level of cost estimation should be considered preliminary and contains a 20% contingency markup for material and labor costs.

Considering the below referenced information and the cost estimates presented in Appendix I, the Opinion of Probable Costs for the entire project including ongoing monitoring, irrigation, engineering and permitting is approximately $3,309,000.

2.8.1 General Costs

Mobilization describes the costs incurred by the contractor to get equipment to the job site and to remove it from the job site after construction is completed. When estimating the cost of mobilization for a construction project, 10% of the total construction cost is a widely accepted value. The mobilization costs is not applied to engineering, permitting and monitoring.

As discussed in Section 2.6, some dewatering will likely be required for this project during the construction period. The estimated dewatering cost is based on using a 6 inch centrifugal pump for forty days, eight hours per day, attended two hours per day. The estimate also assumes discharging the pond water directly into Steamboat Creek, land applying the water, or using it for dust control.

Best management practices (BMP's) required during construction for sediment control and stormwater runoff include the installation of a 3 ft high polypropylene silt fence. This fence shall be placed around the job site to prevent contaminated water/soils from entering existing water ways including storm drain systems. The cost of this silt fence is based on using 10,000 linear feet of the fencing.

A survey crew will be needed to layout the job site and to set grade for the contractor. During the beginning stages of project construction, the survey crew will be needed full time. Throughout the rest of the project, the survey crew will only be needed sporadically. The crew will consist of a party chief and a rod man.

Post construction monitoring will be required to ensure the success of the newly planted vegetation. A botanist should perform this monitoring and will need to spend approximately 8 hours a month at the job site for the first five years.

A grade control structure will also be installed for downstream channel stability. The estimated lump sum cost of this structure is $15,000. It is anticipated that this roughened channel transition will not contain either grouted rip-rap or hard concrete structures.

The following discussion presents detailed construction costs for each individual project component area. For the purposes of distribution, the cost estimate has been presented in the following three sections: Dermody/UNR Parcel, Steamboat Creek and Yori Drain. The attached plan sets illustrate the boundaries of each of these sections. The Opinion of Probable Cost spreadsheets are presented as Appendix I.

2.8.2 Dermody Family/UNR Property Costs

The Dermody Property contains approximately 14 acres and is located on the far eastern portion of the project site. This area will require removing approximately 7 vertical feet of earth on average throughout the entire 14 acres. The total volume of material to be removed will be approximately 158,000 cubic yards. A front end loader and an end dump or belly dump truck will be most suitable to perform this work. The estimated cost for this work is about $600,000. This estimate assumes use of a front end loader with a three cubic yard bucket and two 34 cubic yard end dump trucks with haul distances of 1000 ft.

A foreman, grade setter, and eight laborers will also be required in addition to the equipment operators. The grade setter and two laborers will ensure that the loader is cutting to the correct grade. The other laborers will guide the operators and perform any necessary hand work.

A water truck will be required for dust control. The water truck will need to run at all times while earth is being disturbed to prevent dust problems. The estimated cost of the water truck includes the assumed cost for a pump to fill it.

2.8.3 Steamboat Creek Costs

The Steamboat Channel property is approximately 30 acres and makes up the bulk of this project. The work for the Steamboat Channel includes backfilling and grading the area of the existing pond that is to be drained and creating walking and biking trails throughout the area.

An average of 6 ft throughout the Steamboat Channel area will be backfilled to grade. The total amount of grading will therefore be approximately 290,000 cubic yards. A 3 cubic yard bucket front end loader will be used to place this material.

Walking and biking trails will also be constructed throughout the area. Approximately 2500 ft of walking trails and 4300 ft of biking trails will be constructed. The walking trails will be 6 ft wide and require 6 inches of decomposed granite (DG) material. The biking trails will be 12 ft wide and portions will require Type II Base and DG surface material while other portions will require only DG material.

2.8.4 Yori Drain Costs

The proposed Yori Drain wetlands covers approximately 8 acres along the Yori Ditch near its confluence with Steamboat Creek. The construction area will be approximately 1000 ft long and 200 ft wide. Work for this area will include excavating the ditch to widen it to 200 ft.

The amount of material to be excavated will be approximately 22,250 cubic yards. Due to the geometry of the terrain in this area a loader cannot be used here. Instead a track hoe excavator or paddle scraper should be used. The excavator will have a 3 cubic yard bucket and will load the excavated material into two 34 cubic yard capacity end dump trucks.

The cost for a Yori Drain grade control structure is a lump sum cost of $12,000. In addition, a flow monitoring station costing approximately $2,600 will be installed.

2.8.5 Revegetation and Irrigation Costs

Western Botanical Services has provided unit costs for the proposed revegetation and floodplain planting effort. These cost are presented in Appendix H as a per acre uniform cost. The total revegetation effort is expected to cost approximately $3,300 per acre. This cost includes irrigation water and TWT control measures. In addition to these costs will be an equipment wash station ($1,000 lump sum) for TWT transport control, and approximately 8,000 ft of 4 inch and 6 inch PVC or HDPE irrigation piping. Therefore, an estimated material and operation cost is $120,000. This cost assumes the use of water from the adjacent reuse (effluent) line from the TMWRF plant.

Section 3: Tall Whitetop Control

Tall whitetop (TWT), *Lepidium latifolium,* is a noxious weed that has invaded tens of thousands of acres of pastures, marshes and riverbanks throughout the western US and has invaded over 12,000 acres of land along the Truckee River and Steamboat Creek. This weed is very tolerant of salty soils and is capable of pulling salts from deeper soils and depositing the salts at the surface. TWT is capable of adapting to adverse conditions and commonly inhabits riparian areas and fields. It creates a monoculture, thereby limiting the germination of other beneficial vegetation types and limiting wildlife habitat. TWT commonly grows to 4 feet tall, is capable of producing more than 6 billion seeds per acre, and its roots can extend to more than 10 feet in length. It is spread through the use of contaminated top soils in landscaping or construction, by a variety of vehicles inadvertently transporting the seeds, or by the movement of livestock or wildlife. In addition, rivers and irrigation ditches can transport the roots and seeds over long distances. Information regarding TWT has been obtained from the following websites (http://www.unce.unr.edu/publications/FS99/FS9995.htm and http://www.wscd.org/projects.html).

Control of the persistent and prolific noxious weed, *Lepidium latifolium,* Tall whitetop (TWT)), presents the greatest challenge to restoration of a healthy, reproductive plant community on this project site. Tall whitetop needs to be controlled upstream of the project area otherwise re-infestation is virtually assured. A wash station(s) must be installed so that all vehicles entering and leaving the site are cleaned of tall whitetop seed (Western Botanical Services, 2004). Currently, traffic is not restricted and visitors are most likely unknowingly transporting seed off the Hidden Meadows site. Project visitors and participants should also be advised that they must wash all clothing following field visits. The spread of tall whitetop in the Truckee Meadows needs to minimized (Appendix H).

Methodologies proposed to control TWT and replace with native vegetation are currently being tested at the 102 Ranch at Tracy, Nevada, and if successful, may be applied to the Hidden Meadows site. The hypothesis behind the design of the tests is that soil flora and fauna have been altered by monocultures of TWT and that native plant symbionts are no longer present. Since these symbionts are necessary for many native plants, they must be added to the soil. In combination with mowing and herbicide applications, native and adapted species will be seeded with seed coated with mycorrhiza (the fungal symbiont) and activated charcoal, which immobilizes the herbicides. Irrigation is also being applied to half the plots (Western Botanical Services, 2004).

To handle the current TWT population, all TWT should be mowed with a brush hog or sickle bar mower at the peak of its flowering stage. All TWT debris should be raked and removed from the site. When tall whitetop has re-grown to the full flowering stage, apply Plateau herbicide through a boom sprayer, utilizing TeeJet flat fan nozzles, 8004, applying 20 gallons of water per acre, at 8 fl ounces per acre with one quart per acre of methylated seed oil (Western Botanical Services, 2004). Depending on the response of the herbicide, this procedure may need to be repeated before seeding of riparian vegetation takes place.

Section 4: Regulatory Assessment

The following permits would be necessary for the proposed realignment of Steamboat Creek through the common area parcel of the Hidden Meadows Subdivision. These permits are required by the City of Reno, Washoe County, the State of Nevada, and the U.S. Army Corps of Engineers, and other regulatory agencies (Codega, 1996).

- **Section 404 Permit (USACE)** – This permit is required for the dredging or filling of material into any waters of the U.S. This includes material being excavated or redeposited and also includes the placement of any new materials including rip-rap or concrete structures. Work on the Yori Drain would not require a Section 404 permit. The proposed Hidden Meadows wetland project would require an Individual permit. Before an individual permit would be issued, a Section 401 Water Quality Certification must be granted by NDEP (Codega, 1996).

- **Section 401 Water Quality Certification (NDEP)** – This permit is required prior to the initiation of any activities that require a federal permit such as a U.S. Army Corps of Engineers' permit, pursuant to Section 404 of the CWA or National Pollutant Discharge elimination System (NPDES) permit, pursuant to Section 402 of the CWA (http://ndep.nv.gov/bwqp/bwqreg.htm). Allow 6 months to obtain this permit. The certificate will be valid for 1 year. Although there are no fees associated with this permiting process, the applicant must provide detailed information describing the project's impact to water quality as well as a written request to obtain a 401 Certification.

- **U.S. Fish and Wildlife Service** - Any federally permitted project that plans to modify any body or water in the U.S. is required to consult with the USFWS under the Fish and Wildlife Coordination Act. A review by the USFWS is coordinated through the USACE.

- **Rolling Stock Permits (NDEP)** – To prevent the release of pollutant into waterbodies, the State of Nevada requires a permit for the utlitization of any excavation equipment for construction, maintenance, or repair work within a stream or river. Allow at least one to two months to obtain this permit.

- **Temporary Authorization to Discharge (NDEP)** – This is a permit required by the State of Nevada to control any water pollution that may result from equipment working in/near a stream or river. Allow at least one to two months to obtain this permit.

- **Stormwater Permit (NDEP)** – A stormwater permit will be necessary for this project. In addition to the stormwater permit, a Notice of Intent and a Stormwater Pollution Prevention Plan must be submitted to the State of Nevada.

- **Nevada Division of State Lands** – A permit is required to perform any bank stabilization, dredging, or sand and gravel bar removal type of activity on State lands. This type of permit is required for work in the Steamboat Creek but is not necessary for work within the pond or on the Yori Drain.

- **Special Use Permit (Washoe County)** – A special use permit is required if restoration activities will require more than 1,000 cubic yards of fill will be imported and placed as fill below the flood hazard area, if more than 1,000 cubic yards of fill will be excavated from the property, or if more than 5,000 cubic yards of fill will be imported.

- **Grading and Excavation Plan (Washoe County)** – Washoe County requires a grading and excavation plan if more than 50 cubic yards of material will be graded. A grading plan must be submitted to the County.

- **Dust Control Plan (Washoe County)** – The amount of material to be moved and a plan for dust control must be submitted to the Washoe County District Health Department.

Section 5: Funding Opportunities

A number of funding opportunities may exist to supply financial support for the development and construction of the proposed Steamboat Creek Restoration at Hidden Meadows. Various grant moneys could be applied toward the planning, construction, and monitoring of the project area. In addition, funds may be available for control of tall whitetop and other noxious weed species as well as the development of a trail system.

5.1 Planning and Construction

Federal Land & Water Conservation Fund Grants Program
(http://www.parks.nv.gov/LWCF/brochure.PDF,
http://www.parks.nv.gov/LWCF/grantmanual.htm)

"The Land and Water Conservation Fund Act of 1965 was enacted "to assist in preserving, developing and assuring accessibility to all citizens of the United States of America... such quality and quantity of outdoor recreation resources as may be available and are necessary and desirable for individual active participation..."(http://www.parks.nv.gov/LWCF/brochure.PDF)

"The L&WCF program provides 50:50 matching grants to States, and through States to local governments and Native American tribes, for the acquisition and development of public outdoor recreation areas and facilities." (http://www.parks.nv.gov/LWCF/brochure.PDF) All political subdivisions with the state (including counties and cities), which have legal authority to operate parks or provide recreation services, are potentially eligible for the 50:50 matching grants. Local matches may consist of cash, in-kind labor and/or volunteer labor, and donated property, materials, or equipment.

Funding may be applied to cover costs of construction, renovation, site planning, demolition, site preparation, and architectural/engineering services. The funds can be used for trails, parking, access ways, walkways, restrooms, interpretive centers, pavilions, as well as many other recreational projects. Funding requests should range between $25,000 and $250,000.

The deadline for this grant application has been set for May 28, 2004 with final approval in the fall 2004.

Funds may be available for the Hidden Meadows project under this grant if Washoe County Parks and Recreation are agreeable to taking ownership of the open space parcel from Hidden Meadows Company. Hidden Meadows Company would donate the lands to Washoe County as a means of providing a portion of the required matching funds. Grant money could be applied toward the design and construction of the wetland system as well as towards the development of a trail system extending along Steamboat Creek.

Clean Water State Revolving Fund (http://cfpub.epa.gov/fedfund/program.cfm?prog_num=5)

"EPA awards grants to states to capitalize their Clean Water State Revolving Funds (CWSRFs). The states, through the CWSRF, make loans for high-priority water quality activities. As loan recipients make payments back into the fund, money is available for new loans to be issued to other recipients. Eligible projects include point source, nonpoint source and estuary protection projects. Point source projects typically include building wastewater treatment facilities; combined sewer overflow and sanitary sewer overflow correction; urban stormwater control; and water quality aspects of landfill projects. Nonpoint source projects include agricultural, silviculture, rural, and some urban runoff control; on-site wastewater disposal systems (septic tanks); land conservation and riparian buffers; leaking underground storage tank remediation, etc." (http://cfpub.epa.gov/fedfund/program.cfm?prog_num=5)

This grant is administered through the Nevada Department of Environmental Protection. The funding fiscal year runs from Oct 1, 2004 through September 30, 2005. The deadline for the priority listing was April 30, 2004. Although grant money is the preferred source of funding for the Hidden Meadows project, a loan from the Clean Water State Revolving Fund should also be considered. This type of loan could provide the funding necessary to move the project forward. However, a suitable vehicle for repayment of the loan and an appropriate recipient would need to be identified.

Five Star Restoration Program
(http://www.epa.gov/owow/wetlands/restore/5star/02factsheet.html)

"The Five Star Challenge Grants Program develops knowledge and skills in young people through restoration projects that involve multiple and diverse partners, including local government agencies, elected officials, community groups, businesses, schools, youth organizations, and environmental organizations. Its objective is to engage five or more partners in each project to contribute funding, land, technical assistance, workforce support or other in-kind services that match the program's funding assistance. Consideration for funding is based upon the project's educational and training opportunities for students and at-risk youth, the ecological benefits to be derived, and the project's social and economic benefits to the community.

EPA's funding levels are modest, averaging about $10,000 per project. However, when combined with the contributions of partners, projects that make a meaningful contribution to communities become possible. At the completion of Five Star projects, each partnership will have experience and a demonstrated record of accomplishment, and will be well-positioned to take on other projects. Aggregating over time and space, these grassroots efforts will make a significant contribution to our environmental landscape and to the understanding of the importance of healthy wetlands and streams in our communities."
(http://www.epa.gov/owow/wetlands/restore/5star/02factsheet.html)

This type of grant is envisioned for the replanting and reestablishment of vegetation along the restored stream channel and along the floodplain. Students from local school districts and/or other community organizations could participate in this program.

Partners for Fish and Wildlife (http://attra.ncat.org/guide/pfw.htm)

This program, sponsored by the U.S. Fish and Wildlife Service, provides technical and financial assistance to private landowners for the restoration of wetlands and other fish and wildlife habitats on their property. The USFWS may partner with "other federal agencies, Tribes, State and local governments, conservation organizations, academic institutions, businesses and industries, school groups, and private individuals. Under cooperative agreements, landowners agree to maintain restoration projects as specified in the agreement, but retain full control of the land.The program aims for 50% non-federal match for each project. Landowners and partner organizations provide this matching support." (http://attra.ncat.org/guide/pfw.htm)

This type of funding opportunity is envisioned to supply Washoe County, Dermody Properties, Hidden Meadows Company, or the City of Reno with the financial resources needed to construct wetlands along Steamboat Creek. Obtaining this type of funding is an iterative process that would require a site visit from the local Reno program contact.

North American Wetlands Conservation Council
(http://northamerican.fws.gov/NAWCA/grants.htm)

A North American Wetlands Conservation Act (NAWCA) standard grant proposal is a 4-year plan of action supported by a NAWCA grant and partner funds to conserve wetlands and wetlands-dependent fish and wildlife through acquisition (including easements and land title donations), restoration and/or enhancement, with a grant request between $51,000 and $1,000,000. Small grants (up to $50,000) are administered separately. Match must be non-Federal and at least equal the grant request (referred to as a 1:1 match). Match is eligible up to 2 years prior to the year the proposal is submitted and grant and match funds are eligible after the proposal is submitted and through the project period." (http://northamerican.fws.gov/NAWCA/USstandgrants.html) The grant funds may not be used for research, conservation education, or public access facilities. In addition, proposals should have low overhead costs.(http://csf.colorado.edu/bioregional/apr99/0052.html). Deadlines for the 2004 funding year are as follows: March 5 and July 30, 2004.

This grant is envisioned to supply funding for the realignment of Steamboat Creek and for the development of valuable wetland habitat along the proposed project reach.

National Fish and Wildlife Foundation General Matching Grants Program (http://www.nfwf.org/programs/guidelines.htm)

This program awards matching grants to eligible recipients for the conservation of fish, wildlife, plants, and the habitats on which they depend. The National Fish and Wildlife Foundation "works with its grantees and conservation partners to stimulate private, state, and local funding for conservation through matching grants." (http://www.nfwf.org/programs/guidelines.htm) Projects that focus on addressing the conservation of fish and wildlife, that work with other conservation groups and community interests, that are able to leverage available funding, and that evaluate their project outcome may be awarded matching grants. This type of grant funding does not support research, litigation, multi-year grants, administrative overhead or indirect costs, or insufficient government agency budgets. The Foundation attempts to provide 2:1 matching for accepted projects. Project pre-proposal reviews should be received by September 17, 2004. Refer to the above listed website for further information.

319(h) Funds (http://ndep.nv.gov/sec/nonpoint_rfp_02.doc)

The Nevada Department of Environmental Protection Nonpoint Source Management Program will provide matching funds for projects from public agencies, educational institutions and nonprofit organizations which aim to address nonpoint sources of pollution in Nevada. Their goal is to reduce, control and prevent nonpoint source pollution thereby improving water quality. However, these funds can not be applied toward pollution trading. All projects must include non-federal matching funds of at least 50% of the total project costs. NDEP anticipates announcing the RFP for 2005 funding during early fall 2004.

Q1 Ballot Initiative (http://dcnr.nv.gov/ab9.htm)

Question 1 is a landmark environmental initiative designed http://dcnr.nv.gov/photo/washoe02_0903.jpgto benefit, protect, and preserve Nevada's natural resources. It authorizes the state to issue general obligation bonds up to $200 million for natural resource projects. It provides a fiscally responsible mechanism for addressing the needs of environmental, historic, and cultural resources across the state. (http://dcnr.nv.gov/ab9.htm)

Highlights of the program:

- Provides funds for development of habitat conservation and open space plans;
- Provides funds to protect drinking water supplies and enhance/restore river systems in Northern Nevada (Truckee and Carson Rivers) and Southern Nevada (Clark County Wetlands Park);
- Provides funds for development of the Las Vegas Springs Preserve and to establish a permanent state museum in Clark County; and
- Ensures the ability to leverage funds from other sources – helps recipients meet the matching requirements for federal/state/local grants as well as funds from public and private foundations.
- Requires almost half of the bond funds to be matched by recipients.

5.2 Tall Whitetop Mitigation

Pulling Together Initiative (http://www.nfwf.org/programs/pti.htm)

"The Pulling Together Initiative (PTI) provides a means for federal agencies to be full partners with state and local agencies, private landowners, and other interested parties in developing long-term weed management projects within the scope of an integrated pest management strategy. The goals of PTI are:

- To prevent, manage, or eradicate invasive and noxious plants through a coordinated program of public/private partnerships.
- To increase public awareness of the adverse impacts of invasive and noxious plants.

Rather than a source of permanent funding for invasive and noxious plant control within a local area, PTI should be considered an opportunity to initiate working partnerships, demonstrate successful collaborative efforts, and develop permanent funding sources for the maintenance of WMAs from the involved parties. A project may be funded for a maximum of five years, although there is no guarantee a project will be funded for all five years. All successful applicants must reapply annually for subsequent funding, and will compete with all other submitted proposals. The PTI review committee strongly encourages financial self-sufficiency within three years. Awards are range from $10,000 to $100,000, with an average award of $30,000." (http://www.nfwf.org/programs/pti.htm)

This type of grant is envisioned for research and mitigation of Tall Whitetop along the Steamboat Creek corridor and floodplain.

5.3 In-Kind Contributions

A number of stakeholders may be included in this project and may be able to provide various levels of in-kind contributions to the project development. Effluent waters for irrigation, contributions of land and property, fill materials and the transportation and moving of fill materials could all be considered in-kind contributions. Kennedy/Jenks Consultants and the WSCD are currently working to identify and coordinate additional sources of in-kind contributions.

In addition to material in-kind contributions the ability to receive credits for floodplain storage, wetland habitat development, open space and park amenity development may also be a bartering factor in terms of stakeholder involvement and in-kind contributions.

Section 6: Project Conclusions and Vision

Restoration efforts along Steamboat Creek will be marked by significant environmental hurdles, regulatory challenges, precedence setting stakeholder cooperation and funding challenges. The momentum developed through this appraisal study process has impressed all of those involved and has provided hope for the realization of a true multi-stakeholder, community supported ecological restoration project. The opportunity for a large scale restoration effort that could address stormwater treatment, aquatic and terrestrial habitat restoration, noxious weed abatement, and protection of the downstream watershed from excess pollutant loading currently exists.

Significant environmental management debates will accompany this project, much of which will be focused on the issue of mercury and mercury methylation. The pitfalls of wetland development should be carefully considered in light of the current opportunity for environmental enhancement.

Community supported, multi-stakeholder opportunities are difficult to identify, and even more difficulty to implement. Therefore the momentum of cooperation that currently surrounds this project should be acted upon and not lost to the endless debate of scientific and regulatory "what if's". Available scientific data should be implemented, the most positive opportunities should be incorporated into the project design, and the obligation for proactive environmental stewardship should be embraced in order to make this project a reality.

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Appendix A: Existing Conditions Memorandum

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Existing Conditions Memorandum for the Hidden Meadows Appraisal Study

April 2004

Prepared for

Washoe-Storey Conservation District
1201 Terminal Way, Suite 222
Reno, NV 89502

K/J Project No. 047012.00

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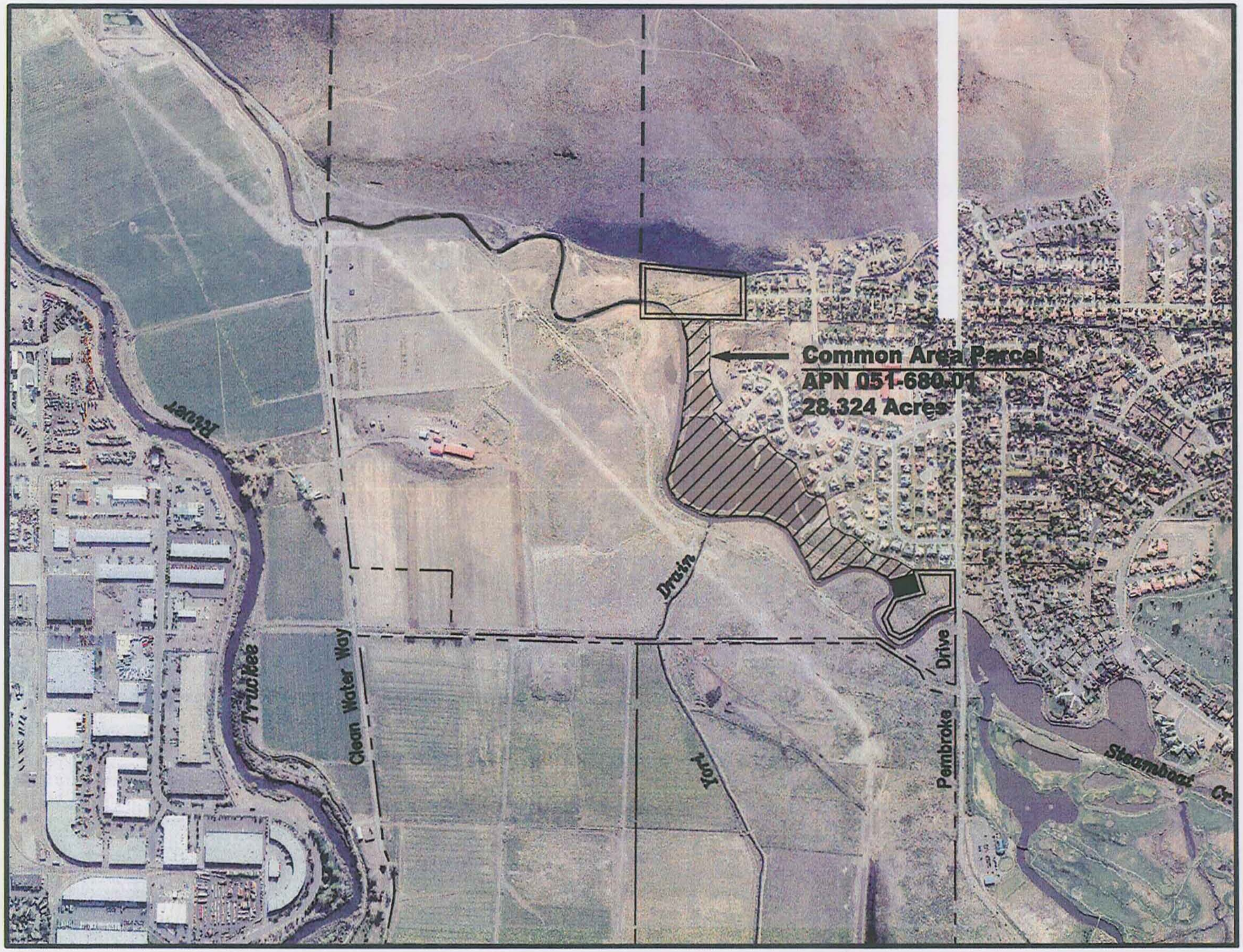
Section 1: Background

1.1 Location of the Hidden Meadows Common Area Parcel

This appraisal study focuses on defining the potential rehabilitation of parcel 051-680-01 in the Hidden Meadows subdivision. The 28.34 acre parcel is located in the NE ¼ of Section 22, T19N, R20E and has been designated as an common area parcel by the developer, Hidden Meadows Company, LTD (HMCo.). This piece of property is bordered by the Steamboat Creek to the west, private homeowners to the south, and Washoe County to the east (Figure 1). Access to the parcel can be obtained through a pedestrian easement near the Sierra Pacific Power Company parcel, through a walk-way off Meadow Edge Court, or from Washoe County property on the East.

1.2 History of the Hidden Meadows Common Area Parcel

In the early 1990's, a series of test pits were dug to gather information for a preliminary geotechnical investigation for the Hidden Meadows Development site. The Engineering Firm of SEA performed the geotechnical investigation for Lewis Homes, who was interested in purchasing the property from Link Piazzo. However, since Lewis Homes was unable to gain approval from Washoe County to develop the site and it decided not to pursue the project. In November 1993, Fred Altmann of Altmann Construction approached the owner about developing the property. Sale of the property was contingent upon Altmann Construction obtaining Washoe County's approval to develop the site. Washoe County reviewed and approved Altmann Construction's application for the development of the Hidden Meadows area with approximately 56 conditions (Simons, 2004). Upon obtaining approval for development, Altmann Construction approached Jess Arndell Construction Company about developing the project and together these entities formed Hidden Meadows Limited.



Legend

- UNR PARCELS
- DERMODY PARCELS
- SIERRA PACIFIC POWER COMPANY PARCEL
- WASHOE COUNTY PARCELS

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Washoe–Storey Conservation District
Hidden Meadows Appraisal Study

Site Map

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March 2004

Figure 1

Figure 2. Succession of photos demonstrating development of the Hidden Meadows common area parcel.

In late 1994, development of the Hidden Meadows Subdivision began under the ownership of Hidden Meadows Limited (Figure 2). The common area parcel was to be used as a borrow pit for material to construct the subdivision. Excavation in the common area parcel began in March 1995 and issues concerning the elevation of the ground water table began to emerge. Over the next two years, the developer and Washoe County debated and discussed the water issue as well as errors in the calculation for fill material required to develop the subdivision. In late 1997, the County approved the excavation of additional material from the common area parcel and the Hidden Meadows Development project moved forward. Due to the necessity to excavate to depths greater than originally anticipated within the borrow area, the creation of a park area was no longer required at completion of the project for the common area parcel (Simons, 2004). However, the County imposed a bond upon Jess Arndell Construction Company for mosquito abatement, slope stabilization in the borrow area, and for the construction of an access road around the ponds to allow for maintenance and vector control. In response to the bond requirements, rip-rap was installed around the perimeter of the ponds to provide stabilization and the access road was constructed. Once all of the conditions were satisfied, the County released the bond.

The current configuration of the common area parcel demonstrates the presence of one large pond with an approximate area of 17 acres. Aerial photographs taken in 2002 show fingers and barriers extending out into the pond area. However, since late 2002, export of fill material has come to an end and the developer has removed these access areas.

The Hidden Meadows Homeowner Association filed a complaint with Washoe County District Health – Vector Control about odor and vector control issues in the common area parcel (Pacini, 2004) in the summer of 2003. In response to the complaints, the developer installed a sprinkler system along half of the southern bank of the pond in September 2003. The system was used to agitate the water surface during the early morning and evening hours to disrupt and prevent the development of midge larvae.

1.3 Property Ownership

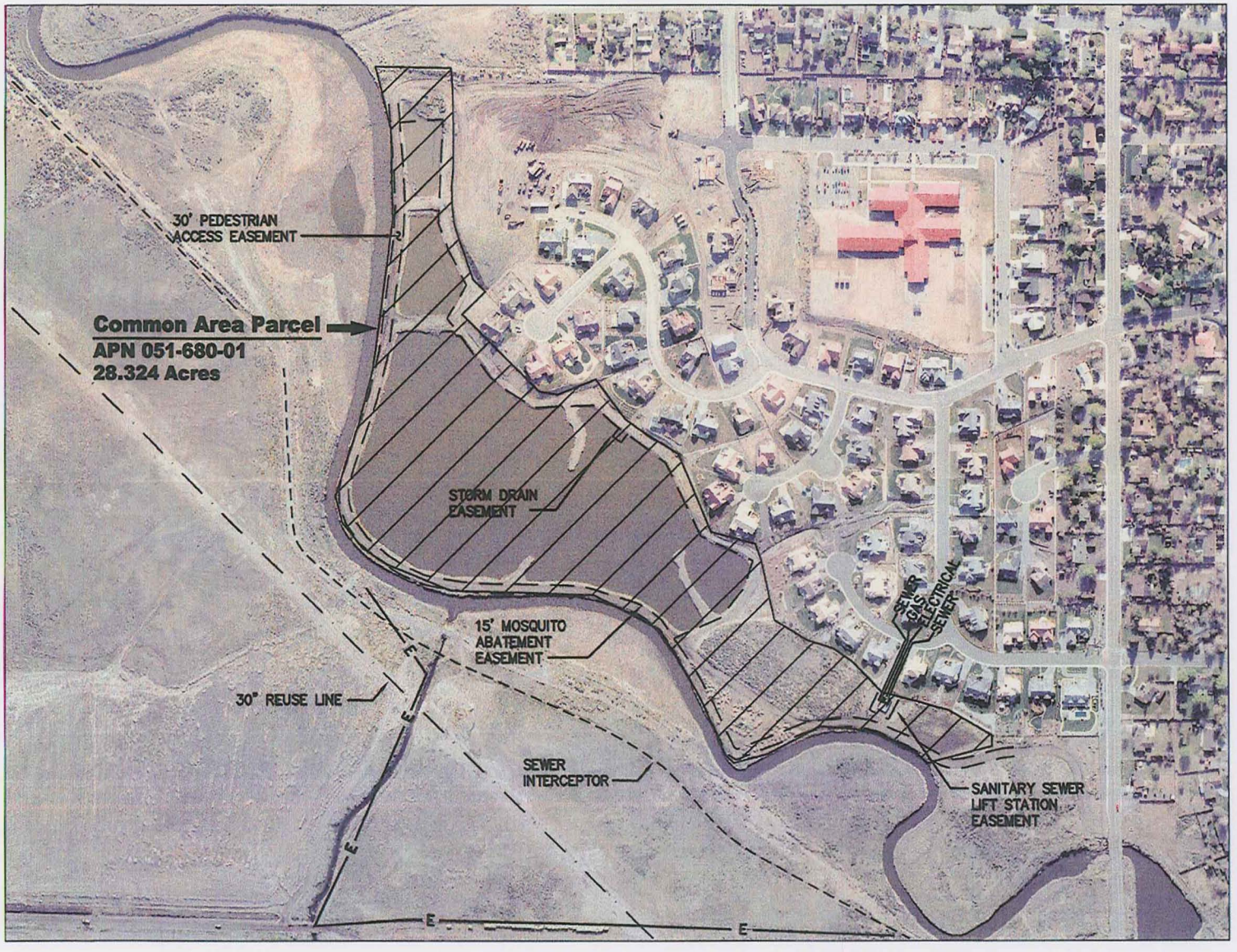
The Hidden Meadows Company , LTD. (HMCo.) is the current owner of the common area parcel parcel. Washoe County would have first right of ownership in the case that HMCo. no longer wants to accept responsibility of the parcel. The HMCo. also has the option of transferring ownership of the property to the Hidden Meadows Homeowners Association, however, they are not required to do so. Rights of ownership are currently under discussion.

Hidden Meadows Company, LTD (the predecessor in interest to Hidden Meadows Company), has granted a number of easements to Washoe County within the common area parcel (Figure 3). A 30-foot wide pedestrian easement was provided along the southern and eastern boundary of the parcel covering 2.7 acres (Easement #2447081). An easement (Easement #2447083) was designated to allow for mosquito abatement activities on 20.184 acres, which encompasses the current pond area. HMCo. also granted an easement for the drainage of storm drain facilities between lots 41 and 42 of the subdivision which empties into the common area parcel (Easement #2221469). In addition, an easement was provided for a sanitary sewer lift station near the southern end of the common area parcel. This easement granted Washoe County access to an area of 0.15 acres.

1.4 Origin of the Project

In the 1990's, the Washoe-Storey Conservation District became concerned with the state of the Steamboat Creek and initiated the Steamboat Creek Restoration Plan. The vision statement reads "The Steamboat Creek Restoration Plan is a community-wide, cooperative effort to restore, enhance, and preserve the Steamboat Creek Watershed" (Jeff Codega, 1996). Five project goals were identified and include: 1) Improvement of water quality in Steamboat Creek, 2) restoration of Steamboat Creek to a sustainable condition, 3) re-establishment of appropriate wildlife habitat for each individual stream reach, 4) reestablishment of appropriate vegetation along individual stream reaches, and 5) stream restoration in conjunction with recreation in areas designated for public access (Jeff Codega, 1996). The Restoration Plan broke Steamboat Creek into 15 reaches with each having its own unique priorities, recommended BMPs, vegetation strategies, channel type, and water quality concerns.

The Steamboat Creek Restoration Plan identified the reach of Steamboat Creek from Clean Water Way to Pembroke Drive to be of high priority for restoration activities due to water quality concerns. The Hidden Meadows common area parcel is located adjacent to Steamboat Creek in this reach.



Legend

- GAS LINE
- E — ELECTRICAL LINE
- SEWER LINE
- EASEMENT LINE
- EXISTING 30" DUCTILE IRON PIPE REUSED LINE
- EXISTING SEWER INTERCEPTOR

N

0 300 600

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Washoe–Storey Conservation District
Hidden Meadows Appraisal Study

Utility and Easement Map

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March 2004

Figure 3

T:\047012.00_HIDDEN_MEADOWS\PRODUCTS\EXISTING CONDITIONS MEMO\MAPS\FIGURE3.DWG

In the late 1990's, the homeowners living along the common area parcel of the Hidden Meadows subdivision began to notice odor and pest issues. The Washoe County District Health Department became aware of the homeowners' concerns regarding the ponds and required the developer to take appropriate measures to discourage mosquito populations and to allow for vector control. The potential to restore the common area parcel in conjunction with other local projects was discussed with the Washoe-Storey Conservation District. The Bureau of Reclamation allocated funds to the Washoe-Storey Conservation District to perform an appraisal study for the rehabilitation of the Hidden Meadows common area parcel.

Section 2: Hidden Meadows Common area parcel

2.1 Geology

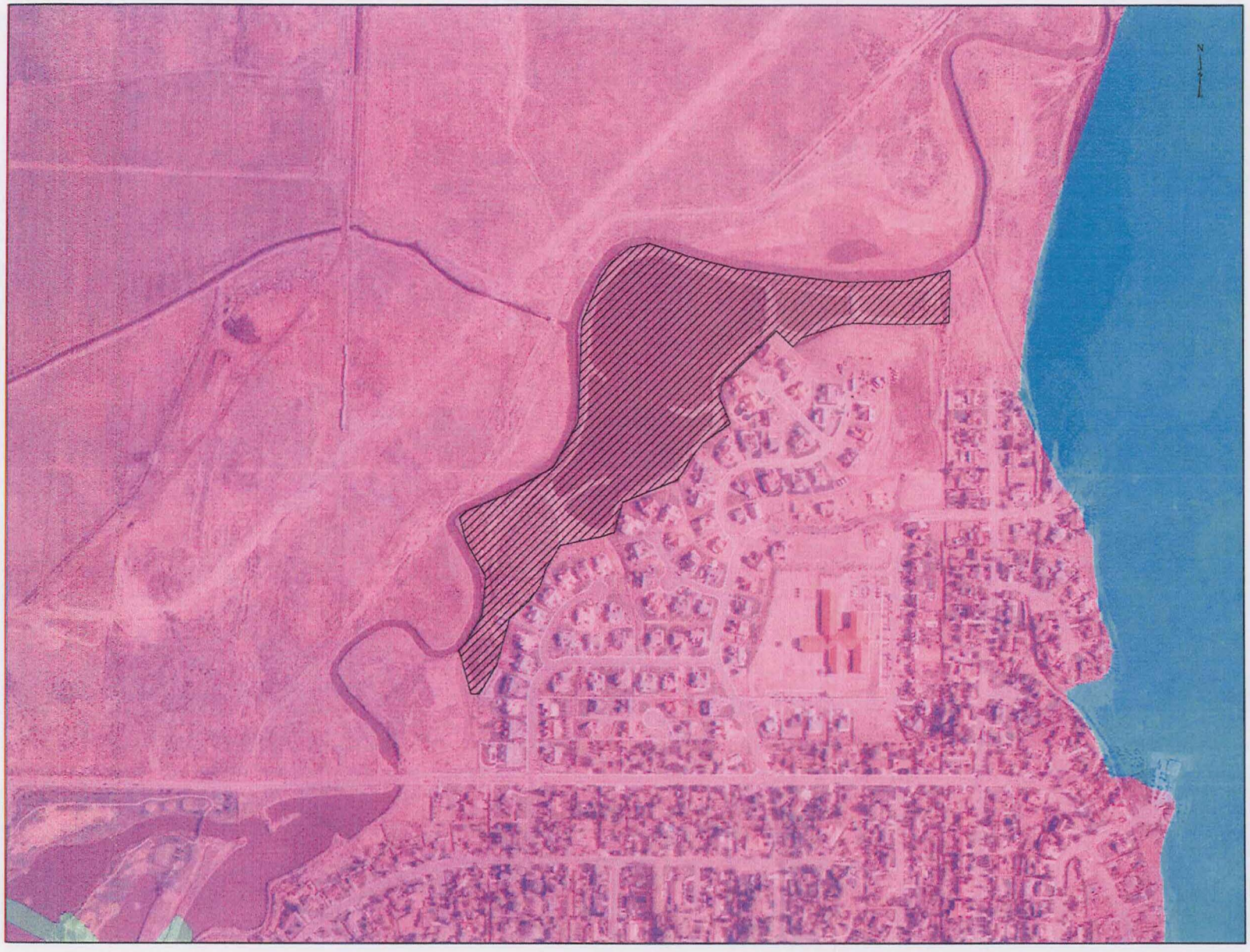
The Vista Quadrangle Geologic map created by the Nevada Bureau of Mines and Geology and prepared in cooperation with the U.S. Geological Survey identifies the common area parcel of the Hidden Meadows Subdivision as floodplain deposits of the Truckee River (Figure 4). These deposits are light gray to dark grayish brown silts, sandy silt, and clayey silt with local lenses of well rounded pebble to cobble gravels. They were deposited from overbank flooding of the Truckee River as well as from old channels and oxbow lakes. To the south of the parcel, the deposits tend to be derived from alluvial fans of the Virginia Range. To the east of the site, the hillslopes are composed of pyroxene, pyroxene-hornblende, and hornblende andesite flows, debris flows, and pyroclastic flows and have been identified as part of the Alta Formation.

A slope map of the area displays the Hidden Meadows common area parcel as having a slope between 0 – 5% and an elevation less than 4,400 feet. Figure 5 demonstrates the relatively flat areas of floodplain along the Steamboat Creek and the alluvial fan of the Hidden Meadows area. Towards the east, along the mountain front, elevations and slopes increase.

Although no earthquake hazards map is available for the Hidden Meadows area, the Truckee Meadows has been identified as lying within Seismic Zone 3. Thus, this area has the potential to be damaged in an earthquake. Due to the fine grained nature of the soils and the relatively shallow ground water table on the Hidden Meadows parcel, the potential exists for the site area to undergo liquefaction during an earthquake (SEA, 1994). Several faults are located in the vicinity of the Hidden Meadows subdivision and are considered to be potentially active. Four short Quaternary faults are noted southeast of the parcel, however no faults were observed on the ground surface or in the test pits dug by SEA (SEA, 1994).

2.2 Soils

Soils information for the Hidden Meadows common area parcel and the surrounding subdivision was obtained from the Soil Survey of Washoe County, Nevada maintained by the National Resources Conservation Service (NRCS). Soil units can be classified into 4 hydrologic soils groups by their infiltration and water transmission rates. The Hidden Meadows area is generally underlain by type D soils (Figure 6). These soils typically have a high runoff potential when saturated and transmit water very slowly. They may be composed mostly of clays, are located in areas having a permanent high water table, supply a thin veneer over impervious rock layers, or may have a clay layer near the surface. Type C soils cover sections of the University Farms property and have a slightly higher infiltration rate than the type D soils. These soils tend to have a fine texture, a slow rate of water transmission, and may impede downward movement of water. The alluvial fan underlying the Hidden Meadows subdivision is composed of type B soils. These soils are well drained and may range in texture from fine to coarse. The map unit, NR, shows urban lands that have not been classified. SEA determined that the onsite soils were predominantly fine grained silty sand and sandy clay with a high percentage of low plastic fines (SEA, 1994). Although these soils do not tend to be expansive, they are sensitive to moisture and tend to lose strength when wet.



Legend

Common Area Parcel

Geologic Unit

Alta Formation

Alluvium

Former Alignment of the Boynton Slough

0 250 500 1,000

Feet

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Washoe-Storey Conservation District
Hidden Meadows Appraisal Study

Geologic Map

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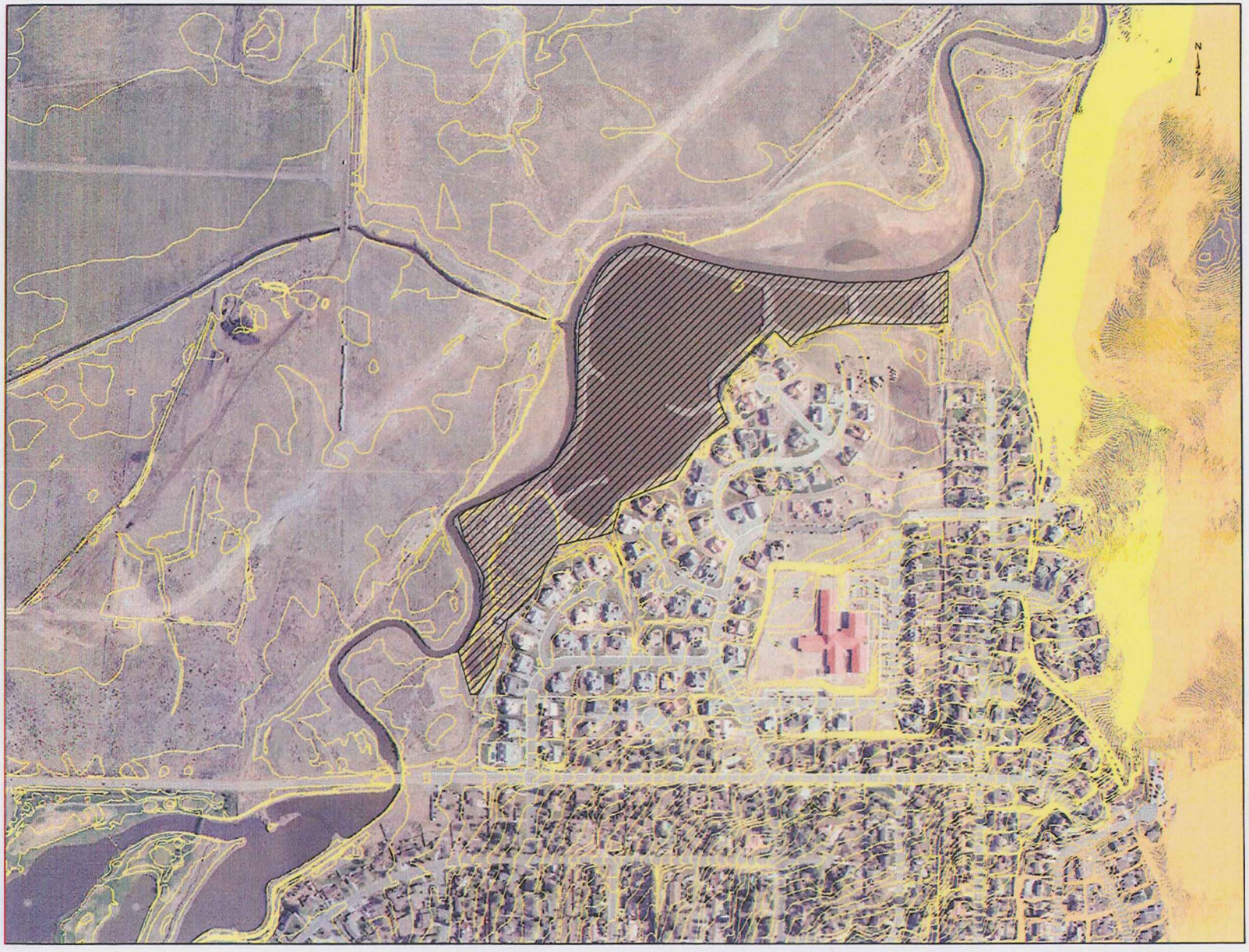
Figure 4



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Hidden Meadows Appraisal Study

Topographic Map

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March 2004

Figure 5

Legend

- Common Area Parcel
- **Hydrologic Soil Group**
  - B
  - C
  - D
  - Not Registered

0 250 500 1,000 Feet

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Washoe-Storey Conservation District
Hidden Meadows Appraisal Study

Hydrologic Soil Groups

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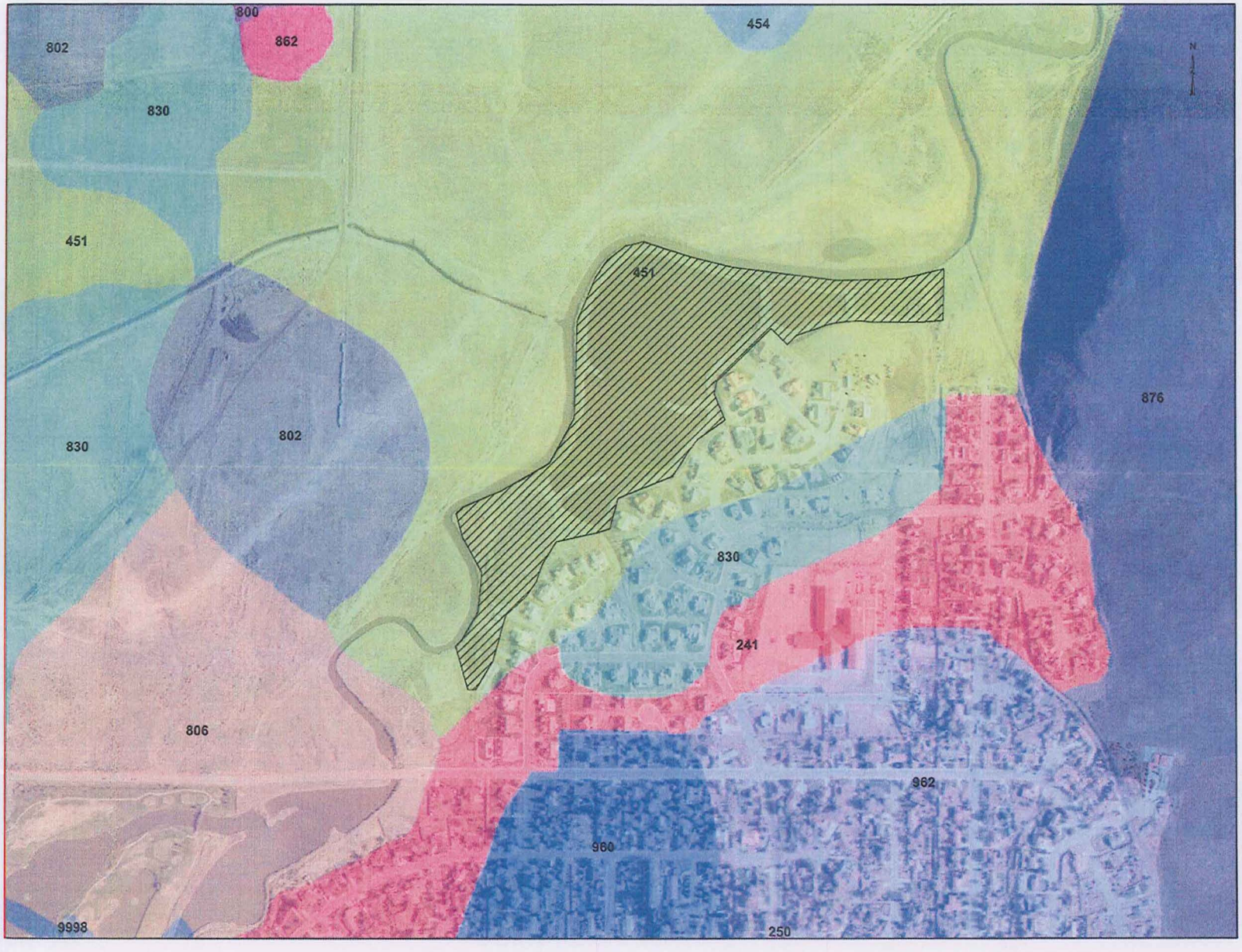
March 2004

Figure 6



Legend

Common Area Parcel

SCS Soil Classification

241	802
250	806
451	830
454	862
585	876
800	960
	962
	991
	9998

0 250 500 1,000 Feet

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Washoe-Storey Conservation District
Hidden Meadows Appraisal Study

Soils Map

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Figure 7

Soils may also be classified according to their formation name. The common area parcel of the Hidden Meadows subdivision and a portion of the surrounding area are underlain by the slightly saline, Voltaire loams (#451) (Figure 7). This soil is common on floodplains and alluvial fans and has poor drainage. It has low permeability, a high water capacity, and a low potential for soil erosion. Surrounding soils include fettic silty clay loams, strongly saline Truckee silt loams, the Xman-Oppio-Old Camp association, and the Updike loam. Although the Voltaire loam is listed as a hydric soil, Fettic silty clay loam and Updike loam are not hydric soils.

In 1993, SEA performed analytical testing on the soils of the Hidden Meadows common area parcel. They collected samples at six locations on the parcel. Results demonstrate that Boron concentrations range between 9 and 63 mg/l and sulfites between 22 and 515 mg/l. The pH of the soils ranges from 6.5 to 8.26. In 1994, a second set of samples were collected. These samples contain Boron concentrations of 5.4 to 33 mg/l and pH of 7.47 to 8.86 (Gibson & Skordal, 1995). High concentrations of boron in the root zones of plants have been known to be toxic to young plants (Huffman & Associates, 1996). Two test pits dug in the common area parcel identified layers of sulfates. One test pit contained sulfates from a depth of 3 to 7 feet (SEA, 1994) while the other noted sulfates throughout the soil column with a high concentration between 6 and 8.3 feet below the ground surface. The presence of sulfates indicates the potential for mercury methylation by sulfate reducing bacteria under anoxic soil and water conditions.

2.3 Hydrogeology

The Nevada Bureau of Mines and Geology Vista Quadrangle Groundwater map, 1992, identifies the common area parcel of the Hidden Meadows subdivision as Type IV, Medium water-yielding capacity. As noted in Section 2.1 ,the surrounding floodplain deposits are composed of sandy silt, silt, and clay. The Type IV unit is generally less than 40 feet thick and overlies the outwash deposits of the Truckee Meadows. Type III, medium to high water-yielding capacity units are located to the southeast of the parcel. This unit is commonly associated with alluvial fan deposits and can exceed 100 feet in thickness. East of the parcel, along the mountain front, the area is dominated by a Type V, low water-yielding hydrogeologic unit. This unit is typically composed of basaltic and andesitic volcanic flow deposits.

Although the Geotechnical Investigation performed by SEA in 1994 intersected the groundwater table in only one test pit, wet soils were often encountered. Test pit #1, located in the southwestern tip of the parcel, encountered water 9 feet below the ground surface (bgs). The other test pits encountered wet soils between depths of 6 to 10 feet (bgs).

2.4 Water Quality

In April 2002, the Truckee Meadows Reclamation Facility (TMWRF) collected a set of discrete samples from the Hidden Meadows ponds and Steamboat Creek. The goal was to determine if effluent from area septic systems was leaching into the three ponds and thus providing a source of bioavailable nutrients. The samples were analyzed for Total Phosphorus (TP), Nitrate ($N0_3$), and Ammonia (NH_4). Results demonstrated that the ponds contained a higher concentration of Total Phosphorus than the Creek but a much lower concentration of Nitrate and Ammonia. This suggests that area septic systems are not leaching into the ponds.

On March 16, 2004, Kennedy/Jenks Consultants collected three samples of the pond water to be analyzed for Total Mercury. The samples were sent to the University of Nevada, Reno and were analyzed under the supervision of professor Mae Gustin. Concentrations of Total Mercury in ng/L were as follows: 9.66, 19.19 and 20.04. These values appear to be elevated. However, Mae Gustin noted that samples collected during that week in the Mira Loma reach of Steamboat Creek at Clean Water Way were in the range of 9 ng/L to 18 ng/L.

Additional water quality sampling is recommended for the pond area. The current water quality appears degraded and the water tends to be green in color (Figure 8) and emits an unpleasant odor, probably due to the presence of Hydrogen Sulfide gas.

Figure 8. Photo of the Hidden Meadows pond water taken on 3/9/04

2.5 Review of Existing Biological Assessments

In response to a request for information submitted by Kennedy/Jenks Consultants, the U.S. Fish and Wildlife Service (USFWS) provided a list of threatened species which fulfills their obligation under section 7 (c) of the Endangered Species Act of 1973. Although a self-sustaining population of Lahontan Cutthroat Trout (LCT) is not currently present in the project area, the area may be necessary for the species' recovery and thus all projects must be reviewed for direct and indirect impacts on riparian and aquatic habitats as they relate to the LCT. In addition, the USFWS is concerned about the potential impacts that proposed rehabilitation of the Hidden Meadows ponds may have on migratory birds in the area. Under the Migratory Bird Treaty Act of 1918 (MBTA), the USFWS is responsible for the conservation and management of migratory birds and thus recommends that any land clearing or surface disturbing activities be scheduled outside of the avian breeding season.

It is no longer the responsibility of the USFWS to provide species of concern lists and thus it was recommended that an inquiry be made to the State of Nevada Natural Heritage Program (Heritage). The continual evaluation of conservation priorities for native plants, animals, and their habitats, especially those in serious decline or threatened by extinction, is the focus of the Natural Heritage Program. A list of rare species for Washoe County has been provided in Appendix A as well as a map showing the occurrences of the LCT. During the design phase of this project, it is recommended that an official inquiry be made to the Heritage and that a list of species specific to the project area be generated.

In June 1997, a Biological Assessment Study was performed for the Airport Wetland Mitigation Site on Steamboat Creek by Huffman & Associates, Inc. Due to the close proximity of the Airport Wetland Mitigation Site to the Hidden Meadows common area parcel, the species listed in Huffman & Associates report may be similar to those found near the common area parcel. The 1997 study identified 37 species of vertebrates including birds, mammals, reptiles, amphibians, and fish. Species such as the American avocet, American white pelican, mallard, Canada goose, and killdeer were often observed. The report, however, noted that a higher species diversity of vertebrates existed for the wetland mitigation sites in comparison to upstream and

downstream locations. A faunal survey was also conducted for a ½ mile upstream and downstream of the wetland mitigation site. They observed only 10 vertebrates species and did not record any reptiles or amphibians. Refer to Appendix B for a list of species that were observed at or near the Airport Wetland Mitigation Site.

2.6 Vegetation

The Delineation Report for the Hidden Meadows subdivision written by Gibson & Skordal in April 1994 listed the following dominant vegetative species: black greasewood, saltgrass, and rabbitbrush. However, subsequent site disturbance and construction of the subdivision greatly altered the vegetative community.

On February 21, 2004, a vegetation survey was performed in the Hidden Meadows common area parcel by Western Botanical Services, Inc. Although most of the site has been previously disturbed, a single, isolated, less disturbed area was dominated by greasewood. Several patches of inland saltgrass were observed throughout the southern portion of the site. These patches were indicative of the plant community that had existed prior to disturbance. The periphery of the pond was abundant with four-horn smother weed. The dominant species in the project area is tall whitetop, a persistent and prolific noxious weed. Table 1 presents the list of vegetation species observed by Western Botanical Services, Inc.

Table 1. Project Area Species List

Botanical Name	Common Name
Bassia hyssopifolia	four-horn smother weed
Bromus tectorum	cheatgrass
Chrsothamnus nauseosus	rabbitbrush
Chenopodium sp.	goosefoot
Distichlis spicata	inland saltgrass
Elaeagnus angustifolius	russian olive
Heliotropium sp.	heliotrope
Iva axillaris	poverty weed
Lactuca serioloa	prickly lettuce
Lepidium latifolium	tall whitetop
Salix exigua	coyote willow
Sarcobates vermiculatus	greasewood
Salsola tragus	russian thistle
Tamarix sp.	tamarisk
Tragopogon dubius	goat's beard

2.7 Onsite Storm Drainage

Original site plans and designs for the Hidden Meadow subdivision routed runoff via street curb and gutters to drainage inlets which would daylight to open ditches leading to sedimentation basins in the common area parcel. The size of the sedimentation basins were designed to treat the 10 year precipitation event. SEA applied the Rational Method (Q=CIA) to determine the 2, 10, and

100 year return periods for the sizing of storm drain pipes within the subdivision. Appendix C contains a map of contributing areas and the estimated stormwater runoff volume for each runoff area. The total estimated stormwater runoff volume from the 10 year, 24 hour storm event routed to the common area parcel is 223,800 ft^3 (SEA, 1995).

A number of storm drain outfalls currently discharge directly into the pond in the common area parcel (Figure 9 and Appendix D). A concrete drainage swale designed to convey the 100 year peak flow of 8.64 cfs drains to an 18" conveyance pipe draining into the northeastern corner of the pond. In addition, storm drain conveyance pipes with diameters of 24 inches, 18 inches (7.65 cfs), 12 inches (7.65 cfs) and 30 inches (6.51 cfs) discharge directly into the pond (Appendix C) (Summit, 2001). A number of smaller riprap swales also discharge storm water into the common area parcel.

2.8 Hydrology

SEA listed the 100 year flood plain elevation to be at 4,392 feet above mean sea level in their Storm Drainage Report for Hidden Meadow Subdivision report. This elevation is a result of backwater from the Truckee River during storm events. If there was no backwater from the river, the 100 year flood plain elevation for the Steamboat Creek would be approximately 3 feet lower. However, with the current configuration, the entire common area parcel lies within the 100 year floodplain and thus must be mitigated as such.

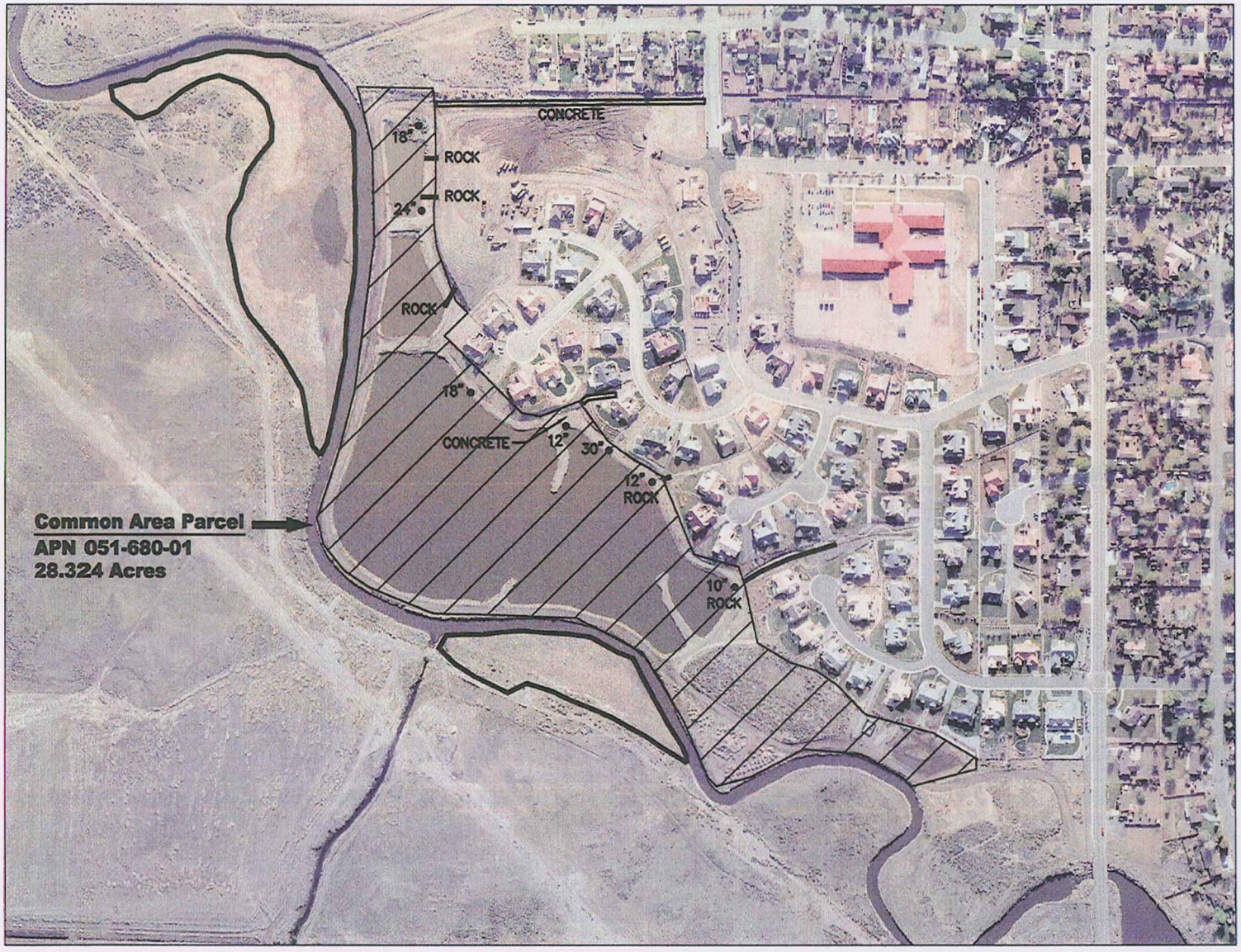
The NOAA atlas 2, vol. VII (1973) lists the 10-year, 6-hour precipitation depth as 1.15 inches and the 10-year, 24-hours precipitation depth as 1.70 inches. These values will be important for the sizing of storm drainage and flood control structures.

2.9 Cultural Resources/ Archeology

Under the National Historic Preservation Act of 1966 (NHPA), a project area must be evaluated to identify the possible existence of properties included in or eligible for inclusion in the National Register of Historic Places (NRHP). During the planning and permitting stages of the Hidden Meadows Subdivision, Archeological Research Services, Inc. (1994) prepared two inventories for the entire subdivision area. Three sites within the Hidden Meadows subdivision property were recommended as eligible for the NRHP. Two of the sites were buried during the development of the Hidden Meadows subdivision. The third site, which was determined to have the highest number of artifacts, may still contain lithic scatter and thus has been left undisturbed. This site currently has not been added as a Nevada entry to the NRHP. Rebecca Palmer of the State Historic Preservation Office (SHPO) suggests that the undisturbed portion of the common area parcel be reevaluated by a professional archeologist to determine if any significant components remain (personal communication, 2004). Since funding for this project has been provided through the Bureau of Reclamation, it is also recommended that their archeologist provide assistance in working with local Tribal groups, principally the Pyramid Lake Paiute Tribe (PLPT).

2.10 Odor and Vector Control

Surrounding homeowners and visitors to the common area parcel have noticed foul odors emitting from the ponds. They have also observed that the ponds are associated with a large population of midges. The Hidden Meadows Homeowners Association has discussed these



Legend

- PIPE OUTFALLS
- CONCRETE
- ROCK — SWALES
- AIRPORT WETLANDS

N

0 300 600

Kennedy/Jenks Consultants

Washoe–Storey Conservation District
Hidden Meadows Appraisal Study

Storm Water Infrastructure

K/J 047012.00
March 2004

Figure 9

issues with the developer, the HM Co. In the fall 2003, the HM Co. installed a PVC pipe, a pump system, and sprinklers along the southeast bank of the pond area in an effort to temporarily control midge breeding. Pond water was emitted from the sprinklers during early morning and evening hours to disturb the water surface and break the surface tension of the pond to inhibit the development of midge larvae. The pumps were only in use for a brief time before the winter season. Therefore, it is currently unknown whether this system proved effective at inhibiting midge populations.

The Hidden Meadows Homeowners Association is concerned with the presence of a stagnant and sulfur-like odor emanating from the pond area during the summer and fall. They have been researching the possible use of aerators to mix the pond waters and alleviate the smell. They are interested in finding a temporary solution until the common area parcel can be rehabilitated.

2.11 Utilities

A review of existing onsite utilities has identified the presence of a utility corridor in the southwestern corner of the common area parcel (Figure 3). A 3-phase power line, two sewer lines, and a gas line extend from Meadow Edge Ct. to a sanitary sewer lift station. There are no other utilities located on the site, however a 3-phase power line ends at 2 transformers on the west bank of the Steamboat Creek located between the two cells of the Airport Mitigation Wetland sites. A discussion with SBC suggests that telephone service may also follow this power line extending from Pembroke Drive towards the northeast. Debbie Boucher with SBC verified that no telephone service lines were located within the Hidden Meadows common area parcel (2004). The final design team will need to do a thorough investigation of the utility infrastructure on the parcels adjacent to the pond site.

2.12 Liability

The Hidden Meadows common area parcel currently contains a pond having an approximate area of 17 acres. The presence of open water introduces a great deal of liability to the property owner. Thus, as part of this appraisal study, it is important to consider issues such as property ownership and amount of liability the owner is willing to assume. HM Co. is the current property owner, but there have been numerous discussions about turning the parcel over to Washoe County Parks and Recreation or to the Hidden Meadows Homeowners Association. The amount of liability that these groups are willing to assume when accepting ownership of the common area parcel will be directly related to the final configuration of the reconstructed pond area.

2.13 Aesthetics

The 28 acre, common area parcel of the Hidden Meadows subdivision is currently dominated by a large pond, a relatively small open area covered with native brush, and an extensive population of tall whitetop. To provide a preliminary design for the common area parcel that will be viewed as a community asset, it is important to consider the aesthetic value of the area. The opinions of local homeowners as well as city and state officials will be considered. Based upon preliminary discussions with the Hidden Meadows Homeowners Association, the construction of a grassy park and a ball field is not an acceptable option. They would prefer the area to be rehabilitated with a natural look and feel. A low maintenance, low liability, and attractive design is preferred.

Section 3: Steamboat Creek Issues

Since Steamboat Creek is considered to be the most polluted tributary of the Truckee River, as such, much attention has been given to this Creek. The Creek originates at Little Washoe Lake and flows approximately 17.5 miles northeast to its confluence with the Truckee River. The Steamboat Creek watershed encompasses approximately 200 square miles and drains Washoe Valley, Pleasant Valley, Steamboat Valley and much of the Truckee Meadows south of the Truckee River.

In the 1960's the U.S. Army Corps of Engineers removed Vista Reef in the Truckee River thereby lowering the invert of the Truckee River. This lowering of the river's base level initiated headward erosion in Steamboat Creek. A grade control structure at Pembroke Drive was installed to prohibit further headcut migration. However, downstream of Pembroke Drive, the Steamboat Creek has incised approximately 8 to 12 feet resulting in steep, unstable, eroded banks (Jeff Codega, 1996).

Various projects and studies have been performed along Steamboat Creek to identify environmental problems and to rehabilitate degraded reaches. The following sections will contain discussions regarding water quality issues as well as rehabilitation projects along the Steamboat Creek.

3.1 Environmental Issues

3.1.1 Water Quality

The reach of Steamboat Creek extending from Section 33, Township 18N, Range 20E to the Truckee River has been listed on Nevada's 2002 303(d) List of Impaired Waterbodies for Arsenic, Boron, Iron, and Mercury. This stretch of Steamboat Creek covers approximately 13.71 miles and flows past the Hidden Meadows appraisal study site. Although Steamboat Creek has not been assigned total maximum daily loads (TMDLs), the Truckee River at Lockwood has been listed for Total Nitrogen (TN), Total Phosphorus (TP), and Total Dissolved Solids (TDS) (NDEP, 1994). Therefore, in order to protect the water quality of the Truckee River and to ensure that TMDLs are not exceeded, any work done in or around Steamboat Creek must not cause an increase in sediment or listed pollutant levels.

The Cities of Reno and Sparks are interested in the water quality of the Truckee River as well as the water quality in Steamboat Creek. The outfall of the Truckee Meadows Water Reclamation Facility (TMWRF) enters into Steamboat Creek close the confluence with the Truckee River. Due to discharge permit conditions, the cities look positively upon projects which improve the water quality in Steamboat Creek.

Pyramid Lake is the receiving water body for the Truckee River. Therefore, the Pyramid Lake Paiute Tribe (PLPT) has historically been concerned with water quality issues and fish habitat in the Truckee River. The PLPT promotes populations of the Lahontan Cutthroat Trout, a fish named on the US Fish and Wildlife Threatened Species List, and the Cui-ui, an Endangered Species. Since Steamboat Creek has been identified as a major source of nitrogen and sediment and is the single largest source of mercury in the Truckee River watershed, the PLPT is concerned about projects that may increase pollutant levels, and impact these two fish

species. The remobilization of mercury from old floodplain deposits and paleochannel sinks are of particular concern to the PLPT in regards to floodplain restoration and wetland development projects.

3.1.2 Mercury

During Comstock mining, mercury was used in the Steamboat Creek Watershed to amalgamate gold and silver from the ore bodies. It has been estimated that waste tailings from 4 mills in Washoe Valley have released more than 40 tons of mercury to the Steamboat Creek watershed. The mercury concentrations in Steamboat Creek have been determined to be about 15 to 53 times higher than the natural background level of 1 to 3 ng/L (Blum, 2001). Although the presence of mercury in its elemental form does not tend to be toxic, mercury in a methylated form is very toxic and has the ability to bioaccumulate. The presence of sulfate-reducing bacteria in anaerobic wetland environments may be responsible for the increased levels of methyl mercury on floodplains and in wetlands due to the bacteria's ability to methylate elemental mercury. Blum et. al. (2001) determined that most of the mercury present in Steamboat Creek is not in a dissolved form or associated with particles <0.45 µm, but rather it tends to be associated with larger particulates in the stream channel and along the banks. Blum also determined that the range of mean methyl mercury concentrations was greatest in wetlands along Steamboat Creek with decreasing amounts in stream channels and along stream banks. Similar results were obtained by University of Nevada, Reno, graduate student Beth Thomas in her 2002-2003 study of mercury along Steamboat Creek and its tributaries (Table 2). As per conversations with University of Nevada, Reno, professor, Mae Gustin, mercury levels measured in the sediments at the Airport Mitigation Site may be lower than ambient concentrations due to recent disturbance at the site.

The presence of mercury and methyl mercury in Steamboat Creek must be considered when creating a preliminary design for the rehabilitation of the Hidden Meadows common area parcel. This environmental concern may impact whether a wetland system is feasible for this area. Significant increases in downstream concentrations of mercury and/or methyl mercury will not be permitted by local municipalities and agencies.

Table 2. Range of mercury and methyl mercury concentrations in unfiltered water samples collected from Steamboat Creek (Thomas, 2003). Samples were collected from base flows, snowmelt, and irrigation flows.

	Unfiltered Water Samples	
Sample Location	Total Mercury, µg/L	Methyl Mercury, µg/L
Rosewood Lakes Outlet	37.3 to 84	0.59 to 0.77
Airport Mitigation Site	44.1 to 105.5	NA
Clean Water Way	36.6 to 134.7	0.53 to 1.12

Table 3. Mercury and methyl mercury concentrations in sediments collected from Steamboat Creek (Thomas, 2003).

	Total Mercury, µg/g, dry weight			Methyl Mercury, µg/g, dry weight		
Location	Channel	Low Bank	High Bank	Channel	Low Bank	High Bank
Rosewood Lake Outlet	2.37 sandy clay loam	0.74 sandy clay loam	0.53 NA	0.136	0.241	NA
Airport Mitigation Site	0.16 silty clay	0.09 silty clay	0.07 loamy sand	0.886	0.201	NA
Clean Water Way	0.86 silty clay	1.71 silty clay loam	0.73 silty clay loam	2.978	0.956	NA

3.2 Confluence Project

"The U.S. Army Corps of Engineers under sponsorship by the Washoe-Storey Conservation District in conjunction with the University of Nevada, Reno and City of Reno are collaboratively conducting a large restoration feasibility study on Steamboat Creek from Clean Water Way to the confluence of the Truckee River. The proposed project on this 80-acre site is the active restoration of 1.1 miles of Steamboat Creek to a more naturally functional lotic riparian area. Currently, the creek is a straightened, incised channel. Incision up to 12 feet has caused destabilization of the banks, causing dehydration of the historic riparian floodplain and significant sediment pollution. This project is conceived to be a process-based restoration effort. The conceptual design for the new channel is a single threaded, low-gradient, meandering channel." http://www.spk.usace.army.mil/civ/SteamboatCreek/documents.html)

In an effort to reconnect this stream to a floodplain, the conceptual plan would be designed such that over-bank flooding will access a 500-foot wide riparian floodway during periods of bankfull flow. Restoration will be accomplished by excavating a new channel and floodplain through the alfalfa fields to the west of the current creek. The channel length will be increased from 5767.65 ft to approximately 9520 ft and the sinuosity will be altered from 1.1 to 1.8 (Blum, 2004).

The proposed confluence project has been designated as a Section 206 ecosystem restoration project on Steamboat Creek. The project proposes to establish riparian habitat as well as improve water quality by avoiding bank erosion, encouraging the deposition of fine sediments, storing of nutrients and by promoting denitrification (USACE, 2001).

3.3 Airport Mitigation Wetlands

In the early 1990's, the Airport Authority of Washoe County was granted permission to fill an area of wetlands on the Reno-Tahoe International Airport in order to upgrade airport facilities and expand the runways. Permission was granted under the condition that the wetlands would be mitigated at a ratio of 2 acres created for every 1 acre lost. The U.S. Army Corps of Engineers issued a permit for the construction of 9.28 acres of mitigation wetlands. The site selected for the airport mitigation wetlands is located at the University of Nevada, Reno

Agricultural Experiment Station in Reno, Nevada. The site encompasses 10.13 acres along the Steamboat Creek and is located between Clean Water Way and Pembroke Drive. The mitigation site has been designed as a mixture of wetlands and open water/riverine habitat (Figure 9).

Extensive work has been done at the Airport Mitigation Wetlands to understand the complex interaction of water quality, soils, and successful establishment of wetland vegetation. Knowledge and experience gained from this project may prove to be a valuable asset during the preliminary design stages of the Hidden Meadows pond rehabilitation.

3.4 Available Data Sets

3.4.1 Water Quality

Water quality samples have been collected along Steamboat Creek by a number of entities including the Nevada Department of Environmental Protection (NDEP), the University of Nevada, Reno, Huffman and Associates, and the Truckee Meadows Water Reclamation Facility (TMWRF).

Due to Steamboat Creek's listing on Nevada's 303(d) List, NDEP is required to perform regular water quality monitoring of the Creek's waters. NDEP collects water quality samples from 15 locations along Steamboat Creek. Samples collected at the following locations may be valuable for the Hidden Meadows Appraisal Study: Boynton Slough, Steamboat Creek near Pembroke Lane, Yori Drain, and Steamboat Creek at Clean Water Way (http://ndep.nv.gov/bwqp/steamboatmap.html).

The University of Nevada, Reno has been studying the presence of mercury and methyl mercury in Steamboat Creek since the 1990's. Their results, which provide concentrations of both total and methyl mercury in water and sediment samples, may provide valuable data for the rehabilitation efforts of the Hidden Meadows common area parcel. Their data has been collected at a number of sites along the Creek including the Rosewood Lakes outlet, the Airport Mitigation Site, and at Clean Water Way. In addition to total and methyl mercury, the water quality of Steamboat Creek and its tributaries were also tested for total arsenic, lithium, pH, specific conductance, water temperature, and dissolved oxygen (Thomas, 2003).

To satisfy the requirements of their mitigation permit, Huffman and Associates have been collecting monthly water quality data at the Airport Wetland Mitigation Site since the mid 1990's. They have been monitoring the following constituents; pH, total suspended solids, total dissolved solids, nitrates, total Kjeldahl nitrogen, total phosphorus, ortho-phosphorus, boron, arsenic, dissolved oxygen, water temperature, and conductivity.

The TMWRF collects water quality samples at approximately 10 locations within the Truckee River system. The site at Clean Water Way along Steamboat Creek is of most interest to this study. Monthly grab samples are analyzed for a variety of nutrient levels. In addition, a YSI-sonde is used to take hourly measurements of temperature, pH, specific conductance, and dissolved oxygen. A database of the TMWRF water quality data is available at http://www.tmwrf.com/facility_data/river_monitoring/.

3.4.2 Water Quantity/ Flow data

The U.S. Geological Survey maintains a number of stream flow gauging sites along Steamboat Creek. At Short Lane in Reno, Nevada, stream flow measurements are recorded at 15 minute intervals. This data is available from October 2000 through the present. In addition, daily streamflow measurements are recorded at Clean Water Way. This site is located at an elevation of 4,375.00 ft above mean sea level NGVD29 and a latitude of 39°30'47", longitude 119°42'41" NAD27. Streamflow data has been collected at this site from 1976 to the present. However, the USGS only has record of peak flows at this site since 1994. This site is the closest monitoring site to the Hidden Meadows project site and thus will be a valuable resource (http://nwis.waterdata.usgs.gov/nv/nwis/discharge/?site_no=10349980).

3.4.3 Streamflow Hydraulic Modeling

A HEC-RAS model has been developed by the U.S. Army Corps of Engineers as part of the proposed Confluence Project. The existing conditions model of Steamboat Creek extends from a point near the confluence with the Truckee River to the bridge at Pembroke Drive. This model includes the section of Steamboat Creek that flows past the Hidden Meadows project site. A proposed conditions model is currently being developed and will need to be reviewed for possible impacts to the Hidden Meadows site.

3.4.4 Steamboat Creek Bedload

Sediment samples were collected from Steamboat Creek to determine the grain size distribution of stream deposits. These samples were collected from the channel at Pembroke Drive and Clean Water Way using a US BMH-53 bed material sampler. The Pembroke Drive sampling location demonstrated a d_{50} of 0.10 mm while the site at Clean Water Way had a d_{50} of 0.4 mm (Blum, 2003). This data was collected by the University of Nevada, Reno as part of the Reno Steamboat Creek Confluence Feasibility Study.

3.4.5 Soils

Soil samples along Steamboat Creek have been collected by a number of entities including CH2MHill, UNR, Huffman and Associates, and SEA.

In March 2003, under contract with the USACE, four soil borings were installed by CH2MHill to a depth of 19.5 ft below ground surface (bgs) on the agricultural lands east of Steamboat Creek. This study was performed to obtain soils data as part of the Confluence project. The samples collected from each borehole were composited before analysis. The four samples representing the four boreholes were analyzed for the following constituents: total metals, mercury, methyl mercury, total sulfur, and soluble metals. In addition, soil boring logs were prepared and provide the following information: depth below surface, split spoon sample blow count, core description, and well data (CH2MHill, 2003).

Professor Mae Gustin with the University of Nevada, Reno has been overseeing a number of studies focusing on concentrations of total mercury and methyl mercury in the sediments and waters of the Steamboat Creek. Refer to the Mercury discussion listed in section 3.1.2 for further details on her studies.

Although a limited amount of soil chemistry data exists for Steamboat Creek sediments, a number of geotechnical studies have characterized the surrounding soils. Soil sampling was performed on the Airport Mitigation Wetland site by Huffman and Associates in 1995. A number of test pits were dug and soil bores were collected. Soil color, texture, smell, and any mottles were noted. Soil samples were characterized into percent silt, sand, and clay.

In April 1992, SEA, Inc. conducted a soils investigation for the Hidden Meadows Subdivision. This data, in addition to sampling conducted in 1994 by Gibson & Skordal, have been incorporated into the Delineation Report for Hidden Meadows (1994). The test pit logs by SEA, Inc. describe the soil moisture, color, type, and composition. Gibson & Skordal noted the mapping unit, mottling, soil matrix color, texture, and whether the soil could be defined as hydric.

3.4.6 Groundwater Elevations

Shallow groundwater elevations at the Airport Mitigation Wetland site have been monitored by Huffman and Associates at 22 piezometers located within the two wetland sites. In addition, three deeper wells were installed in the upland area to the west of Steamboat Creek. Measurements were begun in July 1994 (Huffman & Associates, 1996) and are still being collected.

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Appendix A: Washoe County Rare Species List

State of Nevada
Department of Conservation & Natural Resources
Natural Heritage Program

1550 East College Parkway, suite 137 • Carson City, Nevada 89706-7921, U.S.A.
tel: (775) 687-4245 • fax: (775) 687-1288 • http://heritage.nv.gov

WASHOE COUNTY RARE SPECIES LIST

(5 August 2002)

This list provides information for the 125 Washoe County plants and animals included on the Nevada Sensitive Animal and Sensitive Plant and Lichen lists and on the Nevada Plant and Animal Watch List. These data reflect **only what was entered in our computer databases** as of the above date; additional information for some species may await processing in paper files, or may have been entered subsequently.

Information provided for each taxon in the columns below include the various agency status and rank designations, sand and wetland habitat indicators, and endemic status within Nevada. **A new Occurrence Status (OCC) column has been added to the left side of the list to show any special status within the county: ?=possible or predicted in the county but not yet confirmed, e=endemic in-state (known in Nevada only from this county), E=endemic (known worldwide only from this county), and I=only introduced or re-introduced occurrence(s) present in this county.**

More detailed state-wide information for these taxa is available in our Detailed Rare Plant and Lichen and Detailed Rare Animal lists, and in the **Nevada Rare Plant Atlas**, which provides comprehensive information on **habitat, life-history, description, threats, survey status, literature sources, and known locations** for most plant taxa. **Further information** may be available on-line for some taxa in other lists or reports, or as maps or images, and **general information** is available for nearly all taxa on the NatureServe Explorer web site.

Click on a column heading for an explanation of that column. You may need to scroll **horizontally** in your browser to see all columns. You may also jump to the sensitive taxa or the watch-list taxa.

OCC	RANKS	BSA	BLM	FS	TAXON NAME AND (VERNACULAR NAME)	NV	2N	HAB	END
					SENSITIVE TAXA				
					********** Plants - Bryophytes (moss allies)				
?	G1 S1				Orthotrichum shevockii (Shevock rockmoss)				
					********** Plants - Gymnosperms (conifers)				
c	G3Q		n		Pinus washoensis	CY		D	

	S1				(Washoe pine)					
********** Plants - Flowering Dicots										
	T1Q?1G5				Arabis rectissima var. simulans		T			P
	S1				(Washoe tall rockcress)					
e	T2Q?3			sl	Arabis rigidissima var. demota		N			
	S2				(Galena Creek rockcress)					
e	G2	xC2		i	Arabis tiehmii		W			
	S1				(Tiehm rockcress)					
e	G3?				Astragalus lemmonii		W	W		
	S1				(Lemmon milkvetch)					
e	T2G4		c	c	Astragalus pulsiferae var. pulsiferae		W			
	S1				(Ames milkvetch)					
e	T3G4	xC2	c	c	Astragalus pulsiferae var. sukadorfii		W			
	S1				(Suksdorf milkvetch)					
	G3	xC2	nc		Astragalus tiehmii		N			Y
	S3				(Tiehm milkvetch)					
	G3Q	xC2	nc		Cryptantha schoolcraftii		N			P
	S3				(Schoolcraft catseye)					
e	T2G4			si	Draba asterophora var. asterophora		W			
	S1				(Tahoe draba)					
	G2G3	xC2	n		Eriogonum anemophilum		W			Y
	S2S3				(Windloving buckwheat)					
	G3	RA	nc		Eriogonum crosbyae		W			
	S3				(Crosby buckwheat)					
E	T1G5	LE	s		Eriogonum ovalifolium var. williamsiae	CE	E	W		Y
	S1				(Steamboat buckwheat)					
e	G3	xC2	nc	c	Eriogonum prociduum		W			
	S1				(prostrate buckwheat)					
	G2G3		n		Eriogonum robustum		W			Y
	S2S3				(altered andesite buckwheat)					
	T2G2	xC2	nc	sc	Ivesia aperta var. aperta		?	W		
	S1				(Sierra Valley mousetails)					
	T2G2	RI	nc		Ivesia rhypara var. rhypara		W			
	S2				(grimy mousetails)					
	G2	C	sc	sc	Ivesia webberi	CE4	T			
	S1				(Webber ivesia)					
	G2?				Lomatium packardiae		W			
	S1?				(Succor Creek parsley)					
	G2G3				Lomatium roseanum		W			
	S2S3				(adobe parsley)					
E	G1?Q				Mimulus angustifolius		W			Y
	S1?				(Mount Rose monkeyflower)					
	G1G2Q				Mimulus ovatus		T			Y
	S1S2				(Steamboat monkeyflower)					

	G4 S2S3				Opuntia pulchella (sand cholla)	CY	O	S		
	G2G3 S2S3	xC2	n		Oryctes nevadensis (oryctes)		W	S		
	G2 S2?			c	Phacelia inundata (playa phacelia)		W	W		
	G2G3 S2S3				Plagiobothrys glomeratus (altered andesite popcornflower)		W			Y
	G2Q S2		s	i	Polyctenium williamsiae (Williams combleaf)	CE	T	W		
	G1 S1	C	s	sl	Rorippa subumbellata (Tahoe yellowcress)	CE	T	W		
	T1T2Q S1S2	G4G5			Silene nuda ssp. nuda (naked catchfly)		W			Y
********** Lichens										
?	G3 S1				Aspicilia fruticulosa (rim lichen)		M			
********** Molluska										
	G3 $1?	xC2	n	c	Anodonta californiensis (California floater)			W		
E	G1 S?				Fluminicola dalli (Pyramid Lake pebblesnail)					Y
E	G1 S1				Pyrgulopsis bruesi					Y
	G2G3 S2S3				Pyrgulopsis longiglans (western Lahontan springsnail)			W		Y
********** Insects										
E	T2G5 S1				Euphilotes enoptes aridorum (Peavine blue)					P
	T3?G5 $1	xC2	n		Euphydryas editha monoensis (Mono checkerspot)					
	G2? S1				Formica microphthalma (northern Sierra endemic ant)					
	T1T2G5 S1S2	xC2	n		Limenitis archippus lahontani (Nevada viceroy)					Y
	G2? $2?				Myrmecocystus arenarius (dune honey ant)			S		Y
	T3T4G5 S?				Polites sabuleti alkalinensis (alkaline sandhill skipper)					
	T1G3G4 $1	LE			Pseudocopaeodes eunus obscurus (Carson alkali skipperling)					P
	T1G3 S1	xC2	n		Speyeria nokomis carsonensis (Carson Valley silverspot)					

E	G1? S1				Stenamma wheelerorum (endemic ant)			Y
********** Fishes								
E	G1 S1	xC2	n		Catostomus sp. (unnamed) (Wall Canyon sucker)		N	Y
e	G1 S1	LT	s		Catostomus warnerensis (Warner sucker)		N	
E	G1 S1	LE	s		Chasmistes cujus (cui-ui)	yes	N	Y
e	T1G4 S1	xC2			Gila bicolor eurysoma (Sheldon tui chub)		N	
e	T1G4 S1	PE	c		Gila bicolor vaccaceps (Cowhead Lake tui chub)		N	
	T3G4 S3	LT	s	t	Oncorhynchus clarki henshawi (Lahontan cutthroat trout)	yes	N	
e	T2Q5 S1	xC2		c	Oncorhynchus mykiss pop (Warner Valley redband trout)	yes	N	
********** Amphibians								
	G2G3 SH	xC2		l	Rana muscosa (mountain yellow-legged frog)		N	
********** Reptiles								
	T3T4G5 S2S3				Elgaria coerulea palmeri (Sierra alligator lizard)			
********** Mammals								
	T3?4G5 S1	xC2N L			Aplodontia rufa californica (Mono Basin mountain beaver)	yes	N	
	G4 S3B		n	si	Corynorhinus townsendii (Townsend's big-eared bat)			
e	G4 S2				Dipodomys californicus (California kangaroo rat)			
	G4 S1S2	xC2	s	s	Euderma maculatum (spotted bat)	yes		
	G5 S2S3			il	Martes americana (marten)	yes		
	G5 S3B				Myotis californicus (California myotis)			
	G5 S3B	xC2	n		Myotis ciliolabrum (western small-footed myotis)			
	G4G5 S2B	xC2	n		Myotis thysanodes (fringed myotis)			
	G4	xC2	n		Sorex preblei			

	S2				(Preble's shrew)			

********** Birds

	G5 S3	xC2	p	ai	Accipiter gentilis (Northern Goshawk)	yes		
	TUG4 S3B	xC2	p		Athene cunicularia hypugaea (Western Burrowing Owl)	yes		
	G4 S3	xC2	p		Buteo regalis (Ferruginous Hawk)	yes		
	G5 S2B		p	i	Buteo swainsoni (Swainson's Hawk)	yes		
	G4 S4		n		Centrocercus urophasianus (Sage Grouse)	yes		
	T3G4 S1B	LTNL	n		Charadrius alexandrinus nivosus (Western Snowy Plover)	yes	W	
	G4 S2S3B	xC2	n		Chlidonias niger (Black Tern)	yes	W	
	T3G5 S1B	C	s	i	Coccyzus americanus occidentalis (Western Yellow-billed Cuckoo)	yes	W	
	G5 S2S3N			s	Gavia immer (Common Loon)	yes	W	
	G5 S3		n	s	Oreortyx pictus (Mountain Quail)	yes		
	G4 S1?B		p	s	Otus flammeolus (Flammulated Owl)	yes		
e	G4 S3?			s	Picoides albolarvatus (White-headed Woodpecker)	yes		
	G5 S3B	xC2	p		Plegadis chihi (White-faced Ibis)	yes	W	
e	G5 SAN			si	Strix nebulosa (Great Grey Owl)	yes		
	T3G3 S1N	xC2		si	Strix occidentalis occidentalis (California Spotted Owl)	yes		

WATCH-LIST TAXA

********** Plants - Flowering Dicots

?	G3 S2	Artemisia packardiae (Packard mugwort)	D		
	G3? S3?	Astragalus porrectus (Lahontan milkvetch)	D	Y	
	G3 S3	Camissonia nevadensis (Nevada suncup)	D	Y	
	G3? S3?	Eriogonum lemmonii (Lemmon buckwheat)	D	Y	

	G5?		Hackelia cusickii	D		
	S1		(Cusick stickseed)			
	T2T3G5	c	Loeflingia squarrosa ssp. artemisiarum		s	
	S1S2		(sagebrush pygmyleaf)			
	G3?		Lupinus malacophyllus	D		Y
	S3?		(soft lupine)			
e	G2G3	c	Penstemon sudans	W		
	S1		(Susanville beardtongue)			
	G4?		Perideridia lemmonii			
	S3?		(tuni)			
?	G3		Plagiobothrys salsus	W	N	
	S2S3		(salt marsh allocarya)			
e	G3Q	c	Scutellaria holmgreniorum	D		
	S3		(Ravendale skullcap)			
c	G3		Tonestus eximius	D		
	S1		(Tahoe goldenhead)			
c	G4?		Trifolium lemmonii	D		
	S1		(Lemmon clover)			

**************** Plants - Flowering Monocots

	G4		Calochortus leichtlinii			
	S3		(Leichtlin mariposa lily)			
?	GHQ		Sloden nevadensis		W	P
	SH		(Nevada waterweed)			

**************** Annelids

	G?		Varichaeta nevadana			
	S?		(endemic Tahoe annelid)			

**************** Crustaceans

	G3G4		Stygobromus tahoensis		W	
	S?		(Tahoe cave obligate amphipod)			

**************** Insects

c	G?		Petrophila confusalis			
	S1		(aquatic moth)			

**************** Reptiles

	T3T4G3G4	xC2 c	Clemmys marmorata marmorata		W	
	S3		(northwestern pond turtle)			

**************** Mammals

	G5	i	Antrozous pallidus			
	S3S		(pallid bat)			
	G4	xC2	Brachylagus idahoensis	yes		
	S3?		(pygmy rabbit)			

G5 S3				Glaucomys sabrinus (northern flying squirrel)	yes	
G5 S3N				Lasionycteris noctivagans (silver-haired bat)		
G5 S?			i	Lasiurus blossevillii (western red bat)		
G5 S3?				Lasiurus cinereus (hoary bat)		
T3T4Q G5 S3		xC2		Lepus americanus tahoensis (Sierra Nevada snowshoe hare)	yes	
G5 S1B		xC2	n	Myotis evotis (long-eared myotis)		
G5 S4B		xC2	n	Myotis volans (long-legged myotis)		
G5 S4N		xC2	n	Myotis yumanensis (Yuma myotis)		
G5 S3				Ochotona princeps (American pika)	yes	
G5 S2				Sorex trowbridgii (Trowbridge's shrew)		
G5 S4B				Tadarida brasiliensis (Brazilian free-tailed bat)		
G4 S3				Tamias speciosus (lodgepole chipmunk)		

**********Birds

G3 S2		xC2		Agelaius tricolor (Tricolored Blackbird)	yes	W
G5 S4			p	Aquila chrysaetos (Golden Eagle)	yes	
G5 S4			p	Asio flammeus (Short-eared Owl)	yes	
G2 S2N		PT	s	Charadrius montanus (Mountain Plover)	yes	
G5 S3B			p	Dendroica petechia (Yellow Warbler)	yes	W
G5 S3B			p	Geothlypis trichas (Common Yellowthroat)	yes	W
G4 S4N		xC2	s	Histrionicus histrionicus (Harlequin Duck)	yes	W
G5 S3B			p	Icteria virens (Yellow-breasted Chat)	yes	
G4 S4			p	Melanerpes lewis (Lewis' Woodpecker)	yes	
G5			p	Numenius americanus	yes	W

	S3?B		(Long-billed Curlew)		
G5		p	Oporornis tolmiei	yes	
	S4B		(MacGillivray's Warbler)		
G5		p	Pandion haliaetus	yes	W
	S2B		(Osprey)		
G3		p	Pelecanus erythrorhynchos	yes	W
	S2B		(American White Pelican)		
G5		p	Vermivora celata	yes	
	S4B		(Orange-crowned Warbler)		
G5		p	Wilsonia pusilla	yes	W
	S4?B		(Wilson's Warbler)		

Last updated on 08/05/2002

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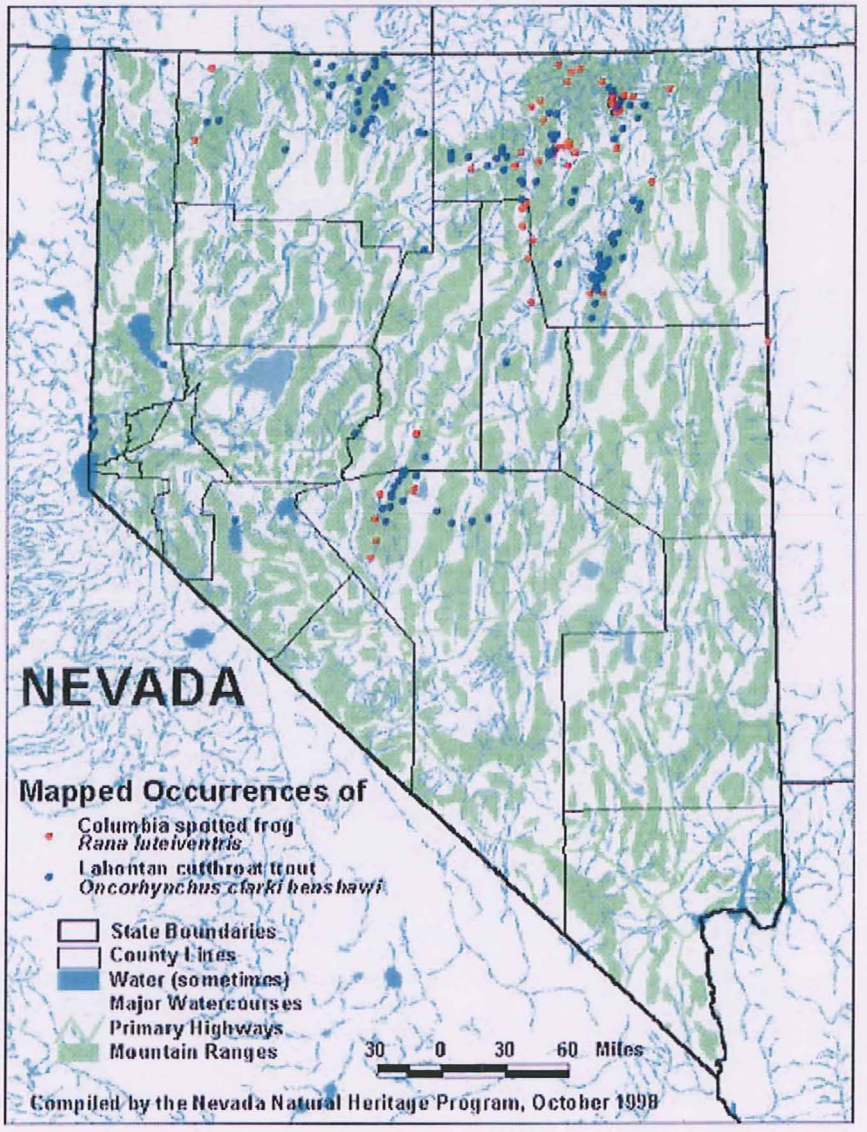

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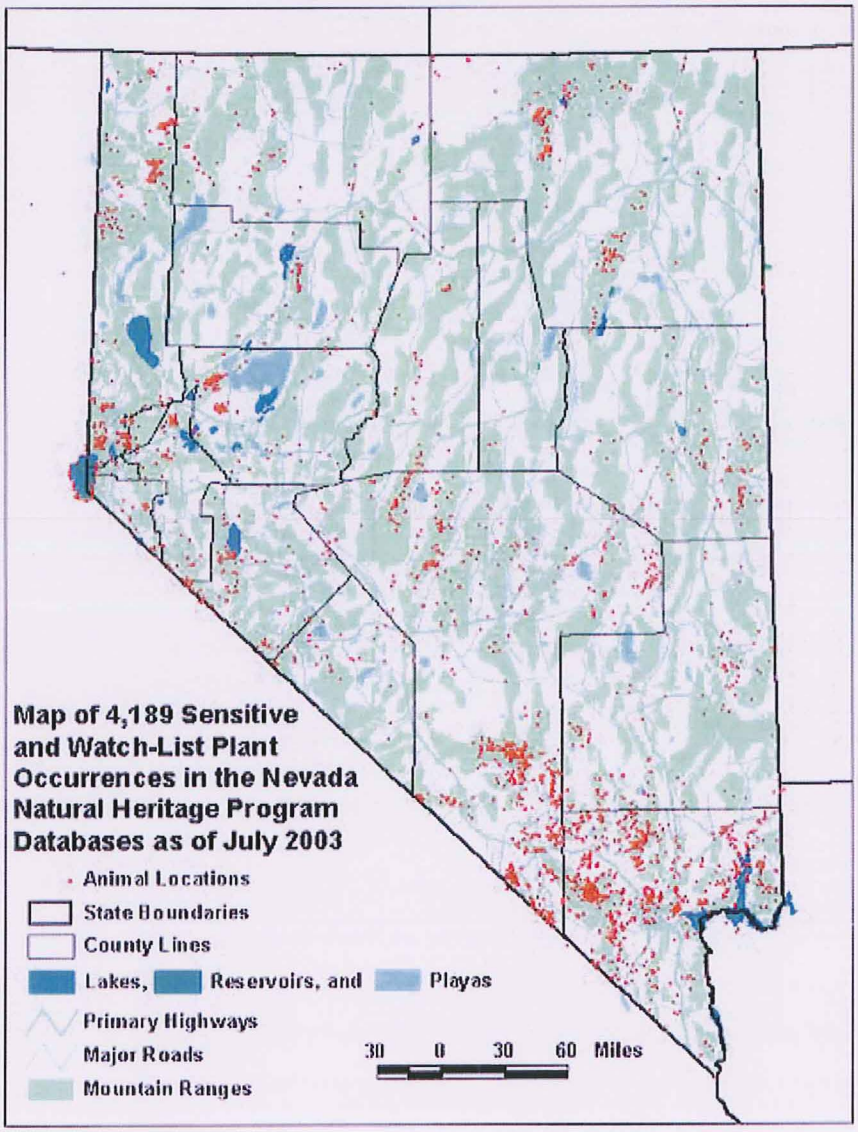


http://www.heritage.nv.gov/maps/plantmap.gif 3/10/2004

Appendix B: Species List from Huffman & Associates Biological Assessment Study at the Airport Wetland Mitigation Site

The data listed in Appendix B incorporates species viewed by Huffman and Associates during four site surveys between June 3 - 5, 1997, a two day assessment in October 1996, and wetland monitoring between April 1995 and June 1997 (Huffman & Associates,1997). The list also includes observations by the University of Nevada staff at the agricultural research station.

Avian Species:

Great Blue Heron (*Ardea herodias*)
California quail (*Callipepla californica*)
Green-winged teal (*Anas crecca*)
Snowy egret (*Egretta thula*)
California gull (*Larus californicus*)
Red-winged blackbird (*Agelaius phoeniceus*)
Foster's tern (*Sterna forsteri*)
American avocet (*Recurvirostra americana*)
American white pelican (*Pellecanus erythrorhynchos*)
Mallard (*Ana platyrhynchos*)
Canada goose (*Branta canadensis*)
Black-necked stilt (*Himantopus mexicanus*)
Spotted sandpiper (*Actitis macularia*)
Killdeer (*Charadrius vociferus*)
Mourning dove (*Zenaida macroura*)
Bank swallow (*Riparia riparia*)
Black-billed magpie (*Pica pica*)
Northern harrier
Red-tailed hawk (*Buteo jamaicensis*)
Cooper's hawk (*Accipiter cooperii*)
Golden eagle (*Aquila chrysaetos*)
Turkey vulture (*Cathartes aura*)
Ring-necked pheasant (*Phasianus colchicus*)
American widgeon (*Mareca americana*)
Double-crested cormorant (*Phalacrocorax auritus*)
Hooded merganser (*Lophodytes cucullatus*)
Lesser yellowlegs (*Totanus flavipes*)
Yellow-headed blackbirds (*Xanthocephalus xanthocephalus*)
Red-shouldered hawk (*Buteo lineatus*)
American coot (*Fulica Americana*)
Unidentified species of owls, likely Barn owls

Mammals:

Black-tailed jackrabbits (*Lepus californicus*)
Mountain cottontail (*Sylvilagus nuttallii*)
Muskrat (*Ondatra zibethicus*)
Yellow-bellied marmot (*Marmota flaviventris*)
Coyote (*Canis latrans*)
Western pipistrelle (*Pipistrellus hesperus*)
Feral horses (*Equus caballus*)
Mule deer (*Odocoileus hemionus*) (tracks)
Skunk (*Mephitis mephitis*) (tracks)
Racoon (*Procyon lotor*) (tracks)
American badger (*Taxidea taxus*) (tracks)
Several small species of mice and other rodents

Amphibians and reptiles:

Western toad (*Bufo boreas*)
Western fence lizard (*Sceloporus occidentalis*)
Gopher snake (*Pituophis melanoleucus*)
Western rattlesnakes (*Crotalus Viridis*)
Bullfrog (*Rana catesheiana*)
Western pond turtle (*Clemmys marmorata*)

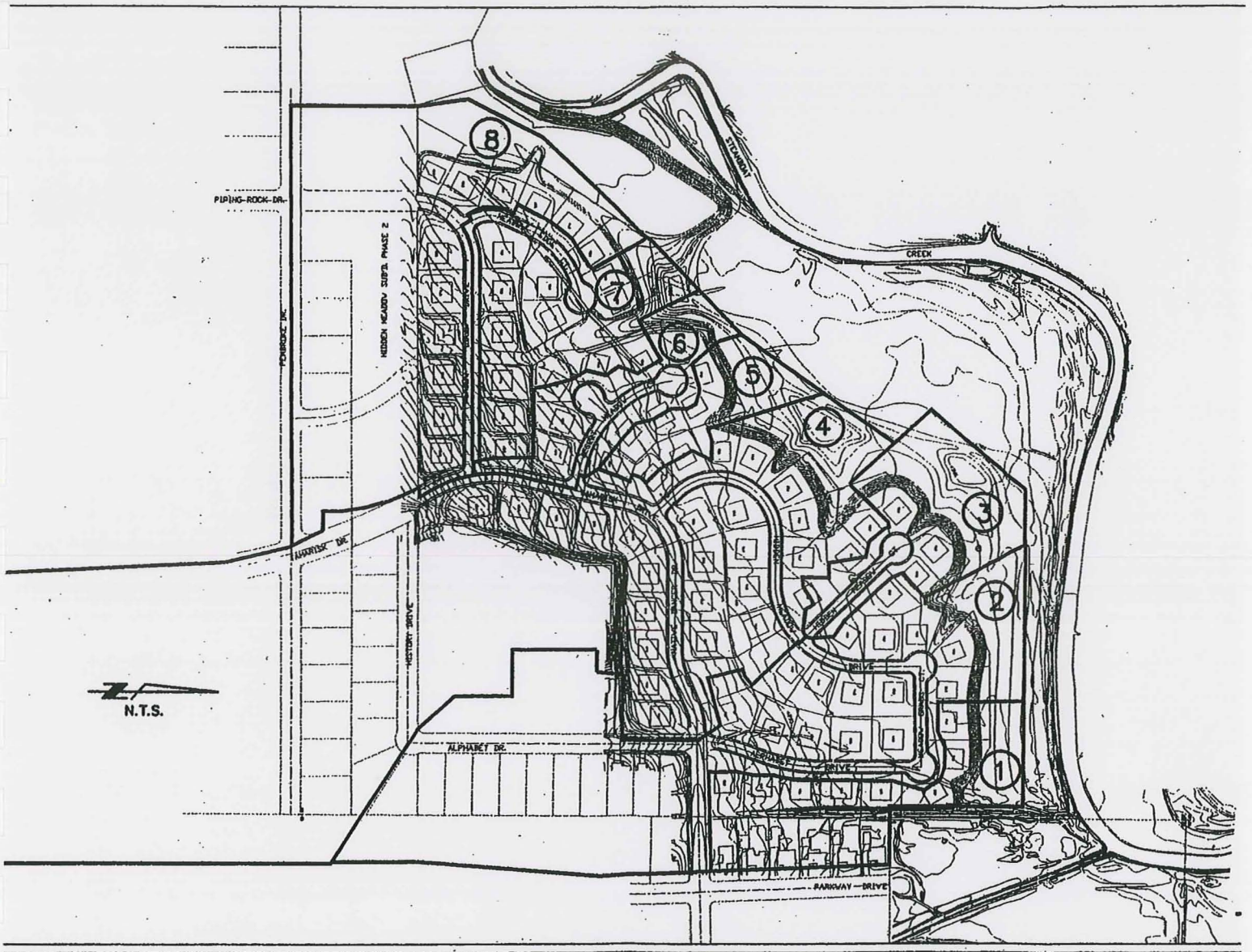
Fish:

Common carp (*Cyprinus carpio*)
Mosquito fish (*Gambusia affinius*)
Catfish (*Ictalurus punctatus*)

Invertebrates:

Butterflies (Lepidoptera)
Ants and bees (Hymenoptera)
Spiders (Arachnida)
Flies (Diptera)
Dragonflies (Odonata)
Grasshoppers (Orthoptera)
Beetles (Coleoptera)
Water bugs and notonectids (Hemiptera)

Appendix C: Storm Drainage Runoff for the Hidden Meadows Subdivision by SEA



STORM DRAINAGE RUNOFF

HIDDEN MEADOW SUBDIVISION

NE 1/4 SEC. 22, T19N, R20E

(S, NEVADA
NEVADA
IZONA

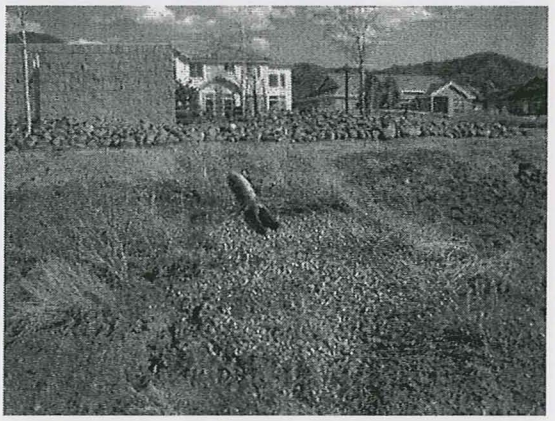
WASHOE

NEVADA

Prc

Plc

Appendix D: Existing Storm Drains and Swales



Drain pipe near the sanitary sewer lift station

Northeast corner of the pond (24" and 18" drains)

Concrete drainage ditch along northeastern boundary parcel

Rock swale along the southern edge of the property

24" Drainage pipe entering the pond

18" Drain pipe and concrete swale

Appendix B: Results of Water Quality Testing 5/4/04

Western Environmental Testing Laboratory
Analytical Report

Kennedy/ Jenks Consultants
5190 Neil Road, Suite 210
Reno, NV 89502
Attn: Christine Kirick

Phone: (775) 827-7900 Fax: (775) 827-7295

EPA Lab ID NV004
Received: 05/04/04
Lab Sample ID: 405-015 01/02
Reported: 05/12/04

Project Name/Number: Hidden Meadows / 047012.00
Sample ID: see below
Date/Time Collected: 5/4/04 @ 1:10, 1:40
Sampled By: Client

Sample ID	Method	Results	Units	Analyzed
YD 1				
Ammonia Nitrogen	350.3	0.060	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	<6.0	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	0.79	mg/L	05/12/04
Total Phosphorus	365.3	0.23	mg/L	05/11/04
Total Dissolved Solids	2540C	220	mg/L	05/05/04
Fecal Coliform	9222D	>100	cfu per 100 ml	05/04/04
Arsenic	3113B	0.0075	mg/L	05/06/04
Boron	200.7	0.10	mg/L	05/06/04
Iron	200.7	0.84	mg/L	05/06/04
YD 2				
Ammonia Nitrogen	351.3	0.051	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	<6.0	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	0.89	mg/L	05/12/04
Total Phosphorus	365.3	0.24	mg/L	05/11/04
Total Dissolved Solids	2540C	220	mg/L	05/05/04
Fecal Coliform	9222D	>100	cfu per 100 ml	05/04/04
Arsenic	3113B	0.0074	mg/L	05/06/04
Boron	200.7	0.10	mg/L	05/06/04
Iron	200.7	0.73	mg/L	05/06/04

Andy Smith, Lab Manager

Western Environmental Testing Laboratory
Analytical Report

Kennedy/ Jenks Consultants
5190 Neil Road, Suite 210
Reno, NV 89502
Attn: Christine Kirick

Phone: (775) 827-7900 Fax: (775) 827-7295

EPA Lab ID NV004
Received: 05/04/04
Lab Sample ID: 405-015 03/04
Reported: 05/12/04

Project Name/Number: Hidden Meadows / 047012.00
Sample ID: see below
Date/Time Collected: 5/4/04 @ 1:35, 1:55
Sampled By: Client

Sample ID	Method	Results	Units	Analyzed
YD 3				
Ammonia Nitrogen	350.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	<6.0	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	0.58	mg/L	05/12/04
Total Phosphorus	365.3	0.18	mg/L	05/11/04
Total Dissolved Solids	2540C	200	mg/L	05/05/04
Fecal Coliform	9222D	>100	cfu per 100 ml	05/04/04
Arsenic	3113B	0.0079	mg/L	05/06/04
Boron	200.7	<0.10	mg/L	05/06/04
Iron	200.7	0.59	mg/L	05/06/04
SC 1				
Ammonia Nitrogen	351.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	14	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	0.90	mg/L	05/12/04
Total Phosphorus	365.3	0.37	mg/L	05/11/04
Total Dissolved Solids	2540C	430	mg/L	05/05/04
Fecal Coliform	9222D	22	cfu per 100 ml	05/04/04
Arsenic	3113B	0.14	mg/L	05/06/04
Boron	200.7	3.8	mg/L	05/06/04
Iron	200.7	0.64	mg/L	05/06/04

Andy Smith, Lab Manager

Western Environmental Testing Laboratory
Analytical Report

Kennedy/ Jenks Consultants
5190 Neil Road, Suite 210
Reno, NV 89502
Attn: Christine Kirick

Phone: (775) 827-7900 Fax: (775) 827-7295

EPA Lab ID NV004
Received: 05/04/04
Lab Sample ID: 405-015 05/06
Reported: 05/12/04

Project Name/Number: Hidden Meadows / 047012.00
Sample ID: see below
Date/Time Collected: 5/4/04 @ 2:10, 3:00
Sampled By: Client

Sample ID	Method	Results	Units	Analyzed
SC 2				
Ammonia Nitrogen	350.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	7.9	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	0.93	mg/L	05/12/04
Total Phosphorus	365.3	0.38	mg/L	05/11/04
Total Dissolved Solids	2540C	380	mg/L	05/05/04
Fecal Coliform	9222D	75	cfu per 100 ml	05/04/04
Arsenic	3113B	0.12	mg/L	05/06/04
Boron	200.7	3.0	mg/L	05/07/04
Iron	200.7	0.98	mg/L	05/06/04
SC 3				
Ammonia Nitrogen	351.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	6.8	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	0.88	mg/L	05/12/04
Total Phosphorus	365.3	0.35	mg/L	05/11/04
Total Dissolved Solids	2540C	380	mg/L	05/05/04
Fecal Coliform	9222D	500	cfu per 100 ml	05/04/04
Arsenic	3113B	0.12	mg/L	05/06/04
Boron	200.7	2.8	mg/L	05/07/04
Iron	200.7	0.93	mg/L	05/06/04

Andy Smith, Lab Manager

Western Environmental Testing Laboratory
Analytical Report

Kennedy/ Jenks Consultants
5190 Neil Road, Suite 210
Reno, NV 89502
Attn: Christine Kirick

Phone: (775) 827-7900 Fax: (775) 827-7295

EPA Lab ID NV004
Received: 05/04/04
Lab Sample ID: 405-015 07/08
Reported: 05/12/04

Project Name/Number: Hidden Meadows / 047012.00
Sample ID: see below
Date/Time Collected: 5/4/04 @ 2:30, 2:40
Sampled By: Client

Sample ID	Method	Results	Units	Analyzed
POND 1				
Ammonia Nitrogen	350.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	13	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	4.1	mg/L	05/12/04
Total Phosphorus	365.3	0.32	mg/L	05/11/04
Total Dissolved Solids	2540C	6300	mg/L	05/05/04
Fecal Coliform	9222D	8.0	cfu per 100 ml	05/04/04
Arsenic	3113B	0.36	mg/L	05/06/04
Boron	200.7	63	mg/L	05/07/04
Iron	200.7	0.13	mg/L	05/06/04
POND 2				
Ammonia Nitrogen	351.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	13	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	4.1	mg/L	05/12/04
Total Phosphorus	365.3	0.32	mg/L	05/11/04
Total Dissolved Solids	2540C	6300	mg/L	05/05/04
Fecal Coliform	9222D	<4.0	cfu per 100 ml	05/04/04
Arsenic	3113B	0.36	mg/L	05/06/04
Boron	200.7	64	mg/L	05/07/04
Iron	200.7	0.041	mg/L	05/06/04

Andy Smith, Lab Manager

Western Environmental Testing Laboratory
Analytical Report

Kennedy/ Jenks Consultants
5190 Neil Road, Suite 210
Reno, NV 89502
Attn: Christine Kirick

Phone: (775) 827-7900 Fax: (775) 827-7295

EPA Lab ID NV004
Received: 05/04/04
Lab Sample ID: 405-015 09/10
Reported: 05/12/04

Project Name/Number: Hidden Meadows / 047012.00
Sample ID: see below
Date/Time Collected: 5/4/04 @ 2:50, 3:15
Sampled By: Client

Sample ID	Method	Results	Units	Analyzed
POND 3				
Ammonia Nitrogen	350.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	16	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	3.7	mg/L	05/12/04
Total Phosphorus	365.3	0.29	mg/L	05/11/04
Total Dissolved Solids	2540C	6600	mg/L	05/05/04
Fecal Coliform	9222D	4.0	cfu per 100 ml	05/04/04
Arsenic	3113B	0.36	mg/L	05/06/04
Boron	200.7	63	mg/L	05/07/04
Iron	200.7	0.073	mg/L	05/06/04
POND 4				
Ammonia Nitrogen	351.3	<0.050	mg/L	05/12/04
Biochemical Oxygen Demand	405.1	13	mg/L	05/05/04
Nitrate Nitrogen	300.0	<1.0	mg/L	05/04/04
Nitrite Nitrogen	300.0	<0.010	mg/L	05/04/04
Total Kjeldahl Nitrogen	351.3	4.1	mg/L	05/12/04
Total Phosphorus	365.3	0.28	mg/L	05/11/04
Total Dissolved Solids	2540C	6300	mg/L	05/05/04
Fecal Coliform	9222D	4.0	cfu per 100 ml	05/04/04
Arsenic	3113B	0.36	mg/L	05/06/04
Boron	200.7	64	mg/L	05/07/04
Iron	200.7	0.046	mg/L	05/06/04

Andy Smith, Lab Manager

Appendix C: Alternative Designs

Option 1: Current Configuration

Features

- ~17 acre pond with 3' to 9' depth.
- 30' pedestrian and vector control easement around the pond area.
- Stormdrains empty into pond.
- No inlet or outlet to Steamboat Creek.
- "No change" alternative.

Pros

- No current impact on Streamboat Creek water quality.
- Maintains existing sediment transport capacity of Steamboat Creek.
- Maintains large open water characteristics.
- Low initial cost.

Cons

- On-going odor and vector control issues.
- Liability of open water.
- Low species diversity.
- Limits flood conveyance capacity.
- High maintenance costs.
- Water quality impairment will persist.

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Washoe-Storey Conservation District
Hidden Meadows Appraisal Study

K/J 047012.00
April 2004
Figure 1

Option 2: Steamboat Creek Realignment

Features

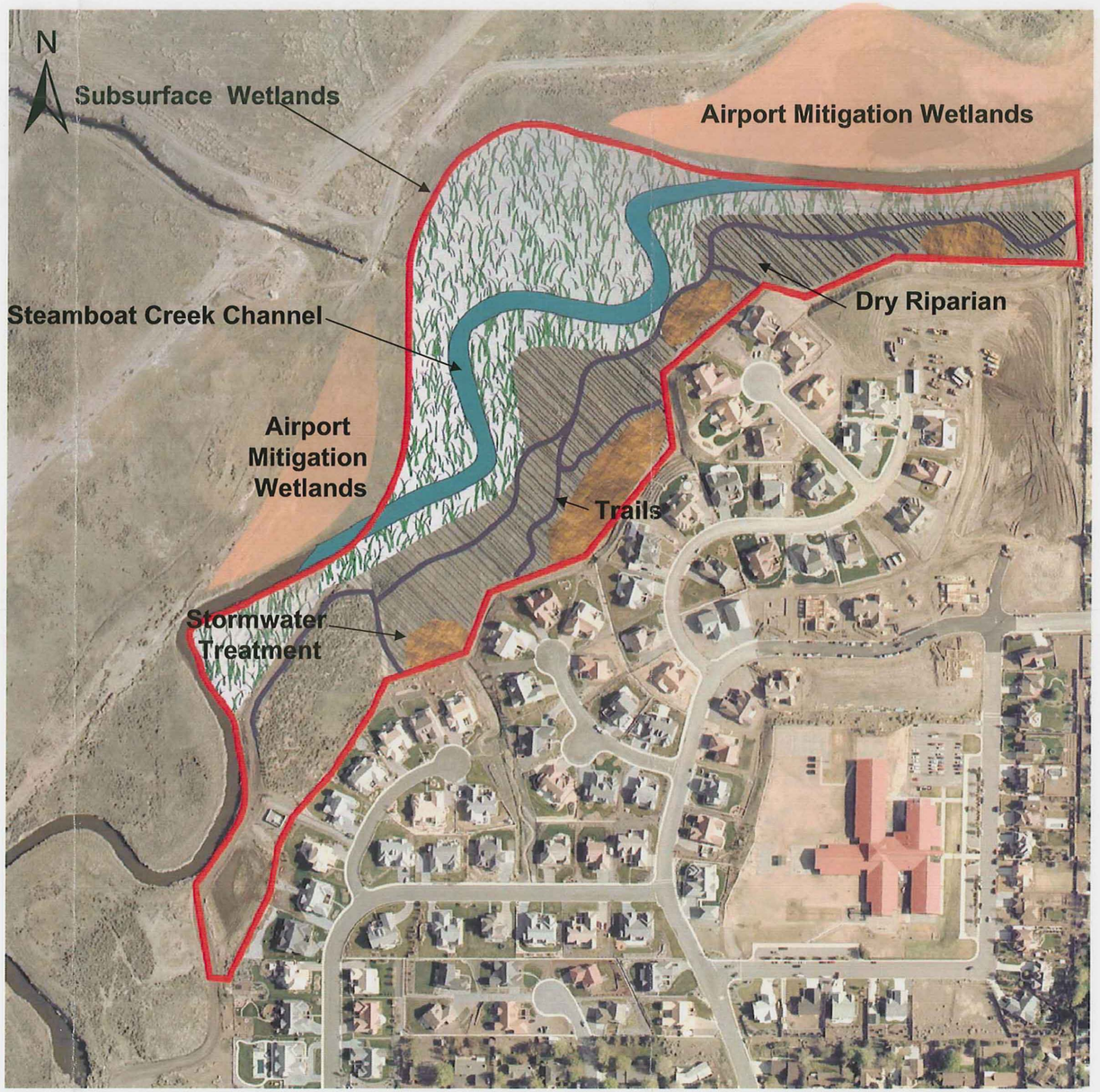
- Align Steamboat Creek through the Hidden Meadows open space parcel.
- Incorporate Yori Drain waters to enhance the water supply to the Airport Mitigation Wetlands.
- Place a grade control structure downstream of the project site to increase water surface elevations approximately 1 ½ ft at the downstream end of the Hidden Meadows reach.
- Develop oxic subsurface wetlands along Steamboat Creek.
- Fill the pond to create a gently graded floodplain to the elevation of Steamboat Creek.
- Dry riparian vegetation transitioning to wet riparian and emergent wetland species.
- Stormwater treatment features along the subdivision boundary.
- 30' pedestrian and bike path along the subdivision boundary.
- Maintain the utility easement near sanitary sewer lift station.
- Maintain the undisturbed portion of the site.
- Trails through the dry riparian area.
- Install educational kiosks.

Pros

- Increased floodplain storage capacity.
- Increased wetland habitat/diversity.
- Increased nutrient assimilation.
- Low maintenance.
- Low liability.
- Incorporates urban stormwater treatment.
- No water right dedication.

Cons

- Permit requirements.
- Costs associated with design and construction.
- Import of fill.
- Potential for mercury methylation if wetland becomes anoxic.
- Potential for failure of riparian vegetation.



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Hidden Meadows Appraisal Study

K/J 047012.00
April 2004
Figure 2

Option 3: Flood Flow Channel

Features

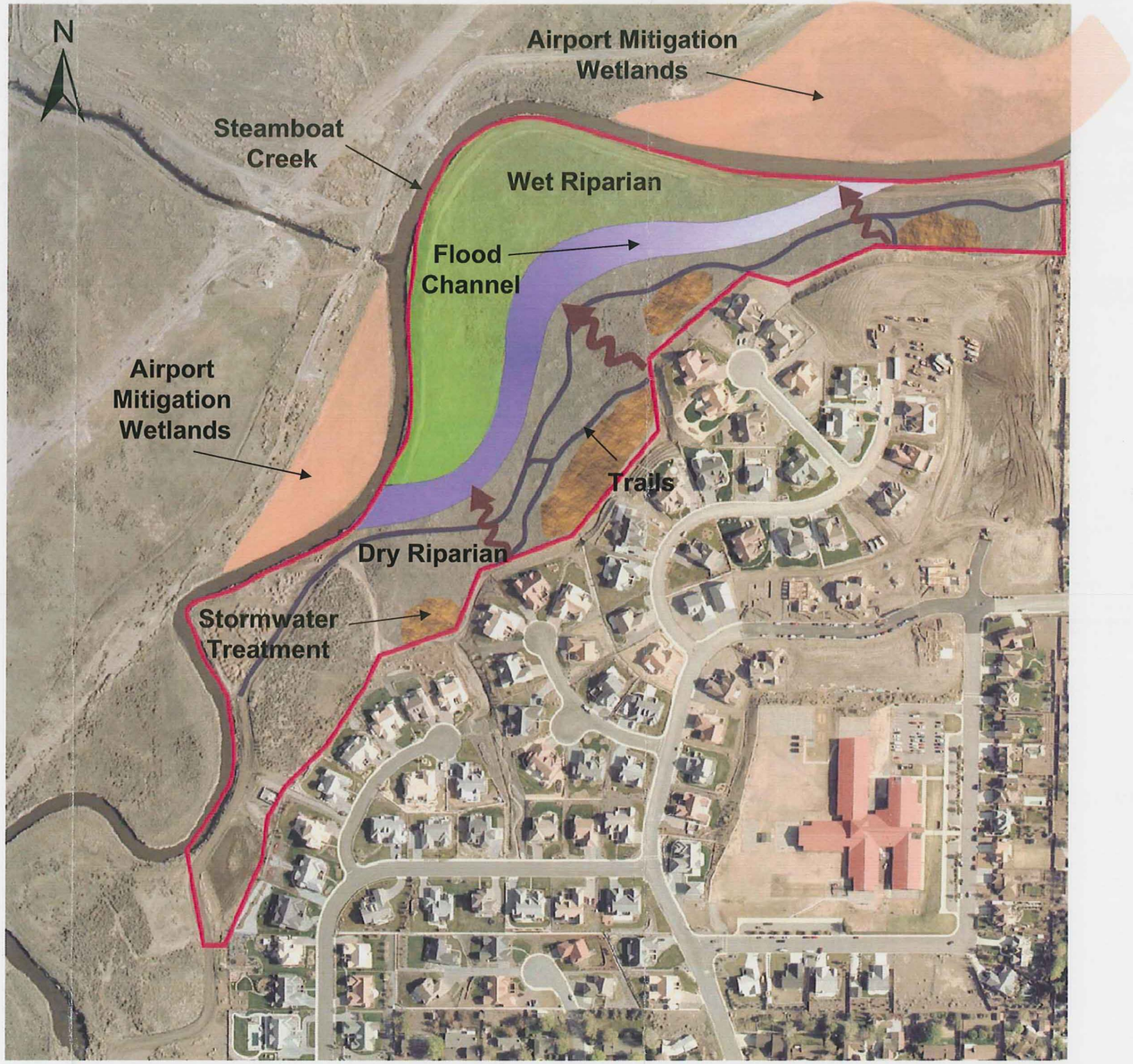
- Fill the pond area to create a seasonally wet flood channel having a cobble and gravel bottom.
- Gently graded floodplain to elevation of flood channel.
- Gently graded floodplain to elevation of Steamboat Creek.
- Dry riparian vegetation transitioning to wet riparian vegetation types.
- Stormwater treatment features along the subdivision boundary.
- 30' pedestrian and bike path along the subdivision boundary.
- Maintain the utility easement near sanitary sewer lift station.
- Maintain the undisturbed portion of the site.
- Trails through dry and wet riparian areas. Consider installing boardwalks in seasonally wet areas.
- Install educational kiosks.

Pros

- Treatment of stormwater from the Hidden Meadows subdivision.
- No adjustment to Steamboat Creek alignment.
- Increased flood conveyance/storage capacity.
- Increased habitat/native vegetation.
- Low liability.
- Low maintenance.
- No water right dedication.

Cons

- No treatment of Yori Drain waters.
- Costs associated with design and construction.
- Import of fill.
- Potential methyl mercury production.
- Potential failure of riparian vegetation.



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Hidden Meadows Appraisal Study

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April 2004
Figure 3

Option 4: Floodplain Extension

Features

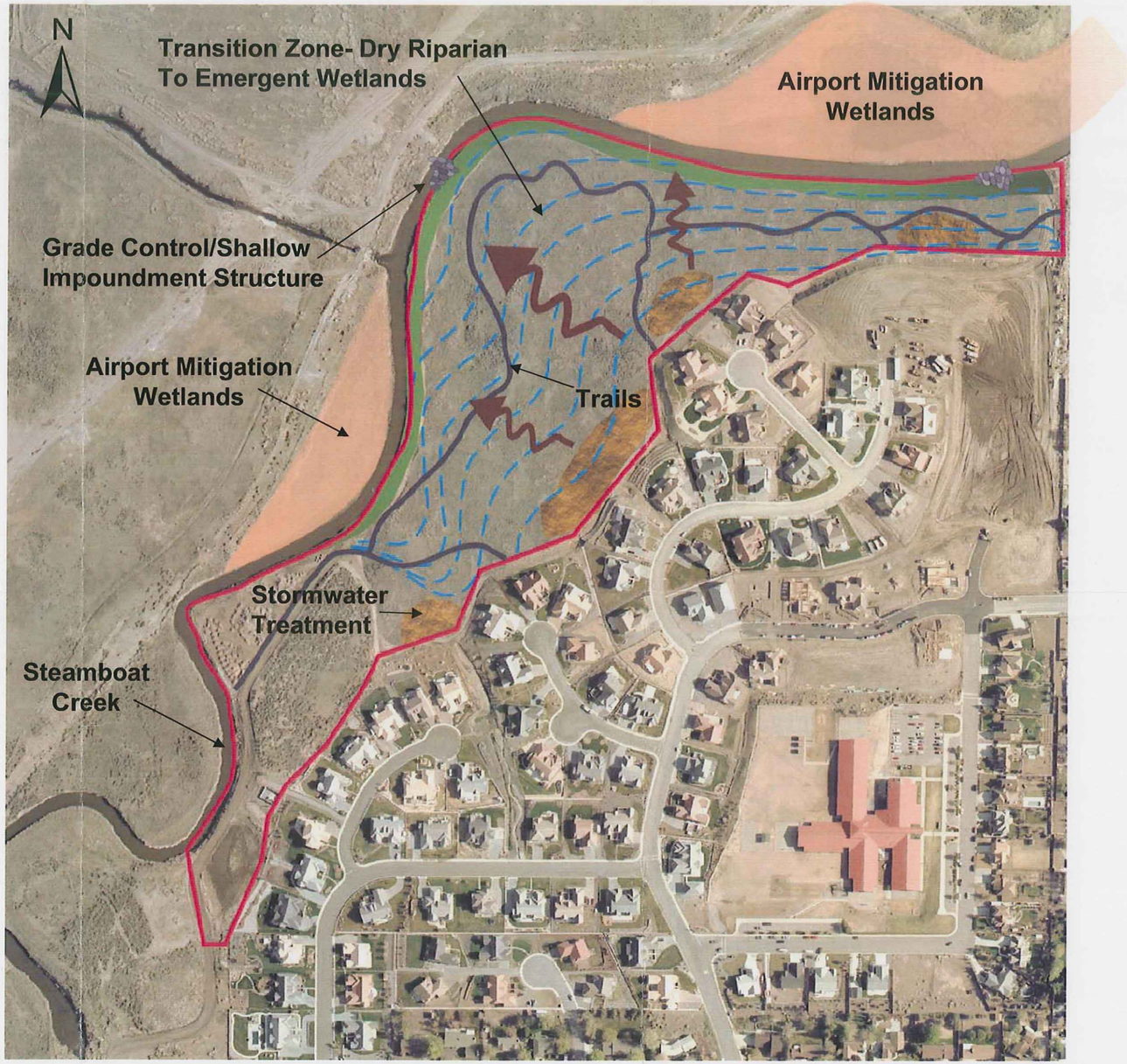
- Fill the pond to create a gently graded floodplain to the elevation of Steamboat Creek.
- Dry riparian vegetation transitioning to wet riparian vegetation habitats.
- Stormwater treatment features along the subdivision boundary.
- 30' pedestrian and bike path along the subdivision boundary.
- Maintain utility easement near sanitary sewer lift station.
- Maintain the undisturbed portion of the site.
- Trails throughout the dry riparian zone.
- Install educational kiosks.

Pros

- Connecting Steamboat Creek channel and floodplain.
- Increased flood storage/conveyance.
- Positive impact on Airport Mitigation Wetlands.
- Treatment of Hidden Meadows stormwater.
- Low maintenance/ liability.
- No water right dedication.

Cons

- No treatment of Yori Drain waters.
- Does not address Steamboat Creek water quality.
- Import of fill.
- Potential failure of riparian vegetation.



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Hidden Meadows Appraisal Study

K/J 047012.00
April 2004
Figure 4

Option 5: Connected Pond

Features

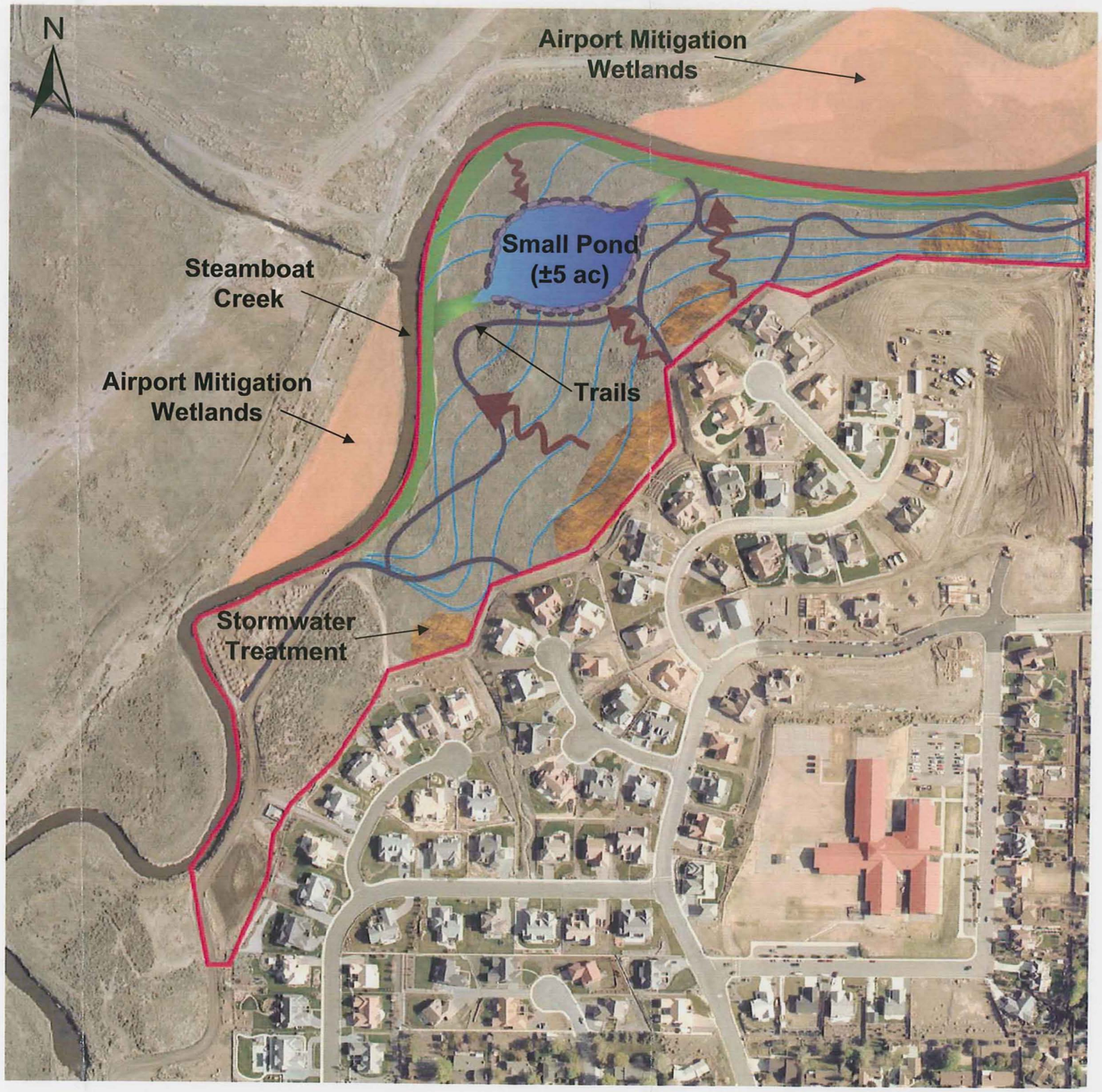
- Fill the current pond to create a ~5 acre pond.
- Floodplain gently graded to the pond and to Steamboat Creek.
- Vegetation community transitions from dry to wet riparian.
- Stormwater treatment along the subdivision boundary.
- 30' pedestrian and bike path along the subdivision boundary.
- Maintain the utility easement near sanitary sewer lift station.
- Maintain the undisturbed portion of the site.
- Provide trails through the floodplain zone.
- Install educational kiosks.

Pros

- Connecting Steamboat Creek channel and floodplain.
- Increased flood storage/conveyance.
- Positive impact on Airport Mitigation Wetlands.
- Treatment of Hidden Meadows stormwater.
- Maintaining some element of open water.

Cons

- No treatment of Yori Drain waters.
- Does not address Steamboat Creek water quality.
- Import of fill.
- Liability concerns.
- Potential for mercury methylation.
- Potential vector concerns.
- Potential for pond to serve as sediment sink.
- Potential need for dedication of water rights.



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Washoe-Storey Conservation District
Hidden Meadows Appraisal Study

K/J 047012.00
April 2004
Figure 5

Appendix D: Preliminary Design Sheets

Steamboat Creek Restoration at Hidden Meadows

Steamboat Creek, Washoe County
Prepared for Washoe-Storey Conservation District

Project Team

Program Manager

Washoe-Storey Conservation District
1201 Terminal Way, Suite 222
Reno, Nevada 89502
(775) 322-9934

Project Manager

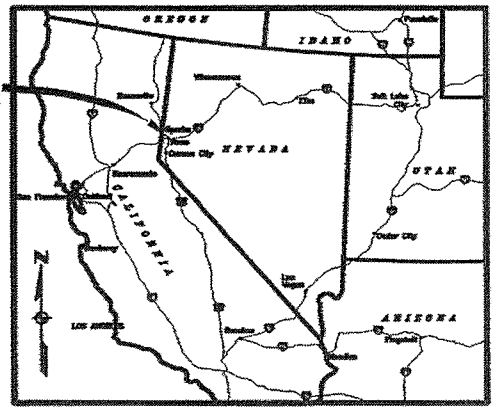
Kennedy/Jenks Consultants
5190 Neil Road, Suite 210
Reno, Nevada 89502
(775) 827-7900

Engineering and Design

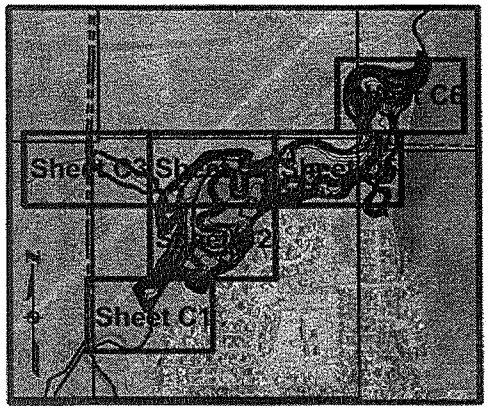
Kennedy/Jenks Consultants
5190 Neil Road, Suite 210
Reno, Nevada 89502
(775) 827-7900

Western Botanical Services
5859 Mt. Rose Highway
Reno, Nevada 89511
(775) 849-3223

Underground Service Alert
Call: Toll Free
1-800
227-2600



Vicinity Map



Sheet Layout

Sheet Index

Preliminary Design Set
NOT FOR CONSTRUCTION

NO.	REMARKS	DATE	BY

DESIGNED: MM/CSS
DRAWN: KSD
CHECKED:

Washoe-Storey Conservation District
Reno, Nevada
Steamboat Creek Restoration at Hidden Meadows

Kennedy/Jenks Consultants
5190 Neil Rd. Suite 210 Reno, Nevada 89502 (775) 827-7900

TITLE SHEET

FILE NAME: G001
JOB NO.: 0025019
DATE: June 2024
SHEET: G1

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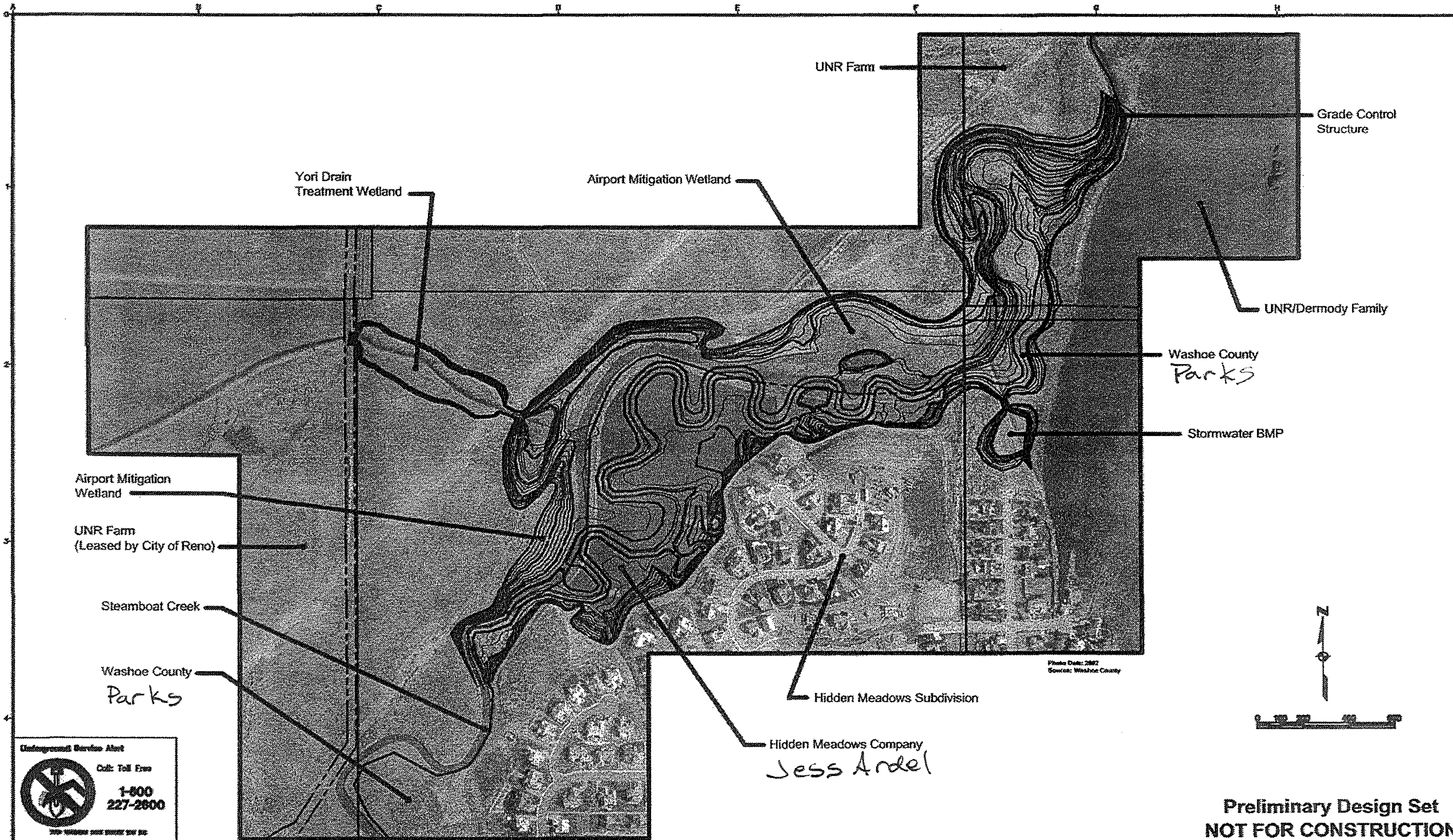

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Washoe-Storey Conservation District
Reno, Nevada
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SITE MAP

DATE: June 2004

SHEET G2

Abbreviations

General Notes

Basis of Elevation

City of Reno Bench Mark 2662, Elevation 4392.66, based on NAVD88

Basis of Bearing

The North American Datum of 1983/94 (HARN), Nevada West Zone as Established by Washoe County, as Shown on Tract Map 4171.

Legend

- FINISHED CONTOUR MINOR
- FINISHED MAJOR CONTOUR
- EXISTING RIVER BOTTOM
- EARTH
- ROCK
- CONTRACTOR'S STAGING AREA
- BASE FLOW CHANNEL
- AIRPORT MITIGATION WETLAND
- BANK FULL CHANNEL
- BENCH MARK
- CONTROL POINT
- SPOT ELEVATION
- COORDINATE POINT
- SECTION (LETTER) DETAIL (NUMERAL)
- SHEET REFERENCED ON
- SHEET DRAWN ON
- WHEN NO LETTER APPEARS BEFORE SHEET NUMBER INDICATES SAME DISCIPLINE

Underground Service Alert

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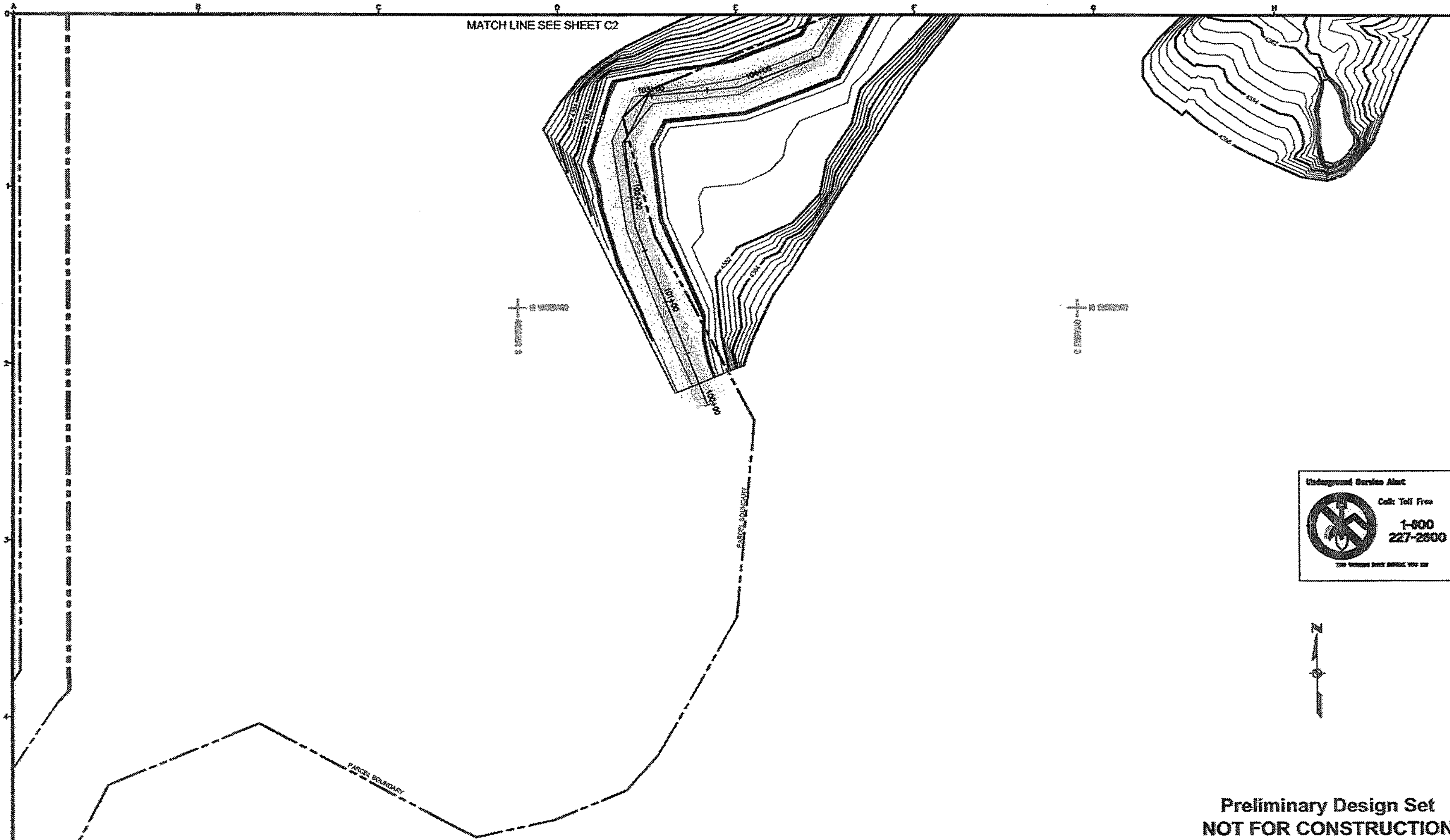
ABBREVIATIONS, GENAL NOTES, LEGEND

SHEET G3



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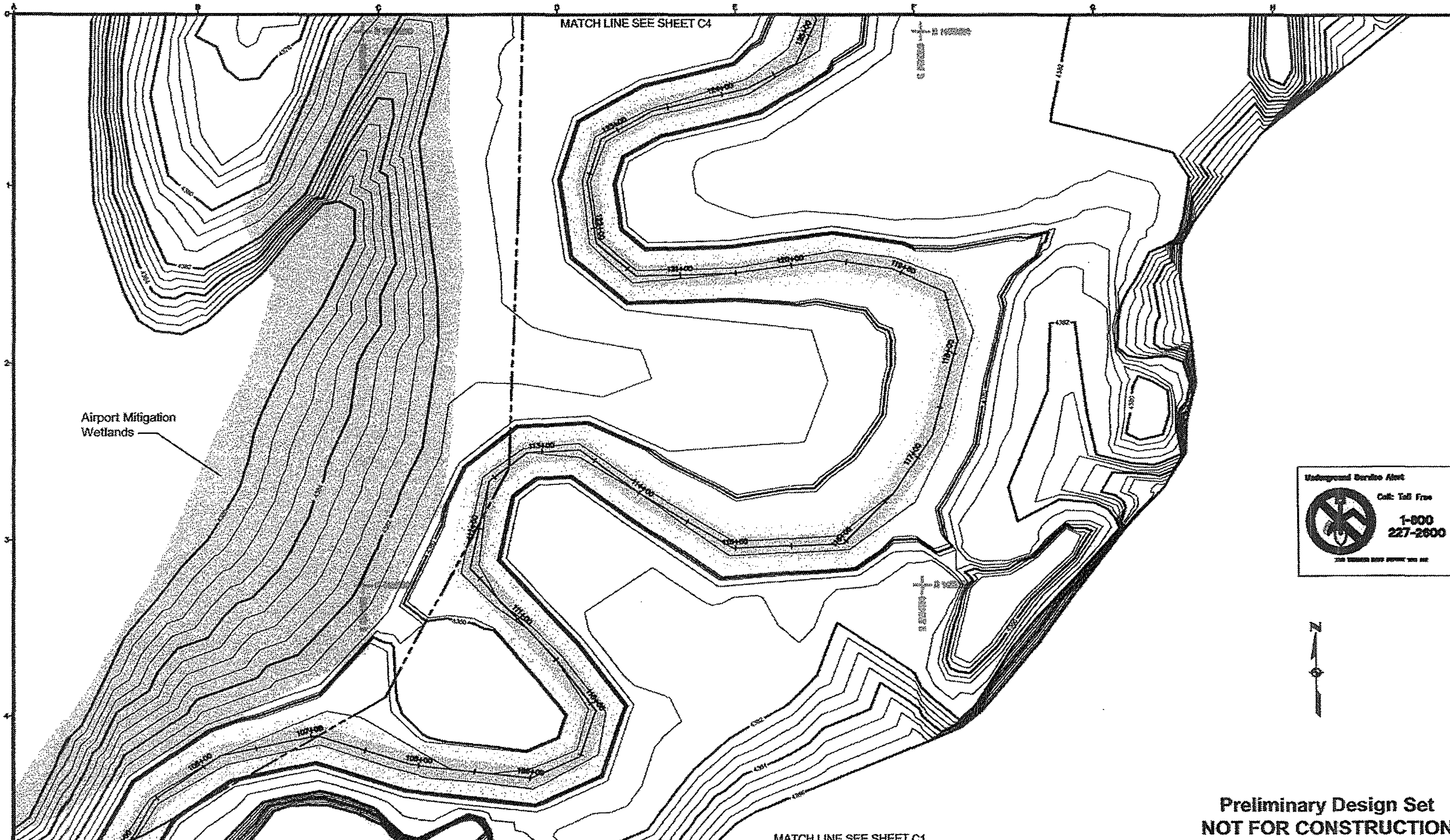

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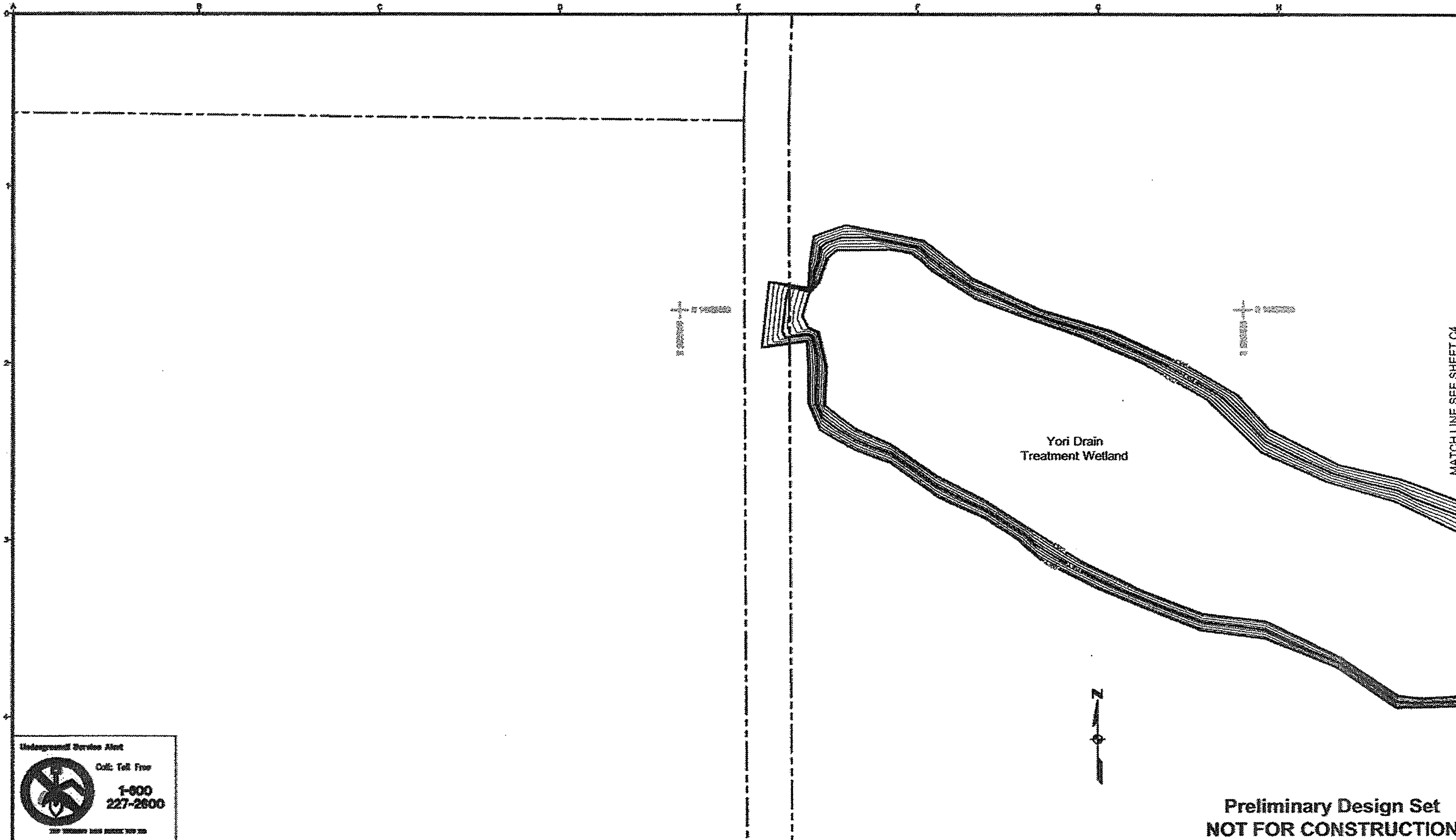

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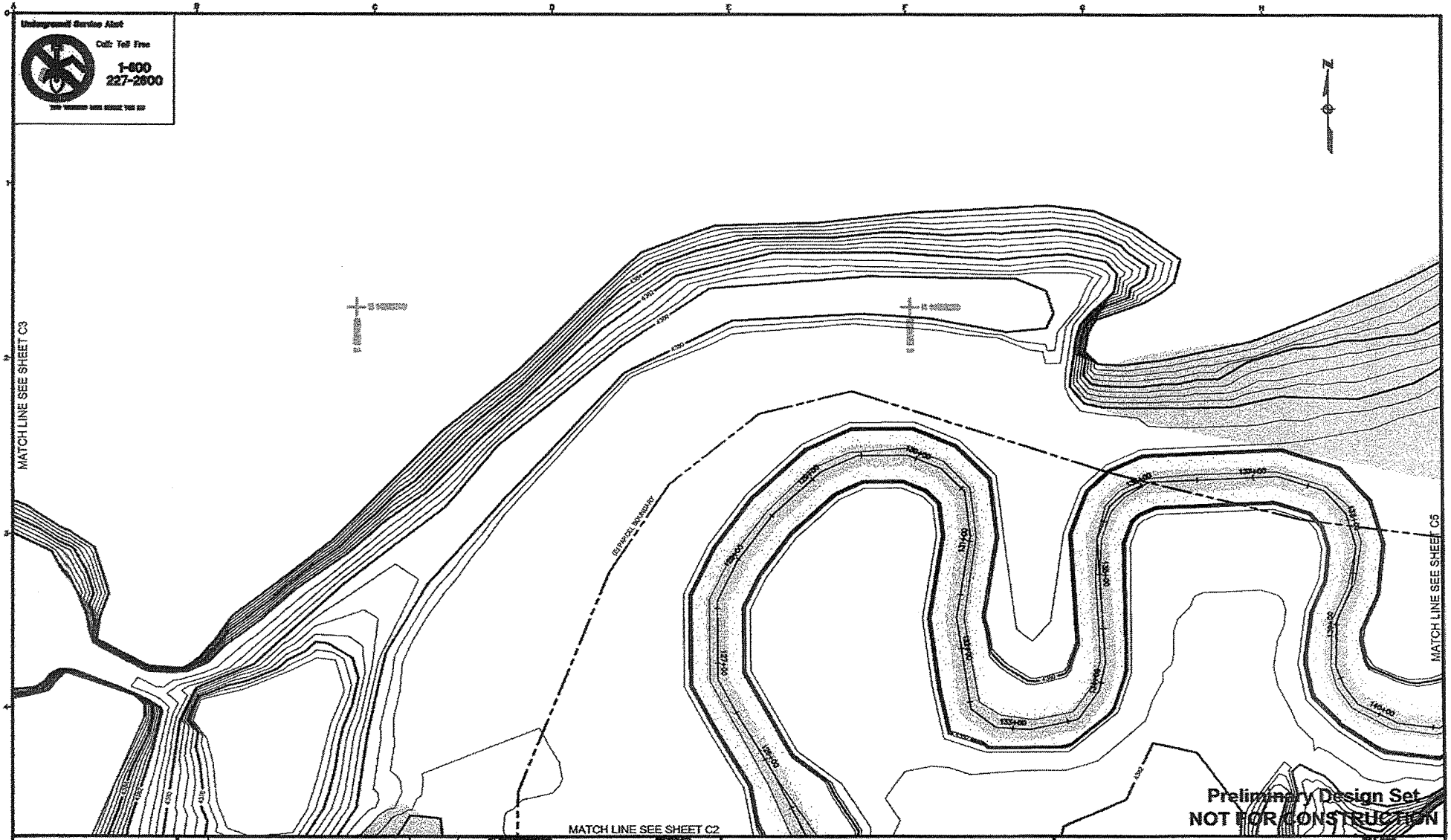

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NO.	REMARKS	DATE	BY

DESIGNED MR/DR
DRAWN RD
CHECKED

Washoe-Storey Conservation District
Reno, Nevada
Steamboat Creek Restoration at Hidden Meadows

Kennedy/Jenks Consultants
3825 Del St. Suite 250 Reno, Nevada 89502 (775) 827-7600

GRADING PLAN

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DATE June 2004
SHEET NO. C4

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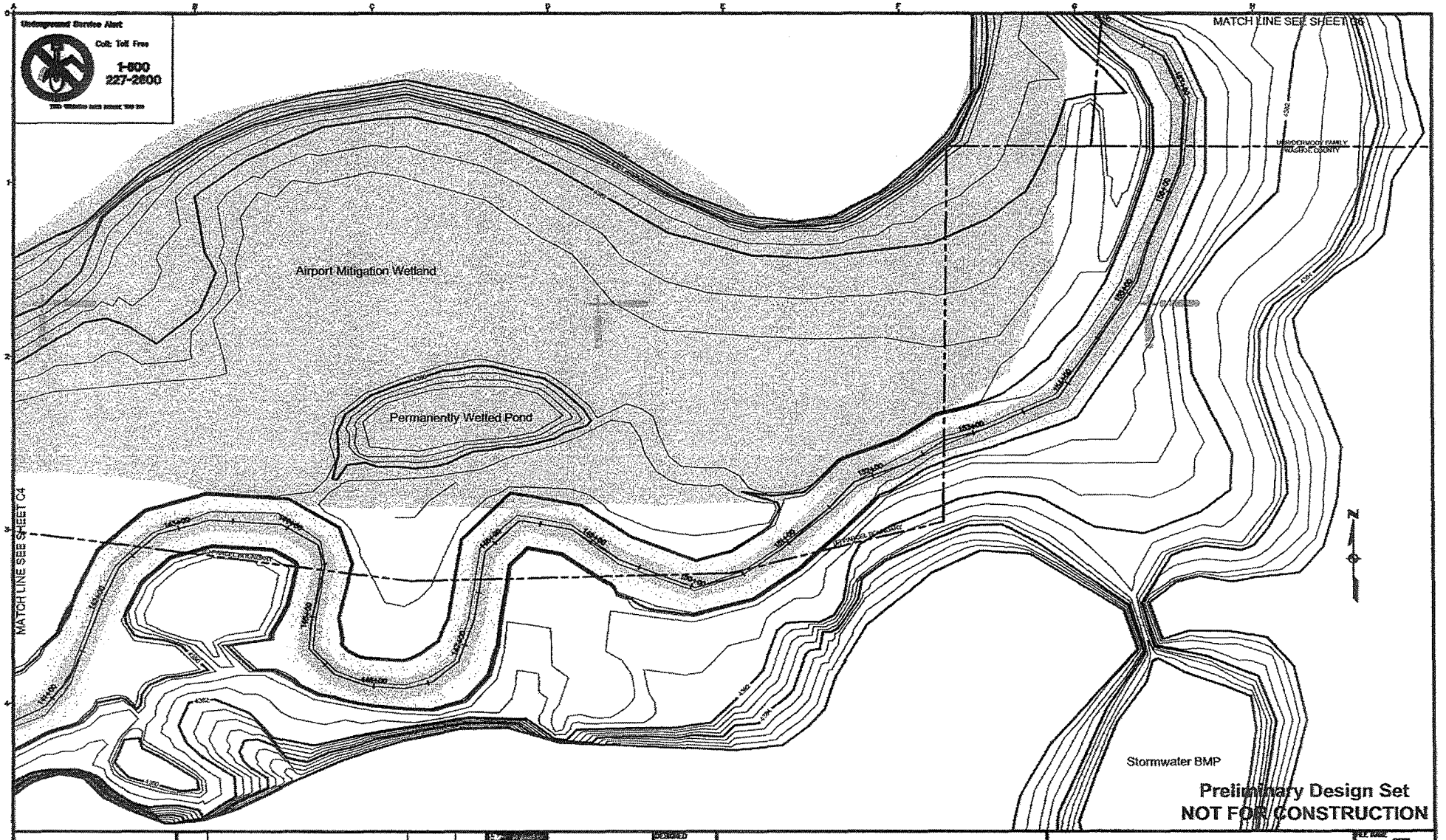

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DRAWN KH
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Washoe-Storey Conservation District
Reno, Nevada
Steamboat Creek Restoration at Hidden Meadows

Kennedy/Jenks Consultants
3990 Mt. Rose Hwy, Suite 200 Reno, Nevada 89502 (775) 827-7600

GRADING PLAN

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DATE June 2024
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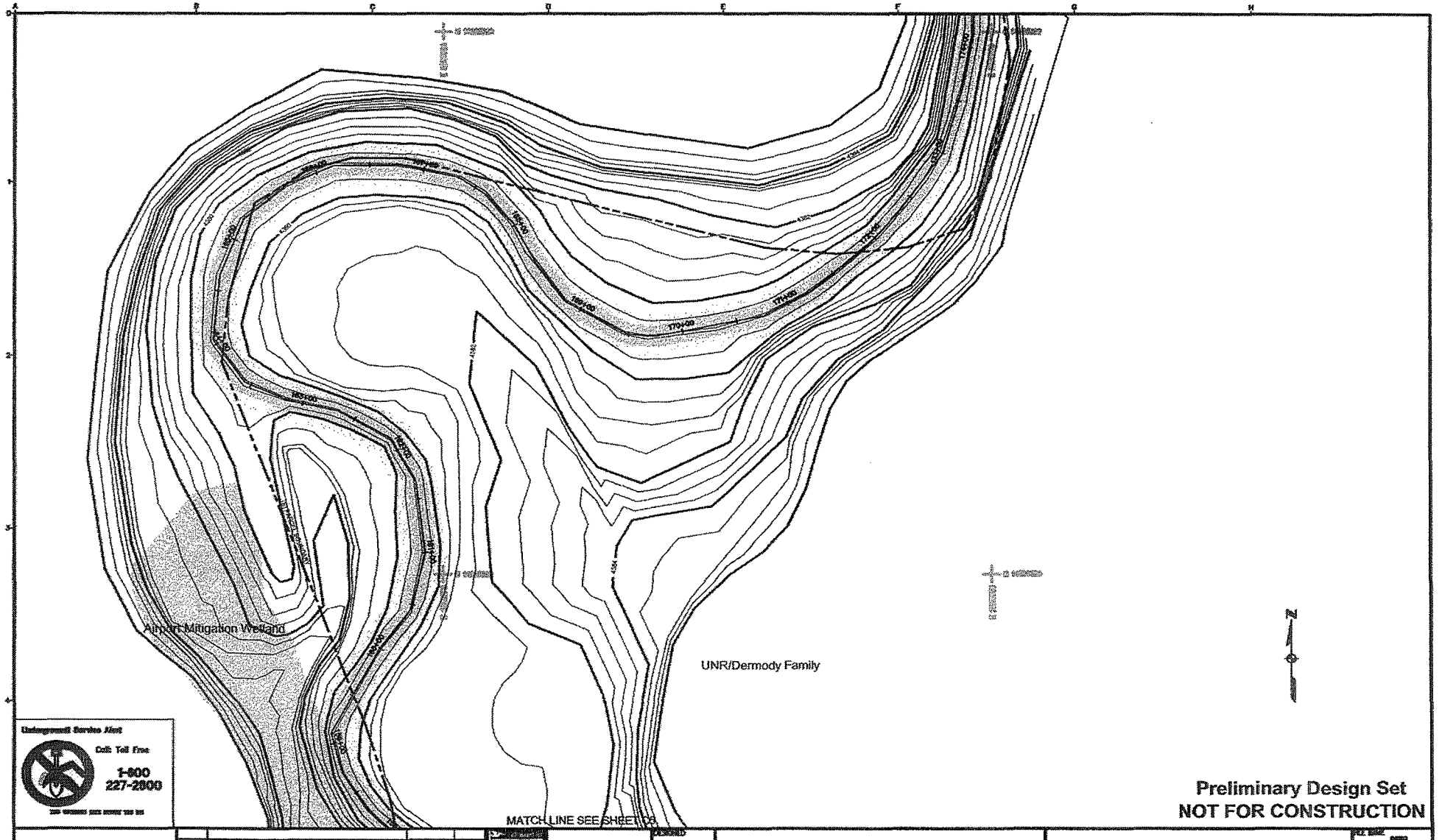

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227-2600

Preliminary Design Set
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USE OF DOCUMENTS

Washoe-Storey Conservation District
Reno, Nevada
Steamboat Creek Restoration at Hidden Meadows

Kennedy/Jenks Consultants

GRADING PLAN

DESIGNED
DRAWN
CHECKED

SCALE
JOB NO.
DATE: June 2004
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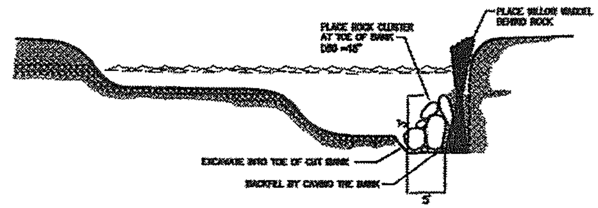

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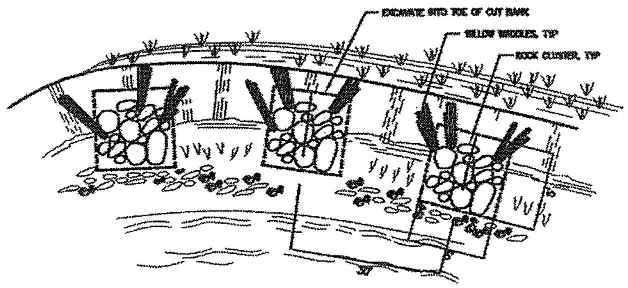
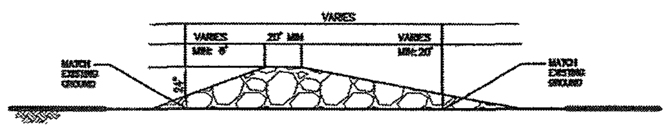


EROSION REDUCTION ON CUT BANKS

EROSION REDUCTION STRUCTURE (1)
NTS



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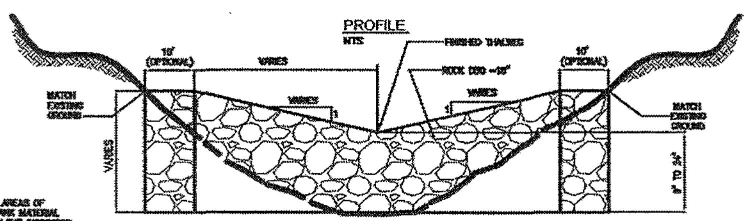

OPTIONAL KEY
1. TO BE USED IN AREAS OF INCOMPETENT BANK MATERIAL AS DIRECTED BY THE INSPECTOR.
2. 1' MINIMUM DEPTH EXCAVATED INTO COMPETENT BANK MATERIAL, OR AS DIRECTED BY INSPECTOR.

CROSS SECTION
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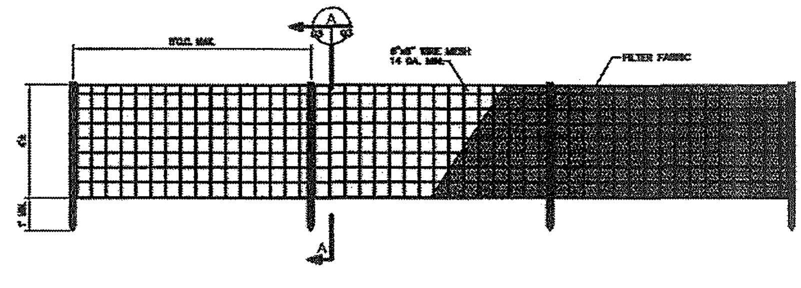
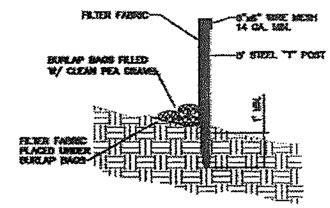


TEMPORARY SILT FENCE (2)
NTS

NOTES FOR TEMPORARY SILT FENCE

1. CONSTRUCT THE LENGTH OF EACH REACH ALONG CONTOURS SO THAT THE CHANGE IN BASE ELEVATION ALONG THE REACH DOES NOT EXCEED 1/3 THE HEIGHT OF THE LINEAR BARRIER.
2. THE LAST 8 FEET OF FENCE SHALL BE TURNED UP SLOPE.
3. STAKE DIMENSIONS ARE NOMINAL. STEEL STAKES ARE ALSO ACCEPTABLE.
4. STAKES SHALL BE SPACED AT 8 FEET MAXIMUM INTERVALS AND SHALL BE POSITIONED ON DOWNSTREAM SIDE OF FENCE.
5. OVERLAP STAKES AND FOLD FENCE AROUND EACH STAKE ONE FULL TURN. SECURE FABRIC TO STAKE WITH AT LEAST 4 WIRE TIES.
6. STAKES SHALL BE DRIVEN TIGHTLY TOGETHER TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT. THE TOPS OF THE STAKES SHALL BE SECURED WITH WIRE.
7. FOR END STAKE, FENCE FABRIC SHALL BE FOLDED AROUND TWO STAKES ONE FULL TURN AND SECURED WITH AT LEAST 4 WIRE TIES.
8. MINIMUM 4 WIRE TIES PER STAKE. DIMENSIONS SHOWN ARE TYPICAL.
9. JOINING SECTIONS SHALL NOT BE PLACED AT SUMP LOCATIONS.
10. SANDBAG ROWS AND LAYERS SHALL BE OFFSET TO ELIMINATE GAPS.



SECTION (A)
NTS

Underground Service Alert
Call: Toll Free
1-800 227-2600

Preliminary Design Set
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

DESIGNED: [illegible]
DRAWN: KJD
CHECKED:

Washoe-Storey Conservation District
Reno, Nevada
Steamboat Creek Restoration at Hidden Meadows

Kennedy/Jenks Consultants

DETAILS

FILE NAME: [illegible]
JOB NO.: [illegible]
DATE: June 2004
SHEET C10 OF XX

T:\047012.00_Hidden_Meadows\CAD-1\FOR\Stab4_C9.dwg LAST USER: KJD PRINT DATE: Jul 14, 2004 — 3:10pm

Appendix E: HEC-RAS Results

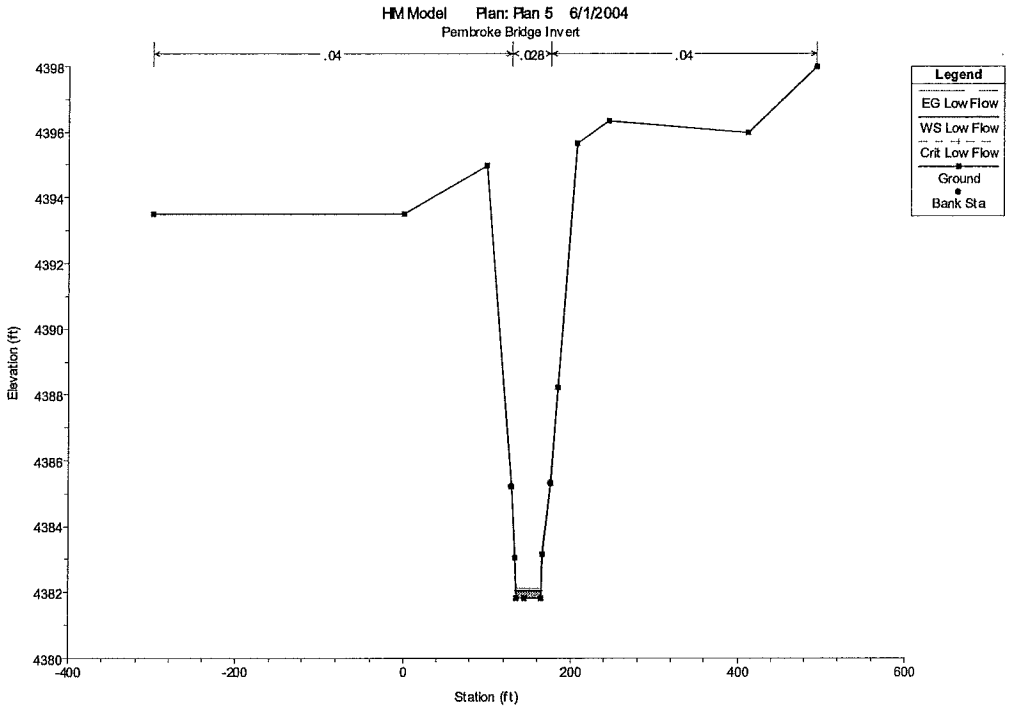
HEC-RAS Plan: Plan 5 River: RIVER-1 Reach: Reach-1

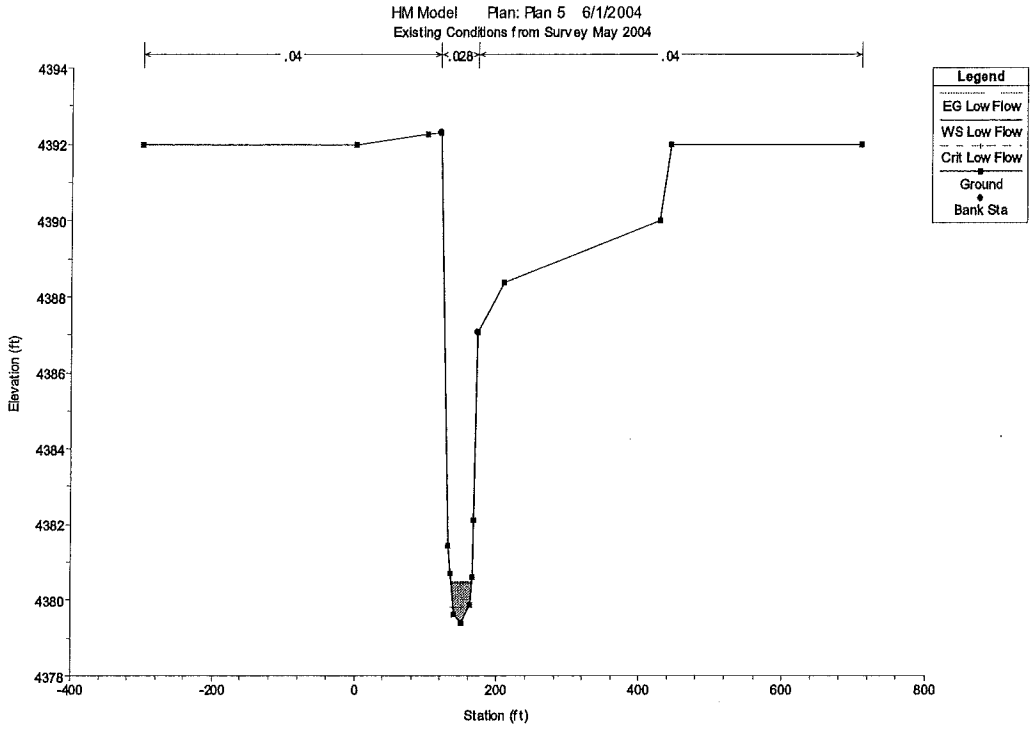
Reach	Sta.	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Top W. (ft)	Froude #
Reach-1	10	Low Flow	15.00	4381.84	4382.03	4382.13	0.019647	30.06	1.00
Reach-1	10	1 yr	60.00	4381.84	4382.34	4382.58	0.014689	30.53	1.00
Reach-1	10	1.5 yr	261.00	4381.84	4383.64	4383.97	0.004130	35.19	0.63
Reach-1	10	2 yr	359.00	4381.84	4384.17	4384.51	0.003357	38.76	0.59
Reach-1	10	5 yr	689.00	4381.84	4385.47	4385.89	0.002498	47.61	0.54
Reach-1	10	10 yr	983.00	4381.84	4386.31	4386.82	0.002131	52.76	0.52
Reach-1	10	25 yr	1451.00	4381.84	4387.43	4388.06	0.001877	59.60	0.51
Reach-1	10	50 yr	1876.00	4381.84	4388.29	4389.01	0.001768	64.83	0.51
Reach-1	10	100 yr	2374.00	4381.84	4389.12	4389.96	0.001744	69.80	0.52
Reach-1	9	Low Flow	15.00	4379.42	4380.47	4380.48	0.000235	28.51	0.14
Reach-1	9	1 yr	60.00	4379.42	4381.38	4381.40	0.000306	34.70	0.17
Reach-1	9	1.5 yr	261.00	4379.42	4382.88	4382.98	0.000586	38.47	0.26
Reach-1	9	2 yr	359.00	4379.42	4383.35	4383.48	0.000687	39.37	0.29
Reach-1	9	5 yr	689.00	4379.42	4384.48	4384.74	0.000975	41.61	0.35
Reach-1	9	10 yr	983.00	4379.42	4385.26	4385.62	0.001175	43.12	0.39
Reach-1	9	25 yr	1451.00	4379.42	4386.29	4386.82	0.001410	45.16	0.44
Reach-1	9	50 yr	1876.00	4379.42	4387.07	4387.75	0.001593	47.17	0.47
Reach-1	9	100 yr	2374.00	4379.42	4387.78	4388.64	0.001803	68.05	0.51
Reach-1	8	Low Flow	15.00	4379.00	4380.42	4380.42	0.000016	54.73	0.04
Reach-1	8	1 yr	60.00	4379.00	4381.27	4381.27	0.000044	84.93	0.07
Reach-1	8	1.5 yr	261.00	4379.00	4382.71	4382.73	0.000081	174.41	0.10
Reach-1	8	2 yr	359.00	4379.00	4383.18	4383.20	0.000086	180.12	0.11
Reach-1	8	5 yr	689.00	4379.00	4384.35	4384.37	0.000099	194.42	0.12
Reach-1	8	10 yr	983.00	4379.00	4385.16	4385.20	0.000106	205.13	0.13
Reach-1	8	25 yr	1451.00	4379.00	4386.28	4386.33	0.000109	216.81	0.13
Reach-1	8	50 yr	1876.00	4379.00	4387.15	4387.20	0.000111	218.81	0.14
Reach-1	8	100 yr	2374.00	4379.00	4387.95	4388.01	0.000119	220.66	0.15
Reach-1	7	Low Flow	15.00	4379.00	4380.41	4380.41	0.000022	50.61	0.04
Reach-1	7	1 yr	60.00	4379.00	4381.24	4381.24	0.000059	87.30	0.08
Reach-1	7	1.5 yr	261.00	4379.00	4382.68	4382.69	0.000049	458.57	0.08
Reach-1	7	2 yr	359.00	4379.00	4383.15	4383.16	0.000041	485.01	0.07
Reach-1	7	5 yr	689.00	4379.00	4384.33	4384.33	0.000034	542.24	0.07
Reach-1	7	10 yr	983.00	4379.00	4385.15	4385.15	0.000031	584.61	0.07
Reach-1	7	25 yr	1451.00	4379.00	4386.30	4386.30	0.000007	1024.11	0.03
Reach-1	7	50 yr	1876.00	4379.00	4387.17	4387.17	0.000007	1033.24	0.03
Reach-1	7	100 yr	2374.00	4379.00	4387.97	4387.98	0.000007	1041.68	0.04

Reach-1	6	Low Flow	15.00	4379.00	4380.41	4380.41	0.000005	94.64	0.02
Reach-1	6	1 yr	60.00	4379.00	4381.23	4381.23	0.000015	232.89	0.04
Reach-1	6	1.5 yr	261.00	4379.00	4382.67	4382.67	0.000016	666.90	0.04
Reach-1	6	2 yr	359.00	4379.00	4383.14	4383.14	0.000014	687.96	0.04
Reach-1	6	5 yr	689.00	4379.00	4384.32	4384.32	0.000008	890.14	0.04
Reach-1	6	10 yr	983.00	4379.00	4385.14	4385.15	0.000008	897.79	0.04
Reach-1	6	25 yr	1451.00	4379.00	4386.30	4386.30	0.000008	924.36	0.04
Reach-1	6	50 yr	1876.00	4379.00	4387.17	4387.17	0.000008	979.92	0.04
Reach-1	6	100 yr	2374.00	4379.00	4387.97	4387.97	0.000009	1031.29	0.04
Reach-1	5	Low Flow	15.00	4379.00	4380.40	4380.40	0.000023	50.40	0.05
Reach-1	5	1 yr	60.00	4379.00	4381.21	4381.21	0.000063	98.28	0.08
Reach-1	5	1.5 yr	261.00	4379.00	4382.66	4382.67	0.000026	489.16	0.06
Reach-1	5	2 yr	359.00	4379.00	4383.13	4383.14	0.000023	498.25	0.06
Reach-1	5	5 yr	689.00	4379.00	4384.32	4384.32	0.000021	519.69	0.06
Reach-1	5	10 yr	983.00	4379.00	4385.14	4385.14	0.000021	526.34	0.06
Reach-1	5	25 yr	1451.00	4379.00	4386.29	4386.29	0.000022	575.30	0.06
Reach-1	5	50 yr	1876.00	4379.00	4387.16	4387.16	0.000021	578.25	0.06
Reach-1	5	100 yr	2374.00	4379.00	4387.96	4387.97	0.000022	580.98	0.06
Reach-1	4	Low Flow	15.00	4379.00	4380.39	4380.39	0.000021	89.58	0.04
Reach-1	4	1 yr	60.00	4379.00	4381.20	4381.20	0.000008	500.24	0.03
Reach-1	4	1.5 yr	261.00	4379.00	4382.66	4382.66	0.000009	566.15	0.03
Reach-1	4	2 yr	359.00	4379.00	4383.13	4383.13	0.000009	572.58	0.03
Reach-1	4	5 yr	689.00	4379.00	4384.31	4384.31	0.000010	582.88	0.04
Reach-1	4	10 yr	983.00	4379.00	4385.13	4385.13	0.000011	590.74	0.04
Reach-1	4	25 yr	1451.00	4379.00	4386.28	4386.28	0.000012	605.04	0.04
Reach-1	4	50 yr	1876.00	4379.00	4387.15	4387.15	0.000012	619.98	0.05
Reach-1	4	100 yr	2374.00	4379.00	4387.95	4387.96	0.000014	633.78	0.05
Reach-1	3	Low Flow	15.00	4379.00	4380.37	4380.37	0.000060	97.37	0.07
Reach-1	3	1 yr	60.00	4379.00	4381.19	4381.19	0.000042	208.80	0.06
Reach-1	3	1.5 yr	261.00	4379.00	4382.64	4382.65	0.000028	405.14	0.06
Reach-1	3	2 yr	359.00	4379.00	4383.11	4383.12	0.000026	440.17	0.06
Reach-1	3	5 yr	689.00	4379.00	4384.29	4384.30	0.000024	464.15	0.06
Reach-1	3	10 yr	983.00	4379.00	4385.11	4385.12	0.000024	485.81	0.06
Reach-1	3	25 yr	1451.00	4379.00	4386.26	4386.27	0.000023	517.80	0.06
Reach-1	3	50 yr	1876.00	4379.00	4387.13	4387.14	0.000023	553.76	0.06
Reach-1	3	100 yr	2374.00	4379.00	4387.93	4387.94	0.000024	586.94	0.06
Reach-1	2	Low Flow	15.00	4379.00	4380.33	4380.33	0.000162	42.47	0.11
Reach-1	2	1 yr	60.00	4379.00	4381.15	4381.16	0.000191	94.08	0.13
Reach-1	2	1.5 yr	261.00	4379.00	4382.61	4382.63	0.000096	295.84	0.11
Reach-1	2	2 yr	359.00	4379.00	4383.09	4383.10	0.000081	307.23	0.10
Reach-1	2	5 yr	689.00	4379.00	4384.27	4384.28	0.000068	353.62	0.10
Reach-1	2	10 yr	83.00	4379.00	4385.09	4385.10	0.000063	372.90	0.10
Reach-1	2	25 yr	1451.00	4379.00	4386.24	4386.25	0.000058	404.32	0.10
Reach-1	2	50 yr	1876.00	4379.00	4387.11	4387.12	0.000059	451.39	0.10

Reach-1	2	100 yr	2374.00	4379.00	4387.90	4387.92	0.000061	494.75	0.10
Reach-1	1	Low Flow	15.00	4379.00	4380.22	4380.23	0.000200	44.90	0.12
Reach-1	1	1 yr	60.00	4379.00	4381.04	4381.05	0.000200	68.04	0.13
Reach-1	1	1.5 yr	261.00	4379.00	4382.52	4382.55	0.000200	123.27	0.16
Reach-1	1	2 yr	359.00	4379.00	4382.99	4383.03	0.000200	144.15	0.16
Reach-1	1	5 yr	689.00	4379.00	4384.17	4384.22	0.000200	166.15	0.17
Reach-1	1	10 yr	983.00	4379.00	4384.98	4385.04	0.000200	178.54	0.17
Reach-1	1	25 yr	1451.00	4379.00	4386.12	4386.20	0.000200	225.78	0.18
Reach-1	1	50 yr	1876.00	4379.00	4386.98	4387.06	0.000200	290.77	0.18
Reach-1	1	100 yr	2374.00	4379.00	4387.77	4387.86	0.000200	350.68	0.19

Hidden Meadows Appraisal Study – Graphical Display of Cross Section Data
Data is plotted from upstream to downstream.

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Existing Conditions from Survey May 2004
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.028
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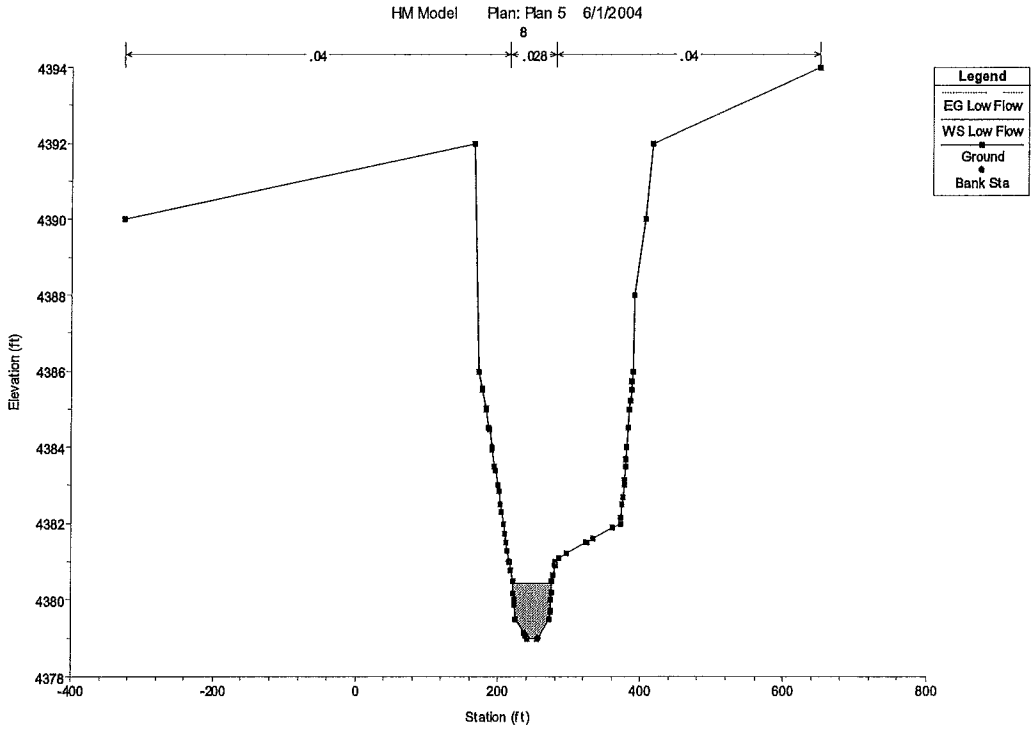
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (ft)
Station (ft)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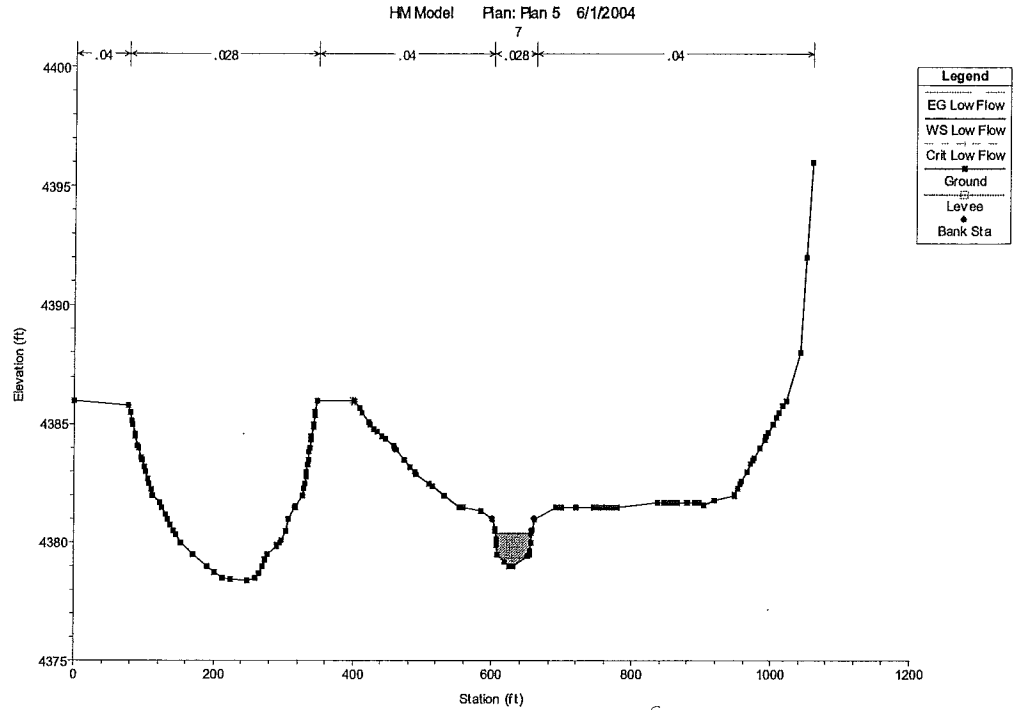
Legend
EG Low Flow
WS Low Flow
Ground
Bank Sta
Elevation (ft)
Station (ft)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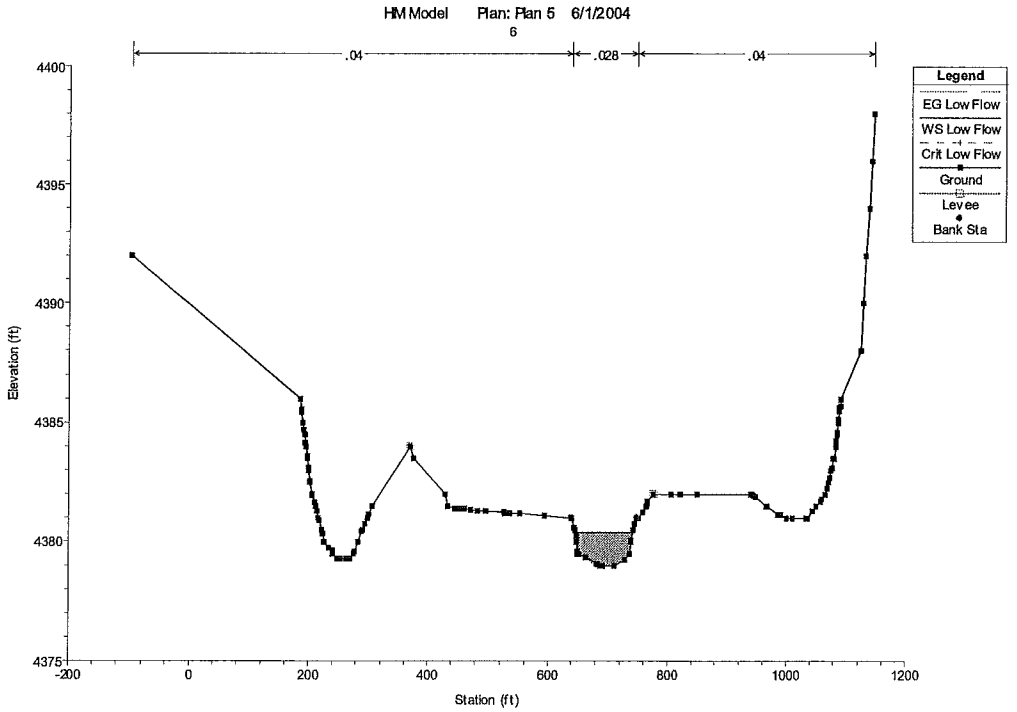
.028
.04
.028
.04
4400
4395
4390
4385
4380
4375
Elevation (ft)
0
200
400
600
800
1000
1200
Station (ft)
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Levee
Bank Sta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4380
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Elevation (ft)
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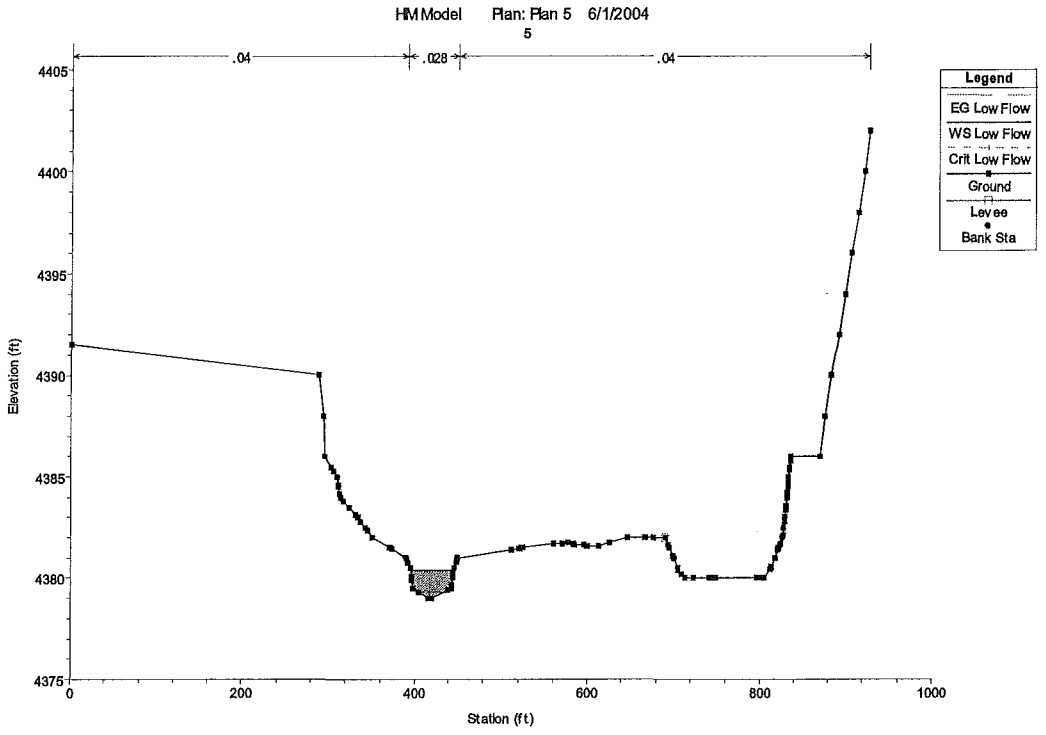
200
400
600
800
1000
1200
Station (ft)
Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Levee
Bank Sta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Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Levee
Bank Sta
Elevation (ft)
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4400
4395
4390
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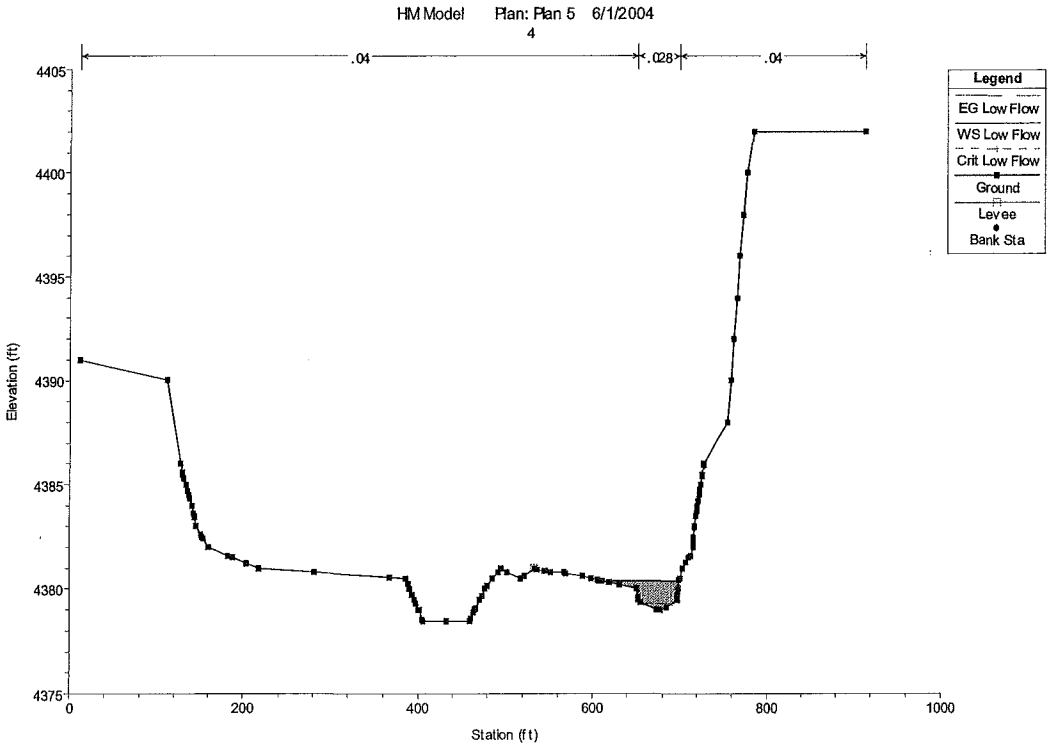
4380
4375
0
200
400
600
800
1000
Station (ft)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WS Low Flow
Crit Low Flow
Ground
Levee
Bank Sta
Elevation (ft)
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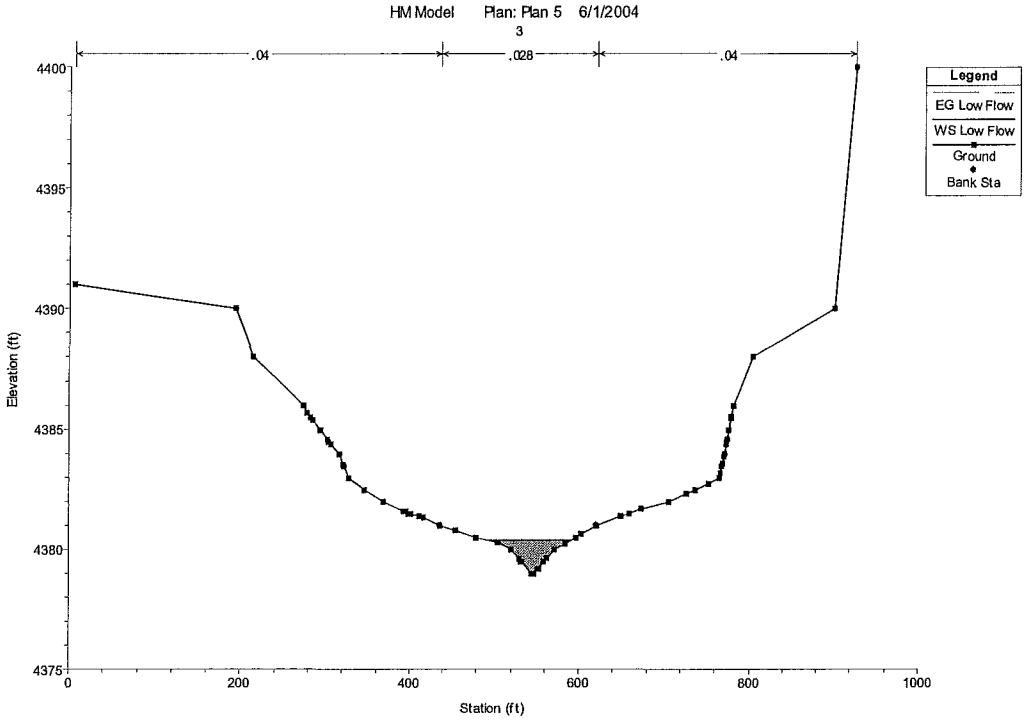
4400
4395
4390
4385
4380
4375
0
200
400
600
800
1000
Station (ft)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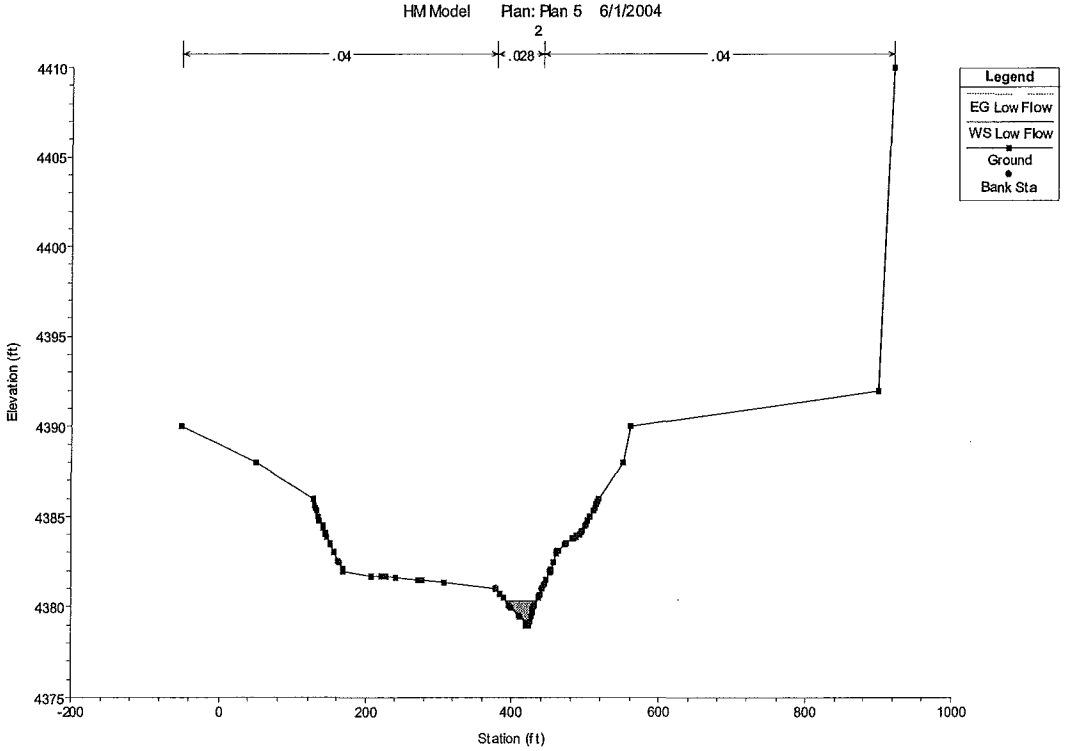
EG Low Flow
WS Low Flow
Ground
Bank Sta
Elevation (ft)
Station (ft)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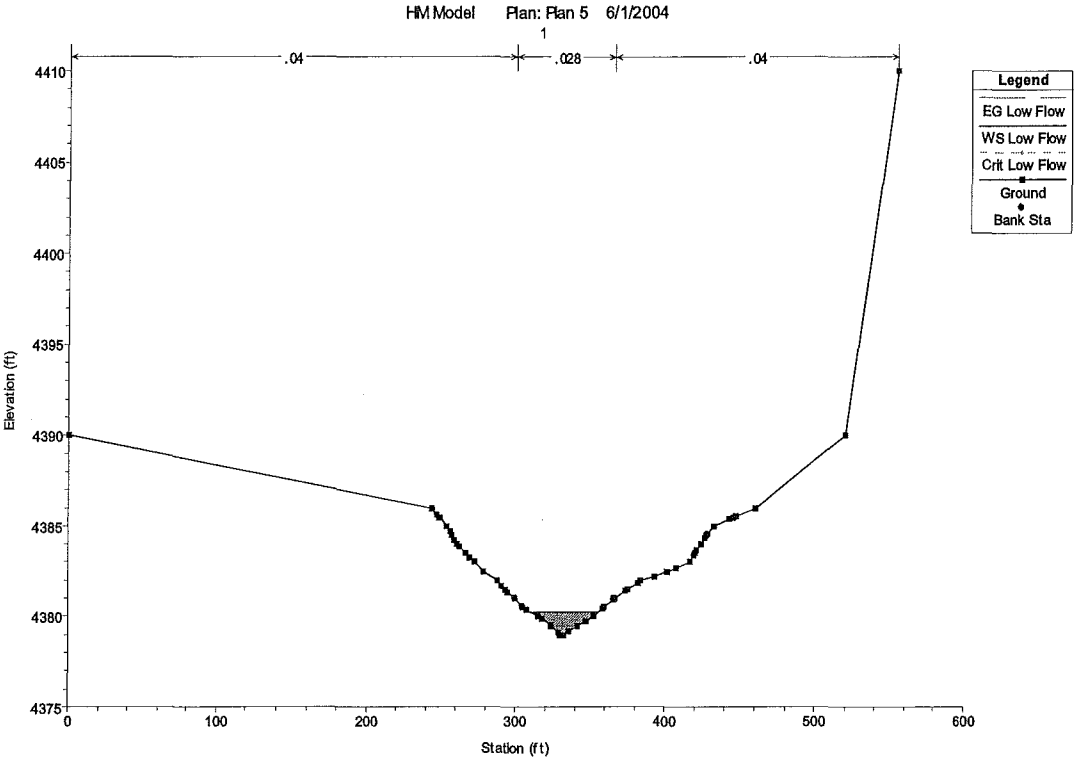
WS Low Flow
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
EG Low Flow
WS Low Flow
Crit Low Flow
Ground
Bank Sta
Elevation (ft)
4410
4405
4400
4395
4390
4385
4380
4375
0
100
200
300
400
500
600
Station (ft)

Appendix F: USGS Annual Peak Flow Frequency Analysis

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 4.0, December, 2000)
--- PROCESSING DATE/TIME ---
2004 MAY 6 12:31:37
--- PROCESSING OPTIONS ---

Plot option = Line printer
Basin char output = None
Print option = Yes
Debug print = No
Input peaks listing = Long
Input peaks format = WATSTORE peak file

1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 4.0, December, 2000)

Station - 10349980 STEAMBOAT C AT CLEANWATER WAY NR RENO, NV
2004 MAY 6 12:31:37

INPUT DATA SUMMARY

Number of peaks in record = 9
Peaks not used in analysis = 0
Systematic peaks in analysis = 9
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = 0.000
Standard error of generalized skew = 0.550
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = --
Plotting position parameter = 0.00

```
 ********* NOTICE -- Preliminary machine computations.      *********
 ********* User responsible for assessment and interpretation. *********

 **WCF118W-SYSTEMATIC RECORD SHORTER THAN 17B SPEC.    9
  WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.              0.0
  WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.    1639.0
  WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.         82.6
 **WCF233W-EXPECTED PROB OUT OF RANGE AT TAB PROB.  0.00001  0.00200
  WCF002J-CALCS COMPLETED.  RETURN CODE =  2
1
      Station - 10349980  STEAMBOAT C AT CLEANWATER WAY NR RENO, NV
                  2004 MAY 6 12:31:37

       ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

              FLOOD BASE              LOGARITHMIC
            ---------------- ------------------------------
                 EXCEEDANCE              STANDARD
            DISCHARGE PROBABILITY   MEAN    DEVIATION    SKEW
            -------------------------------------------------

 BULL.17B ESTIMATE     0.0    1.0000    2.5659    0.3281    0.193

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE
PROBABILITIES

   ANNUAL              95-PCT CONFIDENCE LIMITS
  EXCEEDANCE   BULL.17B   FOR BULL. 17B ESTIMATES
  PROBABILITY  ESTIMATE      LOWER       UPPER

    0.9950       60.3         15.3       113.9
    0.9900       70.7         19.8       128.6
    0.9500      110.8         41.1       183.4
    0.9000      142.1         60.9       225.3
    0.8000      193.7         97.6       295.9
    0.5000      359.2        226.8       563.2
    0.2000      689.4        451.7      1359.0
    0.1000      983.0        617.0      2337.0
    0.0400     1451.0        847.1      4342.0
    0.0200     1876.0       1036.0      6596.0
    0.0100     2374.0       1240.0      9706.0
    0.0050     2954.0       1463.0     13930.0
    0.0020     3867.0       1789.0     21790.0
    0.6667      260.9  ( 1.50-year flood )
    0.4292      410.5  ( 2.33-year flood )
1
```

Station - 10349980 STEAMBOAT C AT CLEANWATER WAY NR RENO, NV
2004 MAY 6 12:31:37

INPUT DATA LISTING

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1994	185.0		2000	237.0	
1995	1590.0		2001	118.0	
1996	661.0		2002	369.0	
1998	506.0		2003	381.0	
1999	320.0				

Explanation of peak discharge qualification codes

PEAKFQ CODE	WATSTORE CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

1

Station - 10349980 STEAMBOAT C AT CLEANWATER WAY NR RENO, NV
2004 MAY 6 12:31:37

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	BULL.17B ESTIMATE
1995	1590.0	0.1000
1996	661.0	0.2000
1998	506.0	0.3000
2003	381.0	0.4000
2002	369.0	0.5000
1999	320.0	0.6000
2000	237.0	0.7000
1994	185.0	0.8000
2001	118.0	0.9000

Appendix G: Stormwater Treatment

SAND FILTER BASINS TC-41

Description

A sand filter basin is a combination of a sedimentation basin and a sand filter. The water quality volume (WQ_V) collects in the basin and gradually infiltrates into an underlying sand bed with an under drain system. Fine grained sediments and associated pollutants are filtered out of the storm water and collected in the void spaces of the sand. The under drain system gradually dewaters the sand bed and filtered storm water then discharges into a vegetated swale, a channel or the storm drain system.

Applications

Sand filter basins can be applied in urban areas with thin soils or soils with low infiltration rates. They are generally used as offline treatment devices with an upstream diversion that diverts the water quality volume into the basin and allows larger flows to bypass. They should be sited in drainage areas with relatively low sediment loads and no baseflow.

Performance Data

The literature reported range of removal for various pollutants is as follows:

Pollutant	Percent Removal Efficiency
Total suspended solids	80 - 90
Total Phosphorus	45 - 55
Total Nitrogen	35 – 55
Total Recoverable Zinc	50 – 80
Total Recoverable Lead	60 - 80
Biochemical Oxygen Demand	60 - 80

Source: UDFCD, 1999.

Limitations

- Potential of clogging exists if runoff contains high amounts of clays and silts.
- Sand filter basins should not be installed in new development until construction is complete and disturbed soils are stabilized.

SAND FILTER BASINS TC-41

Siting Criteria

- Sand filter basins should not be installed near building foundations or in areas containing expansive soils.
- Due to the horizontal design of this BMP, it may be difficult to install a sand filter basin on a steep slope.
- Not to be used in areas where there is a high water table.
- Should not be used in drainage areas that have a perennial base flow because a preferential flow path through the sand filter may occur as well as clogging of the filter media.

Design and Construction Criteria

- Size the basin to capture and treat the water quality volume (WQ_V) using the method outlined in Section 3.2.2.
- Flows in excess of the WQ_V should be diverted around or through the basin without resuspending collected sediments.
- The basin should be designed with a drain time of 48 hours.
- The maximum depth of the basin should be 3 feet.
- The minimum sand filter surface area (A_s in ft^2) at the base of the basin should be determined using the following equation:

$$A_s = WQ_V / 3 \text{ ft}$$

- The bottom of the sand filter basin should be lined with 18 inches of sand (ASTM C-33) overlying a 9-inch gravel layer (AASHTO No. 8).
- If chemicals are stored or handled within the catchment area, install an impermeable layer beneath the gravel layer.
- The following types of under drains can be applied: center collector pipe or a longitudinal pipe in a 9-inch gravel backfill containing a collector pipe at the outlet.
- Collector under drainpipes should have a minimum slope of 0.5 percent.
- The under drainpipes should have a minimum diameter of 6 inches and should be composed of perforated schedule 40 PVC.
- Basin side slopes should not exceed 4H:1V.

Inspection and Maintenance Requirements

- Routinely remove debris and litter from the sand filter basin to minimize clogging and to maintain aesthetics.

- Replace vegetation and perform maintenance on the sand filter basin every 2 – 5 years by removing vegetation and the top 3 inches of the sand layer.
- Rake the top 3 – 5 inches of the filter surface a minimum of once a year.
- Inspect at least twice a year (with one inspection following a significant storm event) to ensure proper drainage and no ponding of water.

References

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Surface Sand Filters, Metropolitan Council/Barr Engineering Co., http://www.metrocouncil.org/environment/Watershed/bmp/CH3_STFiltSurfSand.pdf

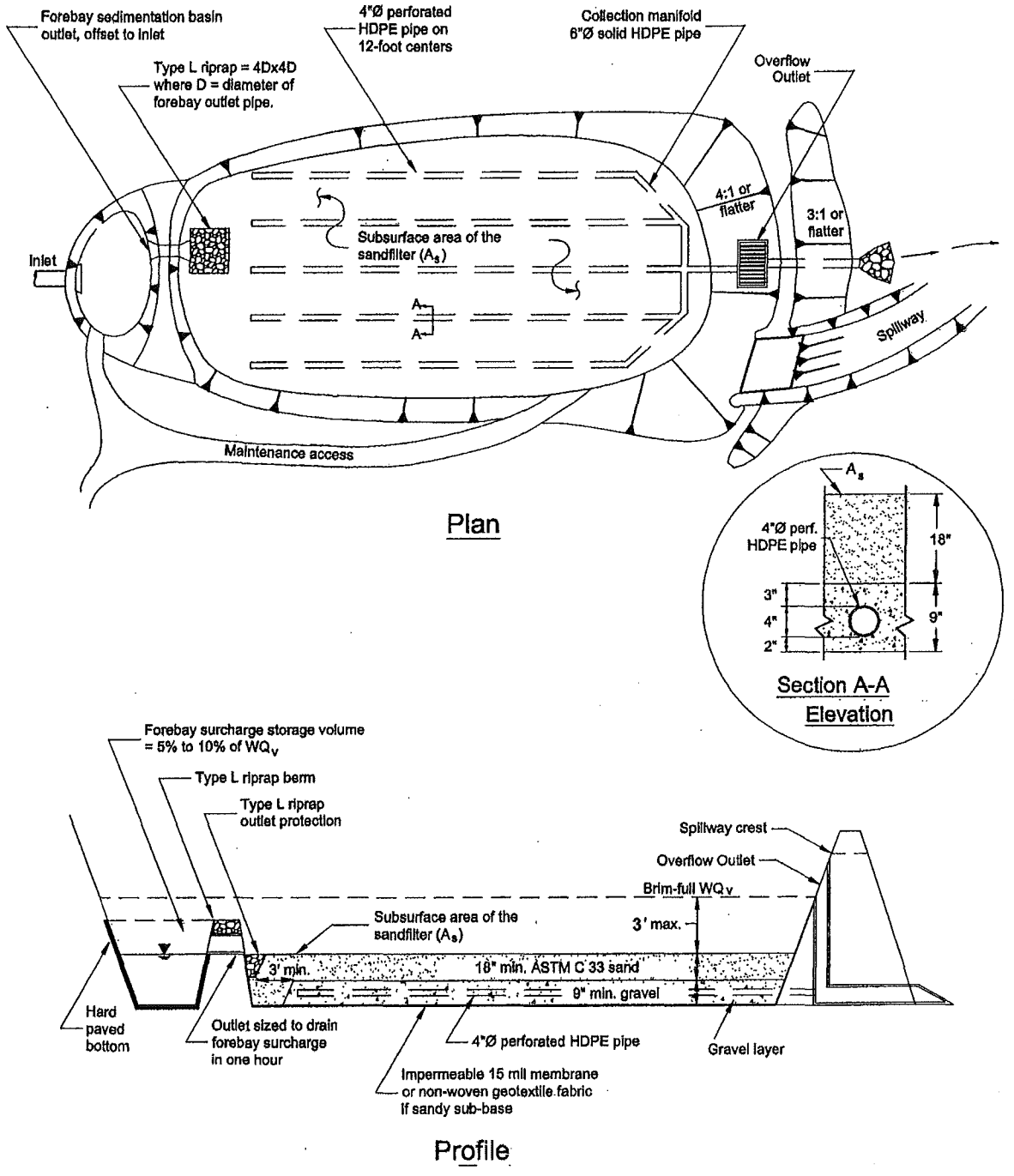

Figure TC-41. Example of a Sand Filter Basin design (modified from UDFCD, 1999).

Appendix H: Technical Memorandum: Preliminary Restoration Design Report by Western Botanical, Inc.

TECHN ICAL MEMORANDUM: PRELIMINARY RESTORATION DESIGN REPORT

Appraisal Study at Hidden Meadows
Reno, Nevada

Prepared for:

Kennedy Jenks
5190 Neil Rd., Suite 210
Reno, NV 89502

May 20, 2004

Western Botanical Services, Inc.
5859 Mt. Rose Highway / Reno, NV 89511

INTRODUCTION

The following report provides a general approach to restoration of native plant communities in the vicinity of Hidden Meadows, Reno, Nevada. Prior to developing this report, a literature search provided by Kennedy Jenks was evaluated. Kennedy Jenks is providing a preliminary design report to the client. It will include recommendations and cost estimates but will not include precise construction documents. Selection of precise treatments will follow the selection of a preferred alternative. Monitoring is a critical and an essential component both during and following construction. Post-construction vegetation conditions, including cover, composition, distribution, and vertical structure are anticipated to change substantially over time.

Control of the persistent and prolific noxious weed, *Lepidium latifolium,* Tall whitetop (TWT)), presents the greatest challenge to restoration of a healthy, reproductive plant community on this project site. Tall whitetop needs to be controlled up stream of the project otherwise re-infestation is virtually assured. A wash station(s) must be installed so that all vehicles entering and leaving the site are cleaned of tall whitetop seed. Currently, traffic is not restricted and visitors are most likely unknowingly transporting seed off the Hidden Meadows site. Project visitors and participants should also be advised that they must wash all clothing following field visits. The spread of tall whitetop in the Truckee Meadows needs to minimized.

Methodologies proposed to control TWT and replace with native vegetation are currently being tested at the 102 Ranch at Tracy, Nevada, and if successful, may be applied to the Hidden Meadows site once an alternative is selected. The hypothesis behind the design of the tests is that soil flora and fauna have been altered by monocultures of TWT and that native plant symbionts, no longer present but necessary for many native plants, must be added to the soil. In combination with mowing and herbicide applications, native and adapted species will be seeded with seed coated with mycorrhiza (the fungal symbiont) and activated charcoal, which immobilizes the herbicides. Irrigation is also being applied to half the plots.

Large scale restoration would most likely benefit from application of soil amendments and application of mulches and tackifiers following seeding. Prior to developing final design and revegetation specifications soil tests will be conducted to determine type and rate of amendment applications. Seedling establishment would be enhanced with irrigation, and willows and cottonwoods could be established from cuttings and/or containerized plants. Use of propagated wetland plugs including emergent species such as *Typha spp and Scirpus spp.* is currently not envisioned due to the expense entailed. These species are good colonizers and establish quite readily when habitat is available. It is estimated that 3-5 years will be needed to get the Tall whitetop under control and floodplain (wet and dry meadow) established. Willow cuttings, particularly Coyote willow can be established more rapidly (2 years). It is also assumed that periodic Tall whitetop treatment will be required until upstream sources are eliminated.

The table below describes potential communities as a function of hydrologic regimes

Table 1. Potential vegetation types as a function of depth to ground water

Wetland Type	Typical Species: Botanical Name	Common Name	Hydrologic Regime	Comments
Emergent	*Typha latifolia* *Scirpus acutus* *Scirpus americanus*	Cattail Tule Three-square	Standing water	All will typically colonize on there own if conditions are suitable
Riparian	*Salix exigua*	Coyote willow	Surface, 6" to goundwater	Rapidly establishing on un-vegetated surfaces
Riparian Shrub	*Rosa woodsii* *Ribes aureum* *Shepherdia argentea*	Woods rose Golden currant Buffaloberry	2-3' to groundwater	Excellent for erosion ontrol Good wildlife species Good wildlife species

	Salix laevigata	Red willow		
Wet Meadow	*Carex nebrascensis* *Carex utriculata* *Juncus balticus*	Nebraska sedge Beaked sedge Baltic rush	Surface water - 18" to groundwater	Poor germination, difficult from seed
DryMeadow/Floodplain	*Distichlis stricta* *Carex douglasii* *Leymus triticoides* *Juncus balticus*	Inland saltgrass Douglas sedge Creeping wildrye Baltic rush	2' + to groundwater	Dormant seed

EXISTING CONDITIONS

A site survey of the Hidden Meadows open space area was conducted on February 21, 2004 by Joan Reynolds, associate of Western Botanical Service Inc. The entire vegetated area was surveyed in a linear zig-zag pattern with transects no greater than 30 feet apart. Approximately 17 acres of the project area are covered in water. The majority of the project area has been previously disturbed. One isolated area was less disturbed, dominated by greasewood. Several patches of Inland saltgrass were observed throughout the southern portion of the project, remnants of the plant community that existed prior to the disturbance and resulting weed dominated plant community. Tall white top dominated the area and plant community throughout the site. Four horn smother weed was abundant around the pond periphery. Other weedy species were observed throughout the area and are included in the species list provided below. The survey was conducted at an inappropriate time of year to identify annual and many perennial species that may inhabit the site. An additional survey in early May to confirm and amend the plant list was recommended but has not yet taken place.

Table 2. Project Area Species List

Botanical Name	Common Name
Bassia hyssopifolia	Four-horn smother weed
Bromus tectorum	Cheatgrass
Chrsothamnus nauseosus	Rabbitbrush
Chenopodium sp.	Goosefoot
Distichlis spicata	Inland saltgrass
Elaeagnus angustifolius	Russian olive
Heliotropium sp.	Heliotrope
Iva axillaris	Poverty weed
Lactuca serioloa	Prickly lettuce
Lepidium latifolium	Tall whitetop
Salix exigua	Coyote willow
Sarcobates vermiculatus	Greasewood
Salsola tragus	Russian thistle
Tamarix sp.	Tamarisk
Tragopogon dubius	Goat's beard

MATERIALS

1. Seed.

The following species for Seed Mix 1 were selected based on their presence in floodplain communities in the Truckee meadows, their ability to establish rapidly and competitively, and their known association with mycorrhiza. An important soil microbial component in most native plant communities is the presence and abundance of mycorrhizal fungi. Mycorrhizal fungi are a specialized group of beneficial soil fungi that form an intimate relationship with plant roots of most plant species. Mycorrhizal fungi colonize plant roots and become an extension of the root systems contributing as much as an 80% increase in root absorbing area. The symbiosis works as an exchange between the plant and the fungus in which the plant receives soil nutrients from the fungus and in exchange, the fungus receives photosynthate or carbon from the plant.

With the exception of ryegrain, Baltic rush and Four-wing saltbrush, all species are mycorrhizal, with varying degrees of dependence on the symbiosis. The cereal crop was added as a nurse crop to provide shade for species slower to germinate and establish. Tall wheatgrass, the other non-native, was included since it is a competitive, rapidly establishing species adapted to fluctuating water tables and soils that occur on the project site. Big sagebrush and Rabbitbrush, both in the family *Asteraceae*, produce an abundance of short-lived seed and are excellent colonizers. Inland saltgrass, however, has a known record of poor establishment from seed due to dormancy mechanisms. It has been included since it is a major component of the Truckee River floodplain community. Creeping wildrye is also a dominant species in these communities.

Table 3. Proposed Seed Mix #1 (Dry Meadow/Floodpain)

Botanical Name	Common Name	PLS Lbs/Acre
Artemisia tridentata ssp tridentata	Big sagebrush	0.50
Atriplex canescens	Fourwing saltbush	2.00
Distichlis stricta	Inland saltgrass	3.00
Chrysothamnus nauseosus	Rubber rabbitbrush	0.50
Elymus cinereus	Great Basin Wildrye	3.00
Elytrigia elongate elongata	Tall wheatgrass, 'Jose'	4.00
Juncus balticus	Baltic rush	0.25
Leymus triticoides	Creeping wildrye, native	5.00
Ryegrain, Cereal		2.30

TOTAL		18.55

Table 3. Proposed Seed Mix #2 (Riparian)

Botanical Name	Common Name	PLS Lbs/Acre
Distichlis stricta	Inland saltgrass	3.00
Leymus triticoides	Creeping wildrye, native	5.00
Mimulus guttatus	Monkey flower	2.30
Phalaris arundinacea	Reed canarygrass	2.00
Sphaeralcea munroana	Globemallow	0.25
TOTAL		12.55

*PLS= purity X germination

All seed shall conform with all laws and regulations pertaining to the sale and shipment of seed required by the Nevada State Department of Agriculture and the Federal Seed Act. All shipments of seed shall be reported to the Nevada State Department of Agriculture for inspection. Deliver seed to the site tagged and labeled in accordance with the State Agricultural Code and acceptable to the County Agricultural Commissioner. For Rabbitbrush and Sagebrush, test seed within 60 days prior to seeding. Seed tags must reflect the most recent test date.

Seed shall be of a quality having a minimum Pure Live Seed as specified. Weed seed shall not exceed 0.5 percent of the pure live seed and inert material. All seed is subject to inspection, and tags shall be submitted to the project inspector. Species and/or varieties may be substituted upon the written approval. Seed samples from seed bags shall be made available for testing 30 days prior to application.

2. Herbicides

PLATEAU® herbicide for weed control, native grass establishment and turf growth suppression on pastures, rangeland, and non-crop areas.

Active ingredients consist of Ammonium salt of imazapic (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid*23.6%.
Inert ingredients 76.4%, for a total of 100.0%

*Equivalent to 22.2% (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid. (1 gallon contains 2.0 pounds of active ingredient as the free acid)

3. Mycorrhiza Inoculants: Background, Specifications

Diverse native plant communities are more resistant to weed invasion and there is a growing body of research that is relating plant-microbe-soil interactions to plant community structure and function and how invasive weed species can drastically alter the soil microbial and chemical environment (Reynolds et al. 2003, Kourtev et al. 2003, and Kourtev et al. 2002). An important soil microbial component in most native plant communities is the presence and abundance of mycorrhizal fungi.

Mycorrhizal fungi are a specialized group of beneficial soil fungi that form an intimate relationship with plant roots of most plant species. Mycorrhizal fungi colonize plant roots and become an extension of the root systems contributing as much as an 80% increase in root absorbing area. The symbiosis works as an exchange between the plant and the fungus in which the plant receives soil nutrients from the fungus and in exchange, the fungus receives photosynthate or carbon from the plant.

The main responsibility of mycorrhiza is to increase the efficiency of mineral uptake and water in soil. Once the soil becomes disturbed from its native state, the mycorrhiza do not persist without the symbiont and the soil has difficulty supporting native species since the root system is reduced. Mycorrhizal inoculation can improve plant establishment, nutrient and water uptake, plant vigor, yield and growth, and disease resistance. It will also reduce transplant shock and drought stress. Mycorrhizal plants are often more competitive and better able to tolerate environmental stresses than are non-mycorrhizal plants. About 95% of the world's land plants form the mycorrhizal relationship in their native habitats. TWT is one of the 5% that does not form this relationship.

The benefits of mycorrhizal inoculation are:

- A natural functioning ecosystem with a strong mycorrhiza presence may force out non-mycorrhizal species such as TWT.
- Greater resistance to invasion by noxious weeds.
- Improved soil structure.
- Improved plant growth rate.
- Protection from pathogens.
- Increased seedling survival.
- Higher species diversity.
- Increased drought resistance.

The three species of mycorrhizal inoculants recommended for use on this site are:

- *Glomus intraradices*
- *Glomus mosseae*
- *Glomus aggregatum*

All three species were originally collected in the western United States and isolated and identified at the International Culture Collection of Vesicular Arbuscular Mycorrhizal Fungi (INVAM) located at the University of West Virginia. These three species were chosen because of their widespread occurrence in arid environments and ability to colonize and affect plant growth under a wide range of environmental conditions.

Mycorrhizal inoculants shall consist of spores, mycelium, and mycorrhizal root fragments in a solid carrier suitable for handling by dry application. The carrier shall be the material in which the inoculum was originally produced, and may include organic materials, vermiculite, perlite, calcined clay, or other approved materials consistent with proper application and good plant growth.

Each endomycorrhizal inoculum shall carry a supplier's guarantee of number of propagules per unit weight or volume of bulk material. Species shall include *Glomus aggregatum*, *Glomus mosseae*, and *Glomus interadices*. Each species shall comprise approximately 33.3% of the mix. The inocula shall contain at minimum 120 spores per gram. Inocula shall be transported and stored in areas with a temperature of less than 90 ° F. Use a dust mask when handling the material.

4. Activated Charcoal- Background and Specifications

The activated charcoal is used in the seed coating to sequester the active ingredients that are present in the soil which has resulted from the application of the BASF herbicide Plateau®. The herbicide will stop any of the undesirable seeds present in the soil such as TWT from germinating and the activated charcoal present in the seed coating of the desirable seeds that have been treated with charcoal and mycorrhiza in combination should germinate and become established on the site. There is certain literature that suggests that if a natural functioning ecosystem with a strong mycorrhiza presence becomes established on a site, the non-mycorrhizal species such as TWT will be forced out (http://www.mycorrhizae.com).

5. Plants

Table 3. Riparian Plants- cuttings and containerized plants

Botanical Name	Common Name	Percent of Total
Salix exigua	Coyote willow	60%
Populus fremontii	Fremont's cottonwood	40%
TOTAL		**100%**

Plant size shall be maximum 1 gallon in size. Plant names used on the revegetation plans shall comply with standard horticultural nomenclature, and names generally accepted in the nursery trade. All plants shall be reviewed at the time of delivery to the site. The plant material will be judged and accepted or rejected on basis of the following criteria:

(a) Provide trees, shrubs, and plants of quality, size, genus, species, and variety.

(b) All plant material will be subject to inspection by the Nevada Division of Agriculture.

(c) Plants shall be free of disease, insects, eggs, larvae, and defects.

(d) Treetops shall have an intact and undamaged central leader.

(e) Bark shall be damage free with all minor cuts and abrasions showing healing tissue. Foliage, roots and stems of all plants shall be of vigorous health and normal habit of growth for its species. All plants shall be free of insect infestations and diseases. Top growth shall be proportionate to bottom growth.

Cuttings shall be Coyote willow and Fremont's cottonwood. Install cuttings on average 4-ft. centers.

Willow stakes shall not be prepared more than 7 days prior to installation and must be harvested when dormant. Material shall be kept in a moist, shaded environment or water filled bucket. All materials shall be cut from healthy, live branches of willow shall be taken from suitable materials in the vicinity on the project area.

Cuttings may vary in length, depending on source material, but shall be a minimum 18 inches. Stakes shall be of straight, healthy, and relatively young material and shall have a minimum ¼ inch and maximum ½ -inch diameter. They shall be free of all disease. Remaining leaves shall be removed from the stems. Cuts shall be clean without frayed ends. Bottoms shall be cut on a 45-degree angle.

5. Mulches and Tackifiers

Mulches can include certified weed free straw, as well as wood fiber material that is hydraulically applied. They can be anchored by mechanically crimping straw, and/or applying plant derived tackifiers (glues) over the straw or with the wood fiber mulch

Wood Fiber Mulch shall consist of consist of degradable green-dyed wood-cellulose fiber or 100%-recycled long-fiber pulp, and shall be produced from newsprint, chipboard, corrugated cardboard, or a combination of these materials, and shall be free from weeds or other foreign matter toxic to seed germination.

Tackifier shall be of an organic, plant-derived substance containing psyllium or guar gum, such as PT-TAC, Reclamare 2400, M-Binder, Eco-tak, Fisch-Stick, or approved equal. Material shall form a transparent 3-dimensional film-like crust permeable to water and air and containing no agents toxic to seed germination.

6. Irrigation

Irrigation will enhance seedling establishment and subsequent competition with TWT. An overhead broadcast system will be a temporary, although drip is preferred for containerized species. Extensive filtering of river/pond water may be required. Depending on the total areas requiring irrigation, a valved system on a timer may be necessary. Solar controllers are available to eliminate the need for a source of electrical power.

IMPLEMENTATION

1. Site Preparation and Seeding

Mow TWT with a brush hog or sickle bar mower at the peak flowering stage of TWT. Rake and remove TWT debris. When Tall whitetop has re-grown to the full flowering stage, apply Plateau herbicide through a boom sprayer, utilizing TeeJet flat fan nozzles, 8004, applying 20 gallons of water per acre, at 8 fl ounces per acre with one quart per acre of methylated seed oil.

Depending on the response this may need to be repeated before seeding takes place. A fall seeding is recommended, either broadcasting or drilling the seed. If broadcasted, seeds shall be gently raked in so to create an interface between the soil and the seeds to enhance germination.

2. Planting Containerized Material

Plant containerized willows and cottonwoods on average 8-ft centers (precise locations to be determined on a plan sheet and located in the field). No plants shall be laid out more than one hour before planting.

All planting shall be conducted prior to freezing conditions. Thoroughly water all plants before planting. All planting holes shall be hand dug a minimum of two inches deeper than the root length, measured from the bottom of the container to the plant crown. Excavated holes shall be planted immediately to avoid drying of soils. The planting hole shall be slightly wider than the width of the container. Soils shall be loosened in the bottom and along the sides of the hole. The plant shall then be gently removed from the container and compacted roots loosened.

The plant shall then be placed in the hole and backfilled with the excavated moist soil, so that the crown is ½ to 1 inch below final plan grade. Soil shall then be tamped firmly into place. Thoroughly water following planting.

3. Installing Willow and Cottonwood Cuttings

Cuttings shall be planted on average 4-foot centers. Soils shall be moist at the time of installation. Stakes shall be pushed into soft ground, or if necessary to avoid damage to bark, a hole slightly smaller than the diameter of the stake shall be prepared using reinforcement bar or similar tool. Stakes shall be planted so that a minimum of ¾ of the cutting is buried. Soil around the cuttings shall then be **firmly** tamped into place to eliminate air pockets.

4.Applying Straw Mulch

Evenly apply with a straw blower. Crimp straw into the soil with crimpers, discs, other approved equipment.

5. Applying Hydraulic Wood Fiber Mulch and Tackifier

A hydromulcher with agitator shall be used to evenly apply the mixture at the following rates under suspension. Mix in accordance with the following:

A. Over Straw

Wood-cellulose fiber mulch: 500 lbs. per acre
Tackifier: 150 lbs. per acre
Water: As needed

B. Over Soil/Seed

Wood-cellulose fiber mulch: 2000 lbs. per acre
Tackifier: 150 lbs. per acre
Water: As needed

Apply hydromulch and tackifier, adding organic tackifier to the wood-fiber mulch and water prior to application so that a uniform suspension under agitation is achieved.

MAINTENANCE

Maintain all areas for two years following treatment so that there is no evidence of erosion, such as rills or gullies and so that performance standards, as described below, are met. This may require re-treatment with herbcides, removal of dead material, re-application of soil amendments and inoculants, seed, mulches, and tackifiers. Maintain irrigation system.

PERFORMANCE STANDARD AND ACCEPTANCE

Revegetated areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements. Seventy percent (70%) of pre-disturbance native plant cover must be achieved before the Notice of Termination (NOT) can be issued. If adequate coverage is not achieved, the Contractor may be required to re-seed, re-soil amend, and/or re-mulch. A final inspection and acceptance shall take place at the conclusion of the maintenance period. Provide notification at least 10 working days before requested inspection date.

COST ESTIMATES

ITEM	UNIT	$/UNIT
Mowing/Site preparation	LUMP SUM/ACRE	$500.00
Herbicide	ACRE	$20.00
Herbicide Application	ACRE	$60.00
Seed	ACRE	200.00
Seed Coating (including materials)	ACRE	420.00
Drill Seeding	ACRE	700.00
Wash Station	EA	1,000.00
Irrigation System (assume power available)	LUMP SUM/ACRE	1,200.00
Spot Treat Herbicide	LUMP SUM/ACRE	200.00
TOTAL		

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Appendix I: Cost Estimates

ENGINEER'S ESTIMATE OF PROBABLE COST

KENNEDY/JENKS CONSULTANTS

Project: Hidden Meadows Appraisal Study

Building, Area: Total Project Cost

Prepared By: CNH
Date Prepared: 6/11/2004
K/J Proj. No.

Current at ENR
Escalated to ENR

Estimate Type: [X] Conceptual [ ] Preliminary (w/o plans) [ ] Design Development @ [ ] Construction [ ] Change Order [ ] % Complete

Spec. No.	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total	Source
		Mobilization @ 10%	1	LS	$185,546.11	$185,546.11					$185,546.11	
		Dewatering	40	DAY	$865.00	$34,600.00					$34,600.00	
		Biologist for ongoing vegetation monitoring (1day/mo for 5yrs)	480	HR	$65.00	$31,200.00					$31,200.00	
		Vegetation				$200,000.00					$200,000.00	
		Irrigation				$120,000.00					$120,000.00	
		Permitting				$40,000.00					$40,000.00	
		Silt Fence for Storm Water	10,000	LF	$0.75	$7,500.00					$7,500.00	
		Survey Crew:										
		Party Chief	80	HR	$110.00	$8,800.00					$8,800.00	
		Rodman	80	HR	$73.00	$5,840.00					$5,840.00	
		Dermody Property										
		Excavation w/ 3cy Loader	157,581	CY	$1.56	$245,826.36					$245,826.36	
		(2) End Dumps w/ 34cy Bucket, 1000' Haul	157,581	CY	$1.88	$296,252.28					$296,252.28	
		Water Truck/Pump (Dust Control)	80	HR	$100.00	$8,000.00					$8,000.00	
		Foreman	80	HR	$84.00	$6,720.00					$6,720.00	
		Grade Setter	80	HR	$72.00	$5,760.00					$5,760.00	
		(8) Laborers	320	HR	$60.00	$19,200.00					$19,200.00	
		Steamboat Channel										
		Water Truck/Pump (Dust Control)	160	HR	$100.00	$16,000.00					$16,000.00	
		Fill/Grading w/ 3cy Loader	290,000	CY	$1.56	$452,400.00					$452,400.00	
		Foreman	160	HR	$35.00	$5,600.00					$5,600.00	
		Grade Setter	160	HR	$30.00	$4,800.00					$4,800.00	
		(8) Laborers	1,280	HR	$25.00	$32,000.00					$32,000.00	
		Downstream Grade Control Structure	1	LS	$15,000.00	$15,000.00					$15,000.00	
		Walking Trail										
		Clearing and Grubbing w/ Backhoe	600	CY	$1.90	$1,140.00					$1,140.00	
		DG Rock	600	CY	$52.00	$31,200.00					$31,200.00	
		Spreading/Compaction w/ Backhoe	600	CY	$1.90	$1,140.00					$1,140.00	
		(8) Laborers	320	HR	$25.00	$8,000.00					$8,000.00	
		Biking Trail										
		Clearing and Grubbing w/ Backhoe	1,000	CY	$1.90	$1,900.00					$1,900.00	
		DG Rock	1,000	CY	$52.00	$52,000.00					$52,000.00	
		Type II Base	1,000	CY	$52.00	$52,000.00					$52,000.00	
		(8) Laborers	640	HR	$25.00	$16,000.00					$16,000.00	
		Yorl Drain										
		Excavation w/ Track Hoe	22,250	CY	$2.29	$50,952.50					$50,952.50	
		(2) End Dumps w/ 34cy Bucket, 1000' Haul	22,250	CY	$1.88	$41,830.00					$41,830.00	
		Water Truck/Pump (Dust Control)	80	HR	$100.00	$8,000.00					$8,000.00	
		Foreman	80	HR	$35.00	$2,800.00					$2,800.00	
		Grade Setter	80	HR	$30.00	$2,400.00					$2,400.00	
		(8) Laborers	640	HR	$25.00	$16,000.00					$16,000.00	
		Grade Control Structure	1	LS	$12,000.00	$12,000.00					$12,000.00	
		Flow Monitoring Station	1	LS	$2,600.00	$2,600.00					$2,600.00	
		Subtotals				$2,041,007.25					$2,041,007.25	
		Taxes	@	7.75%		$158,178.06					$158,178.06	
		Subtotals				$2,199,185.32					$2,199,185.32	
		Contractor OH&P	@	15%		$329,877.80					$329,877.80	
		Subtotals				$2,529,063.11					$2,529,063.11	
		Estimate Contingency	@	20%		$505,812.62					$505,812.62	
		Estimated Bid Cost				$3,034,875.74					$3,034,900.00	
		Engineering	@	9%		$273,138.82					$273,141.00	
		Total Estimate				$3,308,014.55					$3,309,000.00	