FINAL DESIGN REPORT

FOR

GLENBROOK CREEK RESTORATION PROJECT

GLENBROOK, NEVADA

January 2013

Approved by:

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INTRODUCTION

The Glenbrook Creek Restoration Project is a stream and meadow restoration to improve channel morphology and function as well as fish and wildlife habitat for Glenbrook Creek, in Glenbrook, Nevada. The project intends to improve vegetation diversity and wildlife habitat with vegetation management of a 3.5 acre area. Additionally, the project proposes to restore approximately 300 linear feet of stream by removing two culverts, replacing one with an arch culvert that allows fish passage, constructing a section of new channel, and stabilizing portions of the existing channel.

BACKGROUND

Glenbrook Creek is the 15th largest tributary to Lake Tahoe (by watershed area). It is fed by two unnamed tributaries above US Highway 50. The creek itself starts at a culvert below Highway 50 and parallels the Old Lincoln Highway. It flows through a canyon into the neighborhood of Glenbrook, passing first through the Glenbrook HOA, then Upper Meadows LP property, under Old US Highway 50, and through GHOA land before becoming a low gradient stream within a meadow. The meadow is owned by both GHOA and Lawrence Ruvo. Glenbrook Creek eventually enters a more developed area before ending at Lake Tahoe.

The map in Figure 1 shows the location of Glenbrook Creek and the approximate Glenbrook Creek watershed.

As discussed in the 1998 TRPA Memorandum entitled "Glenbrook Creek and Adjacent Wetland Restoration Opportunities," the restoration of the Glenbrook Creek SEZ has the possibility to positively affect the TRPA Water Quality, Wildlife, and Fish Habitat Thresholds (TRPA, 1998). With the lack of vegetation diversity and the presence of noxious weeds throughout the meadow, NTCD has identified an opportunity to improve the area to meet the TRPA Vegetation Threshold. The addition of a stream view footpath is applicable to the TRPA Recreation Threshold. The path will also serve as a water quality and riparian health benefit by keeping foot traffic out of the restoration area and allowing access for monitoring and future vegetation management.

NTCD along with TRPA and expert geomorphologists (Swanson, 1999) have identified the following restoration needs for Glenbrook Creek:

1. Improve fish passage by replacing culvert at Old US Highway 50 and removing remnant culvert at abandoned meadow creek crossing.
2. Restore riparian health by increasing flood flows to channel downstream of culvert at Old US Highway 50 and improving floodplain connectivity.
3. Reduce the input of fine sediment to Lake Tahoe by repairing incised portions of the channel and stabilizing banks.
4. Restore riparian heath by removing decadent willows near creek and diversifying the age of vegetation.

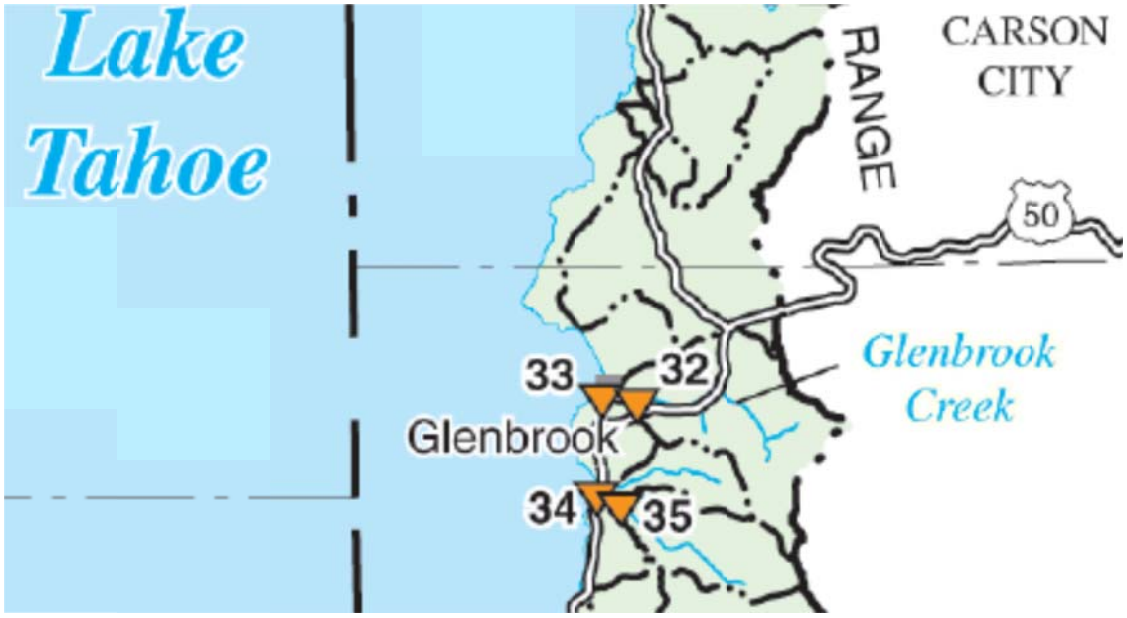

Figure 1. Glenbrook Creek and Watershed. Monitoring locations are indicated by the orange triangles 32 and 33. Monitoring occurred from (USGS, 2002)

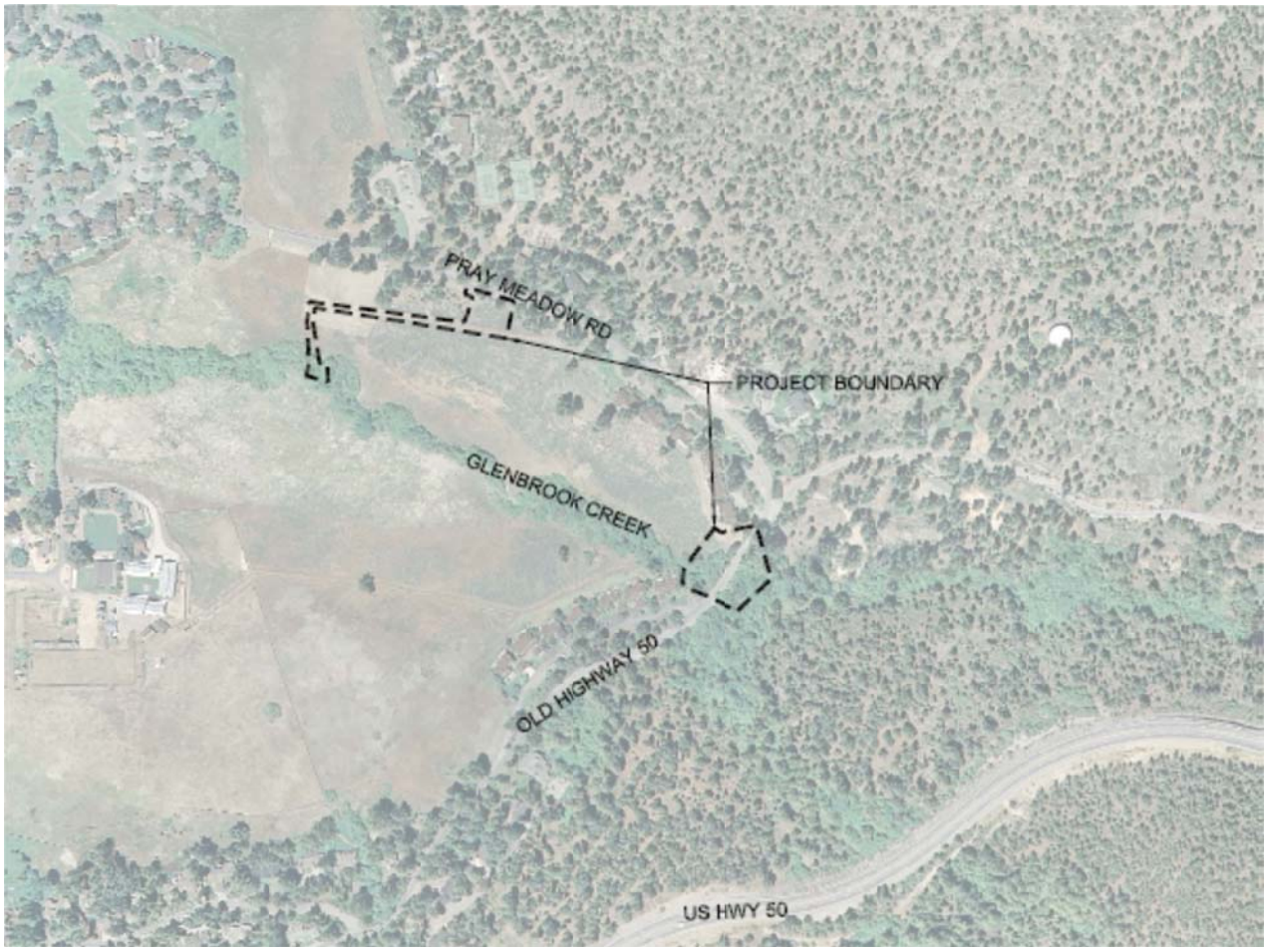

Figure 2. Project area location.

PROJECT LOCATION

The Glenbrook Creek Restoration Project is located in Douglas County, in Glenbrook, NV, along an approximately 1,000 foot length of Glenbrook Creek. The project area is on parcels owned by the Glenbrook Homeowners Association and the Glenbrook Cottage Associations. Appendix A has a list of properties within 300' of the project.

DESCRIPTION

The Glenbrook Creek Restoration Project is a stream and meadow restoration to improve channel morphology and function as well as fish and wildlife habitat for Glenbrook Creek, in Glenbrook, Nevada. The project intends to improve vegetation diversity and wildlife habitat with vegetation management of a 3.5 acre area. Additionally, the project proposes to restore approximately 300 linear feet of stream by removing two culverts, replacing one with an arch culvert that allows fish passage, constructing a section of new channel, and stabilizing portions of the existing channel.

GOALS AND OBJECTIVES

The Glenbrook Creek Restoration Project's goals are as follows:

Goal

The goal of this project is to restore the natural function of the Glenbrook Creek SEZ and create a more visible community resource.

Objectives

1. Improve fish habitat through removal of fish barriers and the addition of spawning bed material.
2. Improve the water quality delivered to the lake and enhance the SEZ by increasing floodplain connectivity.
3. Improve the water quality by reducing bank sediment sources through bank stabilization.
4. Enhance wildlife habitat and riparian health through vegetation management.
5. Create a community resource and education outlet for stream health by providing a public streamside path.

Results

The anticipated results of this project are as follows:

1. A healthier and more diverse riparian vegetation community both within the channel and throughout the surrounding meadow.
2. A larger and healthier trout and aquatic macroinvertibrate community.
3. A more stable channel that overbanks more frequently.
4. A more fire safe community with a viable riparian vegetation management plan.
5. A streamside accessible footpath that is a recreational and outreach resource to the Glenbrook community.
6. A reduction in suspended sediment, phosphorus, and conductivity to Lake Tahoe through Glenbrook Creek's input.

PROJECT FUNDING

The project received funding from the Nevada Division of State Lands Water Quality and Erosion Control Grants Program, The Glenbrook Homeowners Association, and The Glenbrook Project, a non-profit started to improve the Glenbrook community.

Table 1. Funding sources and amounts for the Glenbrook Creek Restoration Project

Agency	**Cash Funding**	**In Kind Funding**	**Total Funds**
Nevada Division of State Lands Water Quality and Erosion Control Grants Program	$467,926	-	$467,926
The Glenbrook Homeowners Association	$50,000	$46,000	$96,000
The Glenbrook Project	$50,000	$5,000	$55,000
Others		$5,000	$5,000
TOTAL			**$623,926**

PROJECT PARTNERS

Nevada Tahoe Conservation District (NTCD) is the project sponsor and lead agency responsible for planning, designing, and implementing the Glenbrook Creek Restoration Project. NTCD is working closely with project consultants River Run Consulting and WaterWays Consulting to design and construct the best project. Additionally, a number of other important partners will continue to participate in the process to ensure successful project delivery. Project partners include:

1. Nevada Tahoe Conservation District (NTCD)
2. Nevada Division of State Lands (NDSL)
3. Nevada Division of Environmental Protection (NDEP)
4. Tahoe Regional Planning Agency (TRPA)
5. The Glenbrook Project (TGP)
6. The Glenbrook Homeowners Association (GHOA)
7. The Great Basin Institute (GBI)
8. Tahoe Douglas Fire Protection District (TDFPD)

DRAINAGE AND HYDROLOGY

EXISTING CONDITIONS

Glenbrook Creek has experienced centuries of human interaction. In the past, the area was used for both logging and grazing. Since grazing ceased in the 1980s, the Creek has been largely ignored. The vegetation surrounding the creek is dense and serves as the major influence in the creek's morphology as no large rocks are present in the project reach. Additionally, two crossings exist within the project reach that are outdated and impediments to fish passage and natural flows.

Glenbrook Creek crosses Old Highway 50 through a standpipe to a culvert. The standpipe was installed in the early 1990s as a quick solution to prevent woody debris from clogging the existing culvert (Ramsdell, 2011). Old Highway 50 currently acts as a levee and the culvert restricts flow and drops the creek considerably in elevation. The culvert itself is failing – it has been retrofit with a smaller pipe to abate further collapse (Figure 2). Furthermore, runoff from Old Highway 50 is currently routed directly

into Glenbrook Creek and could be treated with small modifications to the existing pavement and side slope.

The existing culvert is limiting fish passage and may be moderating the flow regime below Old Highway 50. The willow stand surrounding the creek below Old Highway 50 has become decadent (Figure 3). The impoundment upstream of the culvert may serve a role in eliminating peak flows downstream of Old Highway 50, though a detailed study has not been conducted. Removing the stand pipe could increase the frequency of floodplain inundation in the downstream meadow portion of the creek, improving floodplain connectivity and aiding with capture of fine sediment during large flows.

Below Old Highway 50, a remnant culvert and access road is causing entrenchment downstream and should be removed (Figure 4). When Glenbrook Creek becomes low gradient and enters the meadow, the majority of the stream has good width/depth and entrenchment ratios, but its riparian vegetation lacks diversity.

Figure 3. Existing culvert and standpipe at Old Highway 50.

Figure 4. Decadent willows before vegetation management.

LAND CAPABILITY

The U.S. Forest Service and TRPA developed the Bailey land capability system in the early 1970s based primarily on the official USDA soils maps for the Tahoe Region. Each soil type was assigned to a land capability class ranging from 1 to 7, with capability 1 being the most environmentally fragile and sensitive to development. Wherever land was found to be influenced by a stream or high groundwater, it was assigned to capability 1b, also known as "Stream Environment Zone" or SEZ.

The Glenbrook Creek Restoration project is located within TRPA land capabilities class 1b, 3, and 5.

EXISTING SOILS

NRCS soil survey indicates that the project area is within soil map unit 9011—Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0 to 15 percent slopes (all restoration work) and 7161 Kingsbeach stony sandy loam, 2 to 15 percent slopes (access and staging and footpath only) (Figure 5). Appendix B contains the map unit descriptions from the USDA Soil Survey for the Tahoe Basin Area, California and Nevada (USDA, NRCS 2007).

Figure 6. Project area NRCS soil map units. The project area is outlined in blue.

WETLANDS

A wetland delineation was conducted by Hauge Brueck Associates during summer 2012. The survey focused on the willow understory as LiDAR is available for the entire Tahoe Basin. The surveyors tied the control into the LiDAR control point at Spooner Summit.

TOPOGRAPHY

A topographic survey was conducted by NTCD with assistance from Atkins North America during fall 2011 and winter 2012. The survey focused on the willow understory as LiDAR is available for the entire Tahoe Basin. The surveyors tied the control into the LiDAR control point at Spooner Summit.

PEAK AND DESIGN FLOW

Based on data from two USGS gages located above Old Highway 50 and near the outlet of the creek to Lake Tahoe, the two year design discharge was calculated at 9 cfs (Appendix D). The 100 year flood of 221 cfs was obtained from the downstream Glenbrook gage analysis found in the USGS report "Estimated Flood Flows in the Lake Tahoe Basin, California and Nevada" (USGS 2002).

DESIGN

GUIDING PRINCIPLES

Utilizing the knowledge of geomopholgist Matt Kiesse, who has looked at the site since 1998, our guiding principle is to repair sections of the creek deemed to provide measurable benefits to water quality, wildlife, aesthetics, and/or stream function. We also strived to minimize the impact on the creek and the surrounding environment by only accessing the most impacted sections of the creek.

SITE SELECTION

NTCD collaborated with the Nevada Division of State Lands, The Glenbrook Homeowners Association, The Glenbrook Project, and the Nevada Division of Wildlife to initially assess restoration potential along the GHOA-owned reaches of Glenbrook Creek. When potential locations were located, NTCD walked the site with geomorphologist Matt Kiesse from River Run Consulting who had initially evaluated the site in 1998. Kiesse and NTCD identified 3 potential restoration locations, the remnant culvert within the meadow, the culvert at Old Highway 50, and an entrenched section between the culverts. NTCD, River Run, and WaterWays Consulting, Inc. developed detailed restoration plans for each site. Upon further examination by NTCD personal, the entrenched section between the culverts was eliminated from the restoration since accessing the site had the potential to create more disturbance than benefit.

CULVERT DESIGN

In order to allow for fish passage at multiple flows, an arch culvert was chosen so that a natural stream bed could be constructed below. Both concrete and galvanized metal options were examined, with galvanized metal being chosen for its combination of strength, durability, ease of installation, and cost effectiveness.

Hydraulic calculations to determine the appropriate culvert size were performed using a culvert calculator provided in the "Hydraflow Express" extension of AutoCAD Civil 3D. The proposed culvert dimensions (12' span x 6.25' rise) will be partially filled with channel substrate and result in an open area of approximately 42.4 square feet available for conveyance. Calculations (Appendix D) used an arch culvert with an equivalent open area to determine the proposed culvert capacity under the 100-year flow of 221 cfs. The proposed culvert will flow partially full under the 100-year flood event.

CHANNEL DESIGN

The Glenbrook Creek Restoration Project proposes to construct approximately 250 linear feet of new channel. The proposed channel alignment was selected to increase channel length and reduce the channel gradient to four percent. The new alignment also removes abrupt turns in the channel and the drop that the standpipe introduced. The proposed inset floodplain will result in more frequent out-of-bank flows, reduces erosive forces on the banks, and allows sediment deposition to occur on the floodplains.

Methodology

Manning's equation was used to determine design channel capacity and confirm design channel dimensions. Calculations were performed using the "Hydraflow Express" extension of AutoCAD Civil 3D. Parameters in the equation include:

- Discharge,
- Channel bed slope,
- Hydraulic radius; and
- Manning's roughness coefficient.

A roughness coefficient of 0.14 was estimated using a depth-based roughness equation applicable to the proposed channel and was used in the analysis (USBOR, 2007).

Results of the bankfull hydraulic analysis were used to determine the acceptable range of channel geometries for the constructed channel. The channel dimensions were iterated until the channel dimensions, channel substrate, and the associated roughness coefficient resulted in a flow depth that was at or near overbanking under design flow conditions. Varying the constructed dimensions will

provide hydraulic complexity and allow the channel to overtop in some areas at flows slightly lower than the design flow.

Substrate Design

The substrate gradations used in the engineered streambed material (ESM) were derived from methods recommended by the United States Bureau of Reclamation (USBR, 2007), the Washington Department of Fish and Wildlife (WDFW, 2003), and the California Department of Fish and Game (CDFG, 2009) (Appendix D). These methods predict the stable rock diameter for a given channel slope and unit discharge. Hydraulic modeling results for the 100-year flood event were used to design the ESM gradation and should therefore remain stable during the 100-year flood event. Channel substrate gradations are listed in the construction documents (See Special Technical Provisions and Project Plans).

Creation of the engineered streambed material gradation requires mixing of different sizes of materials to arrive at the correct proportions. Incorporation of fine material in the gradation will seal the channel against piping and help to keep a greater majority of the low flow on the surface of the channel bed. All constructed reaches of the streambed should be thoroughly jetted after placement to fill voids and effectively seal the surface (Appendix D).

PLANT SELECTION

A seed mix of several native species was chosen to create a healthy and diverse floodplain that mimics the healthy floodplain downstream. Willow stakes were added for additional roughness on this steeper stretch. Because the new channel will not have a seasoning period and the floodplain will be stabilitzed by erosion control fabric, shrubs will be installed for community aesthetics . The plant list is available in Appendix E.

OTHER CONSIDERATIONS

Guardrail is specified to replace the existing wooden fences for traffic safety on Old Highway 50 (Figure 7).

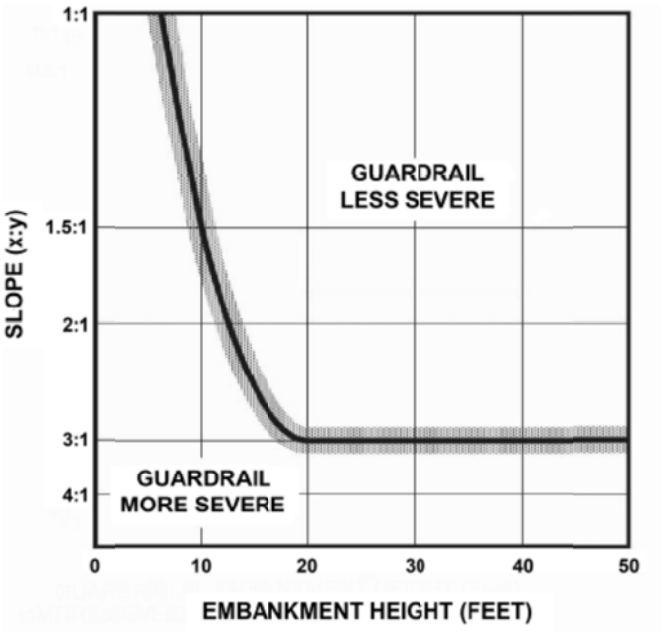

Figure 7. Equal Severity Curve from the California Department of Transportation's Traffic Manual. With an existing slope greater than 2:1 and an embankment height of 15 feet, a guardrail is recommended.

PROJECT PERMITTING

The Glenbrook Creek Restoration Project is approaching the permit process as if it were an EIP project spearheaded by the Funders.

USACE NWP 3

The US Army Corps of Engineers requires projects within Waters of the United States that are less than 0.1 acres to submit a Pre-Construction Notification (PCN) and obtain a Nationwide Permit 3 (NWP 3) which is for "Maintenance." The associated Jurisdictional Wetland Study can be found in Appendix C.

TRPA EIP PROJECT PERMIT

The TRPA EIP Project Review Application and Initial Environmental Checklist for the Glenbrook Creek Restoration Project were submitted to the TRPA on in January 2013 and the permit has been issued.

DOUGLAS COUNTY PERMITS

No Douglas County permits must be obtained prior to construction; however, a Letter of Map Revision (LOMR) must be obtained after construction using the as-built survey since the Creek is a FEMA Zone A.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

The area of disturbance associated with the implementation of the project is expected to be less than an acre in size, therefore, does not trigger a Stormwater Pollution Prevention Plan.

NDEP PERMITS

Two Nevada Division of Environmental Protection (NDEP) permits are required, a Temporary Working in Waterways Permit and a 401 Permit. Both have been obtained.

PROJECT MAINTENANCE

The Glenbrook Homeowners Association is responsible for maintaining the project for the next 20 years. As the entity responsible for managing much of the land within the Glenbrook Community, they are well equipped to care for the project. The project is also designed to be low maintenance.

IRRIGATION

Irrigation will be provided to establish the vegetation in the project area by Glenbrook Homeowners Association. GHOA will maintain the irrigation for one to two growing seasons depending on plant establishment success and then remove temporary irrigation after plant establishment. Maintenance will include periodic checks to ensure proper functioning, coverage and water delivery of the irrigation system. Plants have been selected to be self-sufficient after establishment. More details are provided in the revegetation plan.

CULVERT AT OLD HWY 50

The proposed culvert is designed to pass the 100 year flow. The culvert is expected to need little to no maintenance as it should be able to pass upstream debris.

VEGETATION MANAGEMENT

Although the restoration has the potential to reduce the need for vegetation management, the willows and alders in the riparian corridor will need thinning every 5 years or less as deemed necessary by GHOA. Willows and alders should be thinned so that five to fifteen foot gaps exist every thirty feet of stream channel. Willows and alders should also be cleared near the inlet and outlet of the culvert and in the proximity of any structure.

REFERENCES

Pepi, J, J.P. Kiel and C. Shade. Glenbrook Creek and Adjacent Wetland Restoration Opportunities. Memoradum dated April 14, 1998.

Ramsdell, Rob. 2011. Personal Communication.

Swanson, M. et al. Glenbrook Creek Stream Restoration Project. 1999.

USGS, 2002. Estimated Flood Flows in the Lake Tahoe Basin, California and Nevada. U.S. Soil Geological Service. USDA (U.S. Department of Agriculture). July 2002.

U.S. Department of the Interior Bureau of Reclamation(USBR). 2007. Rock Ramp Design Guidelines.

Washington Department of Fish and Wildlife (WDFW). 2003 Design of Road Culverts for Fish Passage.

U.S. Army Corps of Engineers (USACE). 1994. Hydraulic Design of Flood Control Channels, EM-1110-2-1601

California Department of Fish and Game (CDFG). 2009. Fish Passage Design and Implementation: Part XII of the California Salmonid Stream Habitat Restoration Manual. Sacramento, CA, CA Department of Fish and Game.

APPENDIX A
Addresses within 300' of Project

APN	Street	Town
141811412024	SHORT RD	Glenbrook, NV
141811412025	SHORT RD	Glenbrook, NV
141811412023	SHORT RD	Glenbrook, NV
141811412022	SHORT RD	Glenbrook, NV
141810611001	PRAY MEADOW RD	Glenbrook, NV
141811310001	OLD HWY 50	Glenbrook, NV
141811412029		Glenbrook, NV
141811412028		Glenbrook, NV
141811412030		Glenbrook, NV
ROW		Glenbrook, NV
141811412021	SHORT RD	Glenbrook, NV
141811412020	SHORT RD	Glenbrook, NV
141811412019	SHORT RD	Glenbrook, NV
141811412016	SHORT RD	Glenbrook, NV
141811412014	SHORT RD	Glenbrook, NV
141811412013	OLD HWY 50	Glenbrook, NV
141811412012	OLD HWY 50	Glenbrook, NV
141811412011	OLD HWY 50	Glenbrook, NV
141811412010	OLD HWY 50	Glenbrook, NV
141811311010	GLENBROOK HOUSE RD	Glenbrook, NV
141811412009	LINCOLN HY	Glenbrook, NV
141811412006	LINCOLN HY	Glenbrook, NV
141811412005	LINCOLN HY	Glenbrook, NV
141811311009	GLENBROOK HOUSE RD	Glenbrook, NV
141811412001	LINCOLN HY	Glenbrook, NV
141811412002	LINCOLN HY	Glenbrook, NV
141811311006	GLENBROOK HOUSE RD	Glenbrook, NV
141811311007	GLENBROOK HOUSE RD	Glenbrook, NV
141811311005	PRAY MEADOW RD	Glenbrook, NV
141811311004	PRAY MEADOW RD	Glenbrook, NV
141811311003	PRAY MEADOW RD	Glenbrook, NV
141811410009	OLD HWY 50	Glenbrook, NV
141811411001		Glenbrook, NV
141811401001	OLD HWY 50	Glenbrook, NV
141811412018	SHORT RD	Glenbrook, NV
141811412017	SHORT RD	Glenbrook, NV
141811412015	SHORT RD	Glenbrook, NV
141811312001	LINCOLN HY	Glenbrook, NV
141811411002		Glenbrook, NV
141811311013		Glenbrook, NV
141811412008	LINCOLN HY	Glenbrook, NV
141811412007	LINCOLN HY	Glenbrook, NV

APN	Street	Town
141811311014		Glenbrook, NV
141811412003	LINCOLN HY	Glenbrook, NV
141811412004	LINCOLN HY	Glenbrook, NV
141811311011		Glenbrook, NV
141811311012		Glenbrook, NV
141810802004	GLENBROOK RD	Glenbrook, NV
141811311002	PRAY MEADOW RD	Glenbrook, NV
141811311001	PRAY MEADOW RD	Glenbrook, NV
141811301001	LINCOLN HY	Glenbrook, NV
141811301002	LINCOLN HY	Glenbrook, NV
141811303003	THE BACK RD	Glenbrook, NV
141811303004	THE BACK RD	Glenbrook, NV
141811302001	LINCOLN HY	Glenbrook, NV
141811412028		Glenbrook, NV
141811412028		Glenbrook, NV
141811412030		Glenbrook, NV
141811412030		Glenbrook, NV
ROW		Glenbrook, NV
ROW		Glenbrook, NV
141811412016	SHORT RD	Glenbrook, NV
141811412016	SHORT RD	Glenbrook, NV
141811412014	SHORT RD	Glenbrook, NV
141811412014	SHORT RD	Glenbrook, NV
141811411001		Glenbrook, NV
141811411001		Glenbrook, NV
141811401001	OLD HWY 50	Glenbrook, NV
141811401001	OLD HWY 50	Glenbrook, NV
141811412015	SHORT RD	Glenbrook, NV
141811412015	SHORT RD	Glenbrook, NV
141811312001	LINCOLN HY	Glenbrook, NV
141811312001	LINCOLN HY	Glenbrook, NV

APPENDIX B
Brief Soil Descriptions

7161 - Kingsbeach stony sandy loam, 2 to 15 percent slopes

Composition

- Kingsbeach and similar soils: 80 percent of the unit
- Tahoma and similar soils: 10 percent of the unit
- Jorge, very gravelly sandy loam and similar soils: 8 percent of the unit
- Beaches: 1 percent of the unit
- Dunes: 1 percent of the unit

Setting

Landform(s) alluvial fans, lake terraces, mountains
Elevatio 6217 to 6709 feet
Precipitatio 23 to 33 inches
Slope 2 to 15 percent
Air temperature: 41 to 46 ºF
Frost-free 30 to 80 days

Characteristics of Kingsbeach and similar soils

Average total avail. water in top five feet 10.1
Available water capacity High
Parent alluvium and/or colluvium derived from andesite over lacustrine deposits
Restrictive none
Depth to Water 60 inches
Drainage moderately well drained
Flooding none
Ponding none
Saturated hydraulic conductivity Moderately Low
Soil loss tolerance (T 5
Wind erodibility group 7
Wind erodibility index 38
Land capability class, irrigated:
Land capability class, non- 4e
Hydric soil: no
Hydrologic D
Runoff class: medium
Potential frost moderate

Representative soil profile:

Horizon --	Depth (inches)	Texture	Ksat	pH	Salinity (mmhos/cm)	SAR
Oi --	0 to 1	Slightly decomposed plant	56.7		0 - 0	0 - 0
A --	1 to 6	Stony sandy loam	4.0	5.1 to 6.5	0 - 0	0 - 0
Bt1 --	6 to 20	Loam	0.4	5.1 to 6.5	0 - 0	0 - 0
2Bt2 --	20 to 30	Sandy clay loam	0.0	5.1 to 6.5	0 - 0	0 - 0
2C --	30 to 61	Clay loam	0.0	5.1 to 6.5	0 - 0	0 - 0

Ecological class(es): NRCS Forestland Site - Abies concolor-Pinus lambertiana/Quercus vacciniifolia-Amelanchier utahensis/Pyrola picta

9011 - Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0 to 15 percent slopes

Composition

- Oxyaquic Cryorthents and similar soils: 30 percent of the unit
- Aquic Xerorthents and similar soils: 28 percent of the unit
- Tahoe, gravelly and similar soils: 15 percent of the unit
- Bidart, mucky silt loam and similar soils: 10 percent of the unit
- Watah and similar soils: 10 percent of the unit
- Marla and similar soils: 5 percent of the unit
- Riverwash: 2 percent of the unit

Setting

Landform(s) drainageways, mountains
Elevatio 6217 to 8793 feet
Precipitatio 23 to 61 inches
Slope 0 to 15 percent
Air temperature: 39 to 46 ºF
Frost-free 20 to 75 days

Characteristics of Oxyaquic Cryorthents and similar soils

Average total avail. water in top five feet 4.1
Available water capacity Low
Parent alluvium and/or colluvium derived from
Restrictive none
Depth to Water 29 inches
Drainage somewhat poorly drained
Flooding frequent
Ponding none
Soil loss tolerance (T 4
Wind erodibility group 8
Wind erodibility index 0
Land capability class, irrigated:
Land capability class, non- 6w
Hydric soil: no
Hydrologic A
Runoff class: high
Potential frost low

Saturated hydraulic conductivity High

Representative soil profile:

Horizon	Depth (inches)	Texture	Ksat	pH	Salinity (mmhos/cm)	SAR
Oe	0 to 0	Moderately decomposed plant material	42.5		0 - 0	0 - 0
A1	0 to 2	Gravelly loamy coarse sand	7.1	5.1 to 6.5	0 - 0	0 - 0
A2	2 to 5	Gravelly loamy coarse sand	7.1	5.1 to 6.5	0 - 0	0 - 0
Bw	5 to 9	Gravelly loamy coarse sand	7.1	5.1 to 6.5	0 - 0	0 - 0
C1	9 to 20	Gravelly loamy coarse sand	7.1	5.1 to 6.5	0 - 0	0 - 0
C2	20 to 32	Very gravelly loamy coarse sand	7.1	5.1 to 6.5	0 - 0	0 - 0
C3	32 to 52	Very gravelly coarse sand	10.6	5.1 to 6.5	0 - 0	0 - 0
C4	52 to 80	Coarse sand	10.6	5.1 to 6.5	0 - 0	0 - 0
C5	80 to 112	Coarse sand	10.6	5.1 to 6.5	0 - 0	0 - 0

Ecological class(es): NRCS Forestland Site - Populus tremuloides-Abies concolor/Elymus

Characteristics of Aquic Xerorthents and similar soils

Average total avail. water in top five feet 6.5
Available water capacity Moderate
Parent alluvium and/or colluvium derived from
Restrictive none
Depth to Water 29 inches
Drainage poorly drained
Flooding frequent
Ponding none
Soil loss tolerance (T 4
Wind erodibility group 8
Wind erodibility index 0
Land capability class, irrigated:
Land capability class, non- 6w
Hydric soil: no
Hydrologic A
Runoff class: high
Potential frost moderate

Saturated hydraulic conductivity High

Representative soil profile:

Horizon	Depth (inches)	Texture	Ksat	pH	Salinity (mmhos/cm)	SAR
Oe	0 to 0	Moderately decomposed plant material	42.5		0 - 0	0 - 0
Oa	0 to 1	Highly decomposed plant material	21.3	5.0 to 6.5	0 - 0	0 - 0
A1	1 to 4	Sandy loam	7.1	5.0 to 6.5	0 - 0	0 - 0
A2	4 to 9	Sandy loam	7.1	5.0 to 6.5	0 - 0	0 - 0
C1	9 to 14	Coarse sandy loam	7.1	5.0 to 6.5	0 - 0	0 - 0
C2	14 to 29	Sandy loam	7.1	5.0 to 6.5	0 - 0	0 - 0
C3	29 to 41	Gravelly sandy	7.1	5.0 to 6.5	0 - 0	0 - 0
C4	41 to 45	Loamy coarse sand	7.1	5.0 to 6.5	0 - 0	0 - 0
C5	45 to 59	Sandy loam	7.1	5.0 to 7.3	0 - 0	0 - 0

Ecological class(es): NRCS Forestland Site - Populus tremuloides-Abies concolor/Elymus

Characteristics of Tahoe, gravelly and similar soils

Average total avail. water in top five feet 5.5
Available water capacity Low
Parent alluvium derived from granitic and volcanic rock
Restrictive none
Depth to Water 6 to 39 inches
Drainage poorly drained
Flooding occasional
Ponding occasional
Saturated hydraulic conductivity High
Soil loss tolerance (T 5
Wind erodibility group 8
Wind erodibility index 0
Land capability class, irrigated:
Land capability class, non- 6w
Hydric soil: yes
Hydrologic B/D
Runoff class: very high
Potential frost high

Representative soil profile:

Horizon	Depth (inches)	Texture	Ksat	pH	Salinity (mmhos/cm)	SAR
A1	0 to 10	Mucky gravelly silt loam	4.0	5.1 to 7.3	0 - 0	0 - 0
A2	10 to 27	Gravelly loam	4.0	5.1 to 7.3	0 - 0	0 - 0
Cg1	27 to 32	Gravelly loamy fine sand	22.0	5.1 to 7.3	0 - 0	0 - 0
Cg2	32 to 46	Gravelly fine sand	22.0	5.1 to 7.3	0 - 0	0 - 0

Ecological class(es): NRCS Rangeland Site - Gravelly Flats

APPENDIX C
Wetland Delineation

GLENBROOK CREEK RESTORATION PROJECT

Jurisdictional Delineation Report

Prepared for:

Nevada Tahoe Conservation District

400 Dorla Court

P.O. Box 915

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Contact: Meghan Kelly (775) 586-1610 ext. 30

July 30, 2012

Prepared by:

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1.0 INTRODUCTION

This report presents the results of a preliminary jurisdictional delineation study conducted on the site of the proposed Glenbrook Creek Restoration Project (Project) located approximately 49 miles southwest of Reno and 10 miles north of Stateline, Nevada in northwestern Douglas County, Nevada (Figure 1). The Study Area includes a 2.71-acre section of Glenbrook Creek where it passes under Old U.S. Route 50 via culvert in the Glenbrook community. The Nevada Tahoe Conservation District (NTCD) has requested this study to determine the location and extent of wetland or water features potentially subject to regulation by the U.S. Army Corps of Engineers (Corps) under Section 404 of the Federal Clean Water Act (CWA). The results of this study are considered to be preliminary until they are verified by the respective regulatory agencies and/or permits for impacts to the features are authorized by such agencies.

1.1 Directions to the Study Area

1. From I-80 E in central Reno, take exit 15 to merge onto U.S.-395 S toward Carson City. Drive 10.1 mi then take exit 57B to merge onto U.S.-395 S/S Virginia St toward Virginia City/Carson City/So Lake Tahoe. Continue to follow U.S.-395 S for 17.7 mi then take exit 43 for U.S. 395 Business/North Carson Street for 0.6 mi. Merge onto N Carson St and after 5.6 mi, turn right onto U.S.-50 W/Lincoln Hwy. Drive 12.6 mi and take a sharp right onto Old U.S. Route 50 (restricted usage road). Follow for 0.6 mi to arrive at the Glenbrook Creek crossing.

1.2 Contact Information

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400 Dorla Court, P.O. Box 915
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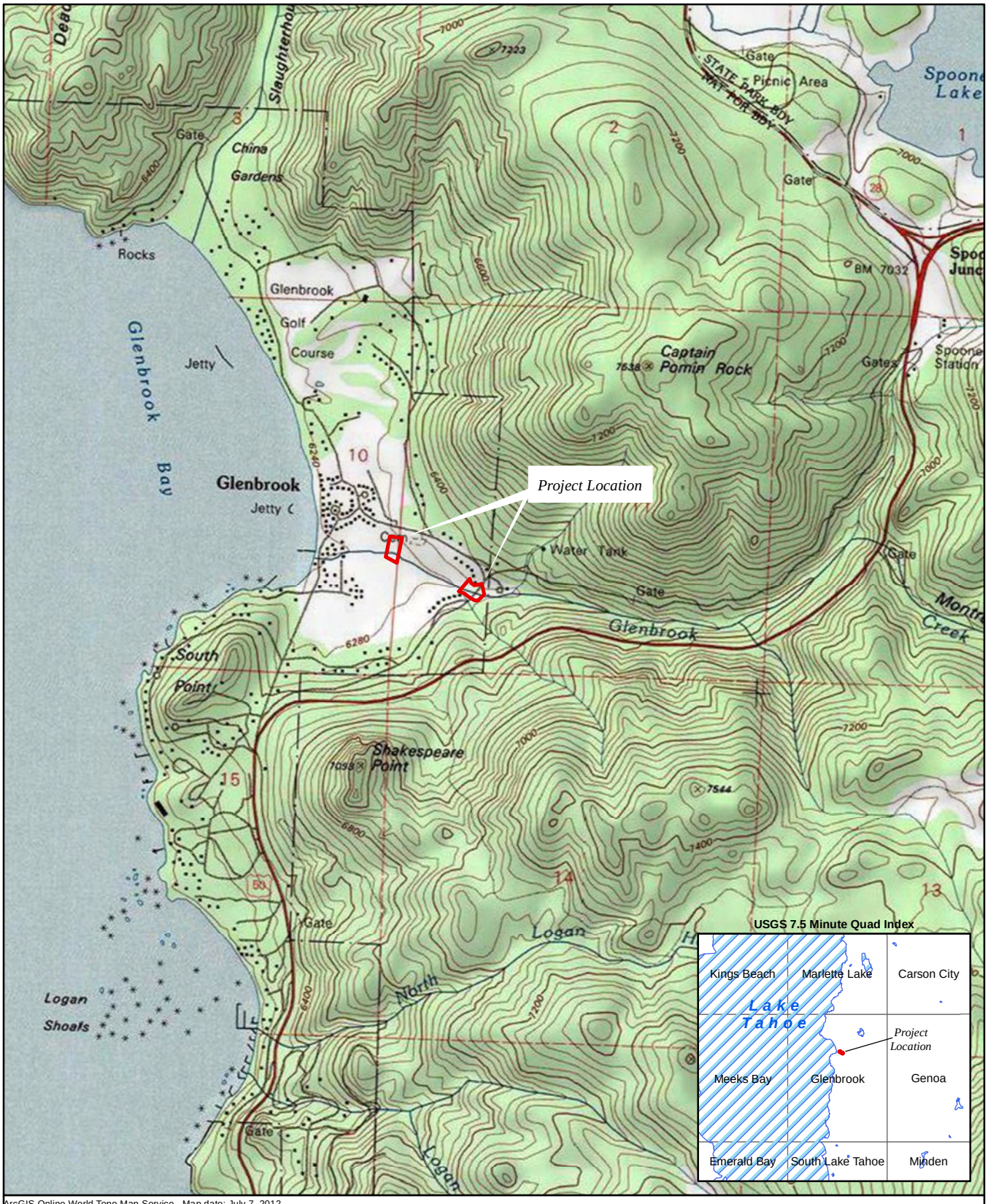
1.3 Project Description

The Project is a stream and meadow restoration proposed by NTCD to improve channel morphology and function as well as fish and wildlife habitat for Glenbrook Creek. The project proposes to restore approximately 300 linear feet of stream by removing two culverts, replacing one with an arch culvert that allows fish passage, constructing a section of new channel, and stabilizing portions of the existing channel. Construction is slated to occur in the Fall of 2012.



ArcGIS Online World Topo Map Service. Map date: July 7, 2012.

N

0 600 1,200
Feet

1:24,000

Nevada Tahoe Conservation District
Glenbrook Creek Restoration Project

Figure 1: Project Location

Glenbrook Quadrangle

HAUGE BRUECK ASSOCIATES

2.0 REGULATORY SETTING

The regulations pertaining to this preliminary delineation study are summarized below and include Waters of the U.S., regulated by Section 404 of the Clean Water Act (CWA), and Waters of the State regulated through (1) Section 401 of the CWA regulating water quality within Waters of the U.S. by the Nevada Department of Conservation and Natural Resources-Department of Environmental Protection (NDCNR-DEP), Bureau of Water Pollution Control and (2) Section 208 of the Clean Water Act by the Tahoe Regional Planning Agency (TRPA).

2.1 Waters of the U.S.

2.1.1 Section 404 of the Clean Water Act

The objective of the CWA is to maintain and restore the chemical, physical, and biological integrity of the Waters of the United States (33 CFR Part 328 Section 328.4). "Waters of the U.S." is the encompassing term for areas that qualify for federal regulation under Section 404 of the CWA. Section 404 of the CWA gives the U.S. Environmental Protection Agency (EPA) and the Corps regulatory and permitting authority regarding discharge of dredged or fill material into "navigable waters of the United States." Section 502(7) of the CWA defines navigable waters as "waters of the United States, including territorial seas." Section 328 of Chapter 33 in the Code of Federal Regulations (CFR) defines the term "waters of the United States" as it applies to the jurisdictional limits of the authority of the Corps under the CWA. A summary of this definition of "waters of the U.S." in 33 CFG 328.3 includes (1) waters used for commerce and subject to tides; (2) interstate waters and wetlands; (3) "other waters" such as intrastate lakes, rivers, streams, and wetlands; (4) impoundments of waters; (5) tributaries of waters; (6) territorial seas; and (7) wetlands adjacent to waters. Therefore, for purposes of determining Corps jurisdiction under the CWA, "navigable waters" as defined in the CWA are the same as "waters of the U.S." defined in the Code of Federal Regulations above. Waters of the U.S include non-isolated "wetlands" and "other waters of the U.S."

Other waters of the U.S. refer to unvegetated waterways and other water bodies with a defined bed and bank, such as drainages, creeks, rivers, and lakes. This approximately translates to the bank to bank portion of water bodies, up to the ordinary high water mark (OHWM). "Other waters" typically lack hydrophytic vegetation (defined below) and may also lack hydric-soils (defined below). Jurisdiction in non-tidal areas extends to the OHWM, which is defined as:

> *"...that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impresses on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and*

> *debris, or other appropriate means that consider the characteristics of the surrounding areas".*
>
> CFR 328.3 (e) [51 FR 41250, Nov. 13, 1986, as amended at 58 FR 45036, Aug. 25, 1993]

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (CFR 328.3, CFR 230.3).

The Corps developed field methods for identifying the location and extent of jurisdictional wetlands (a subset of Waters of the United States) using the Corps Wetland Delineation Manual (Environmental Laboratory 1987). Recently, the Corps issued the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region*, *Version 2.0* (Western Mountain Region Supplement [WMRS]) (Corps 2010) in May 2010. This supplement was intended to address specific wetland issues within the Western Mountain and coastal regions and supersedes much of the 1987 Wetland Delineation Manual.

2.1.2 Significant Nexus of Tributaries

On June 5, 2007, the Corps and the EPA issued joint guidance on implementing the June 19, 2006 U.S. Supreme Court opinions resulting from *Rapanos v. United States* and *Carabell v. United States* (Rapanos) cases (Corps 2007). The agencies received 66,047 public comments on the Rapanos Guidance (65,765 form letters, 282 non-form letters), from States, environmental and conservation organizations, regulated entities, industry associations, and the general public. EPA and the Corps jointly reviewed the comments and released a revised version of the guidance on December 2, 2008 (Corps 2008). The revised guidance states that the agencies will assert jurisdiction over:

- Non-navigable tributaries that are not relatively permanent, where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months);
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent; and
- Wetlands adjacent to but that do not directly abut a relatively permanent non navigable tributary.

The agencies generally will not assert jurisdiction over the following features:

- Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow)
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water

The agencies will apply the significant nexus standard as follows:

- A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters.
- Significant nexus includes consideration of hydrologic and ecologic factors.

2.1.3 Isolated Areas Excluded from Section 404 Jurisdiction

In addition to areas that may be exempt from Section 404 jurisdiction, some isolated wetlands and waters may also be considered outside of Corps jurisdiction as a result of the Supreme Court's decision in Solid Waste Agency of Northern Cook County (SWANCC) v. United States Army Corps of Engineers (531 U.S. 159 [2001]). Isolated wetlands and waters are those areas that do not have a surface or groundwater connection to, and are not adjacent to a navigable "Waters of the U.S.," and do not otherwise exhibit an interstate commerce connection.

2.2 Waters of the State

2.2.1 Section 401 of the Federal Clean Water Act

Section 401 of the Clean Water Act gives the State Board and Regional Boards the authority to regulate, through water quality certification, any proposed federally-permitted activity which may result in a discharge to water bodies, including wetlands. Among such activities are discharges of dredged or fill material permitted by the U.S. Army Corps of Engineers under 404 of the CWA such as navigational dredging, flood control channelization, levee construction, channel clearing, and fill of wetlands or other water bodies for land development. The State may issue, with or without conditions, or deny certification for activities which may result in such discharges. Nevada Department of Conservation and Natural Resources-Department of Environmental Protection (NDCNR-DEP), Bureau of Water Pollution Control oversees development and implementation of water quality standards, 401 water quality certification, and monitoring, among other activities. NDCNR-DEP issues discharge permits, enforces the state's water pollution control laws and regulations, and provides technical and financial assistance to dischargers.

2.2.2 Section 208 of the Federal Clean Water Act

In 1988 the states of California and Nevada and the United States Environmental Protection Agency (USEPA) adopted the Tahoe Regional Planning Agency (TRPA) Water Quality Management Plan for the Lake Tahoe Basin (TRPA 1988), commonly referred to as the 208 Plan. The 208 Plan identifies water quality problems, proposes solutions or mitigation measures, identifies those entities responsible for implementing solutions, and determines

agencies or jurisdictions responsible for enforcement. TRPA was designated by California, Nevada, and the USEPA as the area wide water quality planning agency under Section 208 of the federal Clean Water Act. Through the 208 Plan, TRPA regulates development and disturbance of Stream Environment Zones (SEZs) within the Lake Tahoe Basin. TRPA defines a stream environment zone as a biological community that derives its characteristics from the presence of surface water or a seasonal high groundwater table. SEZs exhibit the ability to rapidly incorporate nutrients into the usually dense vegetation and moist to saturated soils. SEZs are riparian areas identified by the presence of at least one key indicator or three secondary indicators (TRPA Code Section 37.3.B). No additional land coverage or other permanent land disturbance shall be permitted in SEZs unless an exception is made.

2.2.3 Nevada Administrative Code

Water quality classifications are available in Nevada Administrative Code Chapter 445A, which identifies class waters, i.e., smaller perennial streams that are tributaries to the large rivers in the state. The classification process is ongoing, and not all water bodies have been classified. Water bodies are classified according to their quality and potential beneficial uses. The classification is one criterion used in defining the water quality standards and protections that apply to the streams. The classes range from “A” (highest quality) to “D” (lowest quality). The waters are also identified as trout or non-trout waters. Class designations are assigned to specific segments. The classifications of the streams are currently being revised by the Nevada Division of Environmental Protection and are unavailable at this time.

3.0 STUDY METHODOLOGY

The study methods utilized in the preparation of this report included a background information review and multiple site visits to collect pertinent wetland field data. Prior to conducting the initial field visit a 200-scale color aerial photograph of the Study Area and USGS topographic maps were assessed to determine the locations of potential areas of federal and state jurisdiction. Suspected jurisdictional areas were then field-checked and or sampled for the presence of wetland vegetation, soils, and hydrology. The presence of potentially jurisdictional features on the site was evaluated using the Corps methodologies as described below.

3.1 Background Information Review

Prior to conducting field studies, available reference materials were reviewed including but not limited to:

- Soil Survey of Tahoe Basin Area, California, (USDA NRCS 2007);
- National Hydric Soils List (USDA NRCS 2012);
- Regional Climate Data (National Oceanic and Atmospheric Administration [NOAA] 2012 and USDA 2012); and
- National Wetland Inventory (NWI) Map Data (USFWS 2012) for the Glenbrook 7.5 Minute USGS quadrangle that characterize wetland and waters of the United States according to the Classification of Wetlands and Deepwater Habitats of the United States developed by USFWS (Cowardin et al. 1979).

3.2 Field Investigation

3.2.1 Site Visits

On May 31 and June 28, 2012 Amy Parravano and Garth Alling from Hauge Brueck Associates (HBA), conducted a jurisdictional delineation in accordance with the Corps methodologies described below. The extent of potentially jurisdictional waters and wetlands was mapped, quantified, and characterized.

3.2.2 Corps Delineation Methodology

Surveys of the Study Area were conducted using the wetland delineation methodology provided by the Corps in their WMRS to the Wetland Delineation Manual (Corps 2010). This methodology involves observing and recording specific data on wetland vegetation, soils and hydrology. In addition, delineation of non-wetland, “other water” features was conducted according to methodology outlined in the WMRS.

3.2.2.1 Wetlands

The Study Area was evaluated for the presence of potential jurisdictional wetlands according to the WMRS manual. According to the Corps wetland delineation methodology, a wetland must exhibit the following: (1) a prevalence or dominance of hydrophytic vegetation; (2) hydric soils; and (3) wetland hydrology. These characteristics are defined and described in further detail below.

Hydrophytic Vegetation. Plant species identified on the Study Area were assigned a wetland status according to the U.S. Fish and Wildlife (USFWS) list of plant species that occur in wetlands (Lichvar and Kartesz 2009). This wetland classification system is based on the expected frequency of occurrence in wetlands as shown in Table 1.

Table 1. Classification of Wetland-Associated Plant Species (Lichvar and Kartesz 2009)

Abbreviation	Plant Species Classification	Probability of Occurring in a Wetland
OBL	Always found in wetlands	>99%
FACW (±)	Usually found in wetlands	67-99%
FAC	Equal in wetland or non-wetlands	34-66%
FACU	Usually found in non-wetlands	1-33%
UPL	Upland	<1%
NI	No indicator status	Insufficient information to determine status
NL	Plants that are not listed (assumed upland species)	Does not occur in wetlands in any region

The WMRS (Corps 2010) requires that a three-step process be conducted to determine if hydrophytic vegetation is present. The procedure first requires the delineator to apply the "50/20 rule" (Indicator 1) described in the manual. To apply the "50/20 rule", dominant species are evaluated within each herb, shrub, and tree stratum of the community. In general, dominants are the most abundant species that individually or collectively account for more than 50 percent of the total coverage of vegetation in the stratum, plus any other species that, by itself, accounts for at least 20 percent of the total. If greater than 50 percent of the dominant species can be classified by an OBL, FACW, or FAC wetland indicator status, ignoring + and - qualifiers, hydrophytic vegetation is present.

If the community passes Indicator 1 then the community is hydrophytic. If the community fails Indicator 1 and both hydric soils and wetland hydrology are not present, then hydrophytic vegetation is not present, unless the site is a problematic wetland situation. However, if the

plant community fails Indicator 1 but hydric soils and wetland hydrology are both present, the delineator must apply Indicator 2.

Indicator 2 is known as the Prevalence Index. The prevalence index is a weighted average of the wetland indicator status for all plant species within the sampling plot. Each indicator status is given a numeric code (OBL = 1, FACW = 2, FAC = 3, FACU = 4, and UPL = 5). Indicator 2 requires the delineator to estimate the percent cover of each species in every stratum of the community and sum the cover estimates for any species that is present in more than one stratum. All species are then organized into groups according to their wetland indicator status and the Prevalence Index is calculated using the following formula:

$$PI = \frac{A_{OBL} + 2A_{FACW} + 3A_{FAC} + 4A_{FACU} + 5A_{UPL}}{A_{OBL} + A_{FACW} + A_{FAC} + A_{FACU} + A_{UPL}}$$

The Prevalence Index will yield a number between 1 and 5. If the Prevalence Index is equal or less than 3, hydrophytic vegetation is present. However, if the community fails Indicator 2, the delineator must proceed to Indicator 3.

Indicator 3 is known as Morphological Adaptations. Some hydrophytes in the Western Mountain Region develop easily recognized physical characteristics (or morphological adaptations) when they occur in wetland areas. Some of these adaptations may include, but are not necessarily limited to, adventitious roots and shallow root systems developed on or near the soil surface. If more than 50 percent of the individuals of a FACU species exhibit morphological adaptations for life in wetlands, that species is considered to be a hydrophyte and its wetland indicator status should be reassigned to FAC. If such observations are made, the delineator must recalculate Indicator 1 and 2 using a FAC indicator status for this species. The vegetation is hydrophytic if either test is satisfied.

Hydric Soils. The National Technical Committee for Hydric Soils (NTCHS) defines a hydric soil as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (U.S. Department of Agriculture [USDA], Soil Conservation Service [SCS] 1994). Nearly all hydric soils exhibit characteristic morphologies that result from repeated periods of saturation or inundation for more than a few days, including redoximorphic features such as orange oxidized mottles or light-colored (high value, low chroma) reduced matrix or mottle colors.

The WMRS (Corps 2010) contains a list of 23 hydric soil indicators that are known to occur in the Western Mountain region. Soils samples were collected and described according to the methodology provided in the WMRS. Soil chroma and values were determined by utilizing a standard Munsell soil color chart (Kollmorgen Instruments Corporation 1994). Hydric soils were

determined to be present if any of the soils samples met one or more of the 23 hydric soil indicators described in the WMRS (Corps 2010).

Wetland Hydrology. Wetland hydrology exists in areas that are periodically inundated or have saturated soils at some time during the growing season, and for a sufficient duration to support hydrophytic vegetation (Environmental Laboratory 1987). This condition can either be observed through direct observation of primary indicators (such as ponding, saturation, sediment deposits, algal matting), or through indirect or "secondary" indicators (such as drainage pattern, saturation visible on an aerial photograph, raised ant mounds).

3.2.2.2 Other Waters

For non-wetland, "other water" features, the extent of the Corps jurisdiction is defined by the OWHM. Delineation of other waters was based on observing indicators for the OHWM (33 CFR 328.3), following established Corps criteria and considering hydrological connectivity or isolation. In general, the OHWM for a stream is usually determined through an examination of the recent physical evidence of surface flow. Common physical characteristics that indicate the presence of an OHWM include, but are not limited to, a clear natural line impressed on the bank; evidence of scour; recent bank erosion; destruction of native terrestrial vegetation; sediment deposition; and the presence of litter and debris.

4.0 ENVIRONMENTAL SETTING

The Study Area consists of undeveloped parcels owned by the Glenbrook Home Owners Associate (GHOA) located in Douglas County in the community of Glenbrook, Nevada (Figure 1). The site can be found within Section 11 of Township 14 North and Range 18 East of the Mount Diablo Baseline Meridian, in the Glenbrook 7.5-minute USGS topographic quadrangle. The Study Area is gently sloped to the west, draining into the Glenbrook Bay along the eastern shore of Lake Tahoe at an approximate elevation range of 6,260 to 6,270 feet above mean sea level (msl). To conform with the Corps' delineation map scale requirements, the Study Area has been divided in into two sub-areas that trend from west to east that encompass areas where creek restoration work has been proposed: Study Area West Section (Study Area West) and Study Area East Section (Study Area East). These sub-areas are shown on jurisdictional delineation maps provided as Appendices B1 and B2.

4.1 Vegetation

Vegetation communities characteristic of upland areas within the Study Area include upper montane mixed coniferous forest, ruderal grassland, and yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. *viscidiflorus*) scrub. Within Study Area East, located immediately upstream of the culvert crossing under Old U.S. Route 50, mixed upper montane coniferous forest occurs along eastern boundaries and is dominated by Jeffrey pine (*Pinus jeffreyi*) and white fir (*Abies concolor*). Common forest understory shrub species include mugwort (*Artemisia douglasiana*), wood rose (*Rosa woodsii*), Coaltown sagebrush (*Artemisia cana)*, bitterbrush (*Purshia tridentata*), wax currant (*Ribes cereum*), yarrow (*Achillea millefolium*), Gray's lupine (*Lupinus grayi*), snowberry (*Symphoricarpos rotundifolius*), and mule's ears (*Wyethia mollis*). Yellow rabbitbrush scrub occurs along divergent side slopes leading down to the Glenbrook Creek flood plain on the downstream side of the culvert crossing and along north and south facing slopes adjacent to Study Area West. A band of upland ruderal grassland occurs between shrub-dominated hillslopes and the creek channel. Ruderal grassland vegetation supports a mix of the following species: yellow salsify (*Tragopogon dubius*), squirreltail (*Elymus elmoides*), beardless wildrye (*Elymus triticoides*), orchard grass (*Dactlyis glomerata*), smooth brome (*Bromus inermis* ssp. *inermis*), cheat grass (*Bromus tectorum*), blue wildrye (*Elymus glaucus*), corn flower (*Centaurea cyanus*), prickly lettuce (*Lactuca serriola*), bull thistle (*Cirsium vulgare*), cow parsnip (*Heracleum maximum*), and flix weed (*Descurania sophia*).

Wetland plant communities along the active floodplain contain a combination of wetland-adapted plants that are sustained by direction saturation or inundation and phreatophytic plants that have a deep root system supported by saturation/inundation as well as groundwater or capillary fringe above the water table in drier summer and fall months. Wetland plant communities in the Study Area can be divided into two general categories: emergent floodplain

wetlands and riparian floodplain wetlands. A detailed discussion of the plant composition of these communities is provided below in Section 5.1.

4.2 Soils

The USDA Natural Resource Conservation Service (NRCS) has mapped three native soil types within the Study Area. These map units are described in detail below and are illustrated on Figure 2 (USDA, NRCS 2007).

Kingsbeach stony sandy loam, 2 to 15 percent slopes (7161). This soil type is found on moderately sloped upland areas within the Study Area along north and south sides of Glenbrook Creek. This moderately drained soil occurs on alluvial fans and lake terraces and was formed in alluvium and/or colluviums derived from andesite over lacustrine deposits. This map unit is generally comprised of minor components of Tahoma, Jorge, very gravelly sandy loam soil map units. In a typical profile, this soil has a thin (less than one inch) organic layer made up of slightly decomposed plant material. The A horizon is a stony sandy loam to a depth of 6 inches. The B horizon consists of loam to 20 inches and sandy clay loam to 30 inches. The C horizon consists of clay loam down to 60 inches.

Tahoe complex, 0 to 2 percent slopes. This soil type is found within the Study Area at Trout Creek, Herbert Avenue North, and Van Sickle North. This map unit is generally comprised of 55 percent Tahoe silt loam, 25 percent Tahoe silt loam wet and 20 percent minor components such as Marla, Tahoe gravelly, and Watah soils. This poorly drained soil occurs on frequently inundated floodplains and valley flats and was formed in alluvium derived from granitic and volcanic rocks. In a typical profile, this soil is characterized as mucky gravelly silt loam in the upper ten inches, gravelly loam from ten to 27 inches, gravelly loamy fine sand from 27 to 32 inches, and gravelly fine sand from 32 to 46 inches. This soil map unit is classified as hydric, as soil components are poorly drained and/or are frequently ponded or flooded for a long or very long duration during the growing season when they occur in outwash terraces, flood plains, and valley flats (USDA, NRCS 2012).

Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0 to 15 percent slopes (**9011).** This soil type is found along the streambed and lower terrace of Glenbrook Creek in the central portion of the Study Area. This somewhat poorly drained to poorly drained soil occurs in drainageways, floodplains and valley flats and was formed in alluvium and/or colluviums from mixed parent material sources. This map unit is generally comprised of 30 percent oxyaquic cryorthents, 28 percent aquic xerorthents, 15 percent Tahoe, gravelly, and similar soils, and 27 percent minor components. This soil is classified as hydric and contains map unit components that are frequently flooded for long duration or very long duration during the growing season that: (USDA, NRCS 2012).

Nevada Tahoe Conservation District
Glenbrook Creek Restoration Project

Figure 2: Soils

Soil Description

- Kingsbeach stony sandy loam, 2-15% slopes
- Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0-15% slopes
- Tahoe complex, 0-2% slopes
- Study Area Boundary

N

0 100 200
Feet

1:3,000

Data sources: USDA National Resource Conservation Service Soil Data Mart; USGS National Hydrography Dataset; ESRI StreetMap North America; ArcGIS BING image service. Map date: July 7, 2012.

HAUGE BRUECK ASSOCIATES

4.3 Hydrology

The Study Area is situated on a broad alluvial fan that drains into Lake Tahoe to the west. The Study Area is situated entirely within the Glenbrook Creek watershed, which ranges in elevation from 6,245 to 8,000 feet mean sea level (msl). Headwaters of Glenbrook Creek originate in the Carson Range, just below the north side of South Camp Peak in Toiyabe National Forest at approximately 8000' msl. Glenbrook Creek is a moderate-gradient perennial stream with year-round flows and is mapped as a "blue line" stream by the U.S. Geological Survey (USGS). The creek is conveyed across the Study Area and under Old U.S. Route 50 through an 18-inch diameter culvert, discharging into Lake Tahoe approximately 0.5 mi downstream. The main source of hydrology for wetlands and waters mapped within the Study Area is groundwater that is conveyed through the confined Glenbrook Creek channel and discharged to the ground surface through seasonal fluctuations in the ground water table and direct precipitation (primarily as snow melt). For the purpose of this study, Glenbrook Creek is considered to meet the definition of a relatively permanent water (RPW). Surface and subsurface flows supply the principal source of hydrology for wetlands and waters mapped within the Study Area; all areas mapped as wetlands remain saturated (and in some areas, inundated) for at least 14 days during the growing season.

The Study Area receives between 20 and 35 inches (in) of precipitation a year, with the majority of the precipitation falling during the winter as snow. Based on a preliminary review of precipitation data for the site survey period, a precipitation recorded for the month of May 2012 was 0.12 in and 0.44 in for June 2012; these totals were below the normal monthly averages of 0.81 in for May and 0.75 in for June, according to local rainfall data for the nearest monitoring station in South Lake Tahoe. Annual precipitation in this area for January 1 to June 28, 2012 was 10.73 in, which is well below the average annual range for this area. This information indicates that the hydrology indicators observed during the site surveys (ponding and/or saturation) occurred during a below normal rainfall season (NOAA 2012).

5.0 RESULTS

The entire 2.71-acre Study Area was evaluated for the presence of Waters of the U.S. under Corps jurisdiction, as well as Waters of the State. No portions of the Study Area have been classified as wetlands according to the National Wetland Inventory (NWI) maps (USFWS 2012). The results of jurisdictional site evaluation are described below. Field data were recorded on standard Corps WMRS datasheets provided in Appendix A. Maps in Appendices B1 and B2 depict the extent of potentially jurisdictional areas within Study Area West and East, respectively. A list of plant species observed during the site visits is provided in Appendix C. Representative photographs taken during site surveys to document existing site conditions are provided in Appendix D. Descriptions of potential federal and state jurisdictional waters and wetlands found on the Study Area are provided below.

5.1 Potential Section 404/401 Wetlands

Approximately **0.351 acres** of potential jurisdictional wetlands occur on the Study Area, shown on maps in Appendix B2. The wetlands abut Glenbrook Creek, a perennial stream and Relatively Permanent Water (RPW) that is directly confluent to Lake Tahoe, a Traditional Navigable Waters (TNWs). It is therefore presumed that all features that meet the Corps' wetland criteria within the Study Area will be considered jurisdictional. Potential Section 404 wetlands are classified into two categories based on their vegetation structure (i.e., forested or emergent), plant species composition and wetland indicator status (Lichvar and Kartesz 2009), hydroperiod, and topographic position or landform.

5.1.2 Emergent Floodplain Wetland

Approximately **0.155 acre** of emergent floodplain wetland A (refer to Appendix B2) was mapped within Study Area East and is characterized by wetland sample points P4 and P5 (Appendix A). This wetland classification is primarily based on its topographic landform, vegetation structure, and primary hydrology source. These features are perennially saturated to inundated by surface and subsurface flows along the Glenbrook Creek channel. A predominance of perennial OBL and/or FACW-classified wetland vegetation characterized the wetlands along the low stream terrace, such as (*Carex amplifolia*; OBL), *Equisetum arvense*; OBL), (*Equisetum hyemale*; OBL), (*Glyceria elata*; FACW), (*Geum macrophyllum*; FAC), and America speedwell (*Veronica americana*; OBL) and occasional mountain alder saplings in the herb and shrub strata. Depleted Matrix (F3) was the hydric soil indicator found in emergent floodplain wetlands. Wetland hydrology was evidenced by saturation (A3) and oxidized rhizospheres (C3) primary indicators, and drainage patterns (B10) and passing the FAC-neutral test (D5), which are secondary hydrology indicators. Wetland boundaries were defined by the upper edge of the sampled area that exhibited evidence of wetland hydrology, hydric soils and/or a shift to non-hydrophytic vegetation, as evidenced by sample points P2 and P3.

5.1.3 Riparian Floodplain Wetland

Approximately **0.196 acre** of riparian floodplain wetland B was mapped along the lower terrace of the Glenbrook Creek channel in Study Area East and is characterized by sample points P6 through P8 (refer to Appendix A and B2). Riparian wetlands occur on floodplains, springs, seeps, adjacent to running waters, and in other areas with high water tables (Corps 2010). Riparian floodplain wetlands in the Study Area are characterized by stands of mountain alder (*Alnus incana*; FAC+), creek dogwood (*Cornus sericea* ssp. *sericea*; FACU), and shining willow (*Salix lasiandra ssp. lasiandra*; FACW) that comprised the tree and shrub strata, and a an herbaceous understory of various grasses and forbs, including (but not limited to) common horsetail, rough horsetail, small-fruited bulrush (*Scirpus microcarpus*; OBL), Idaho fescue (*Festuca idahoensis*; FACU), Sierra currant (*Ribes nevadense*; FAC), and arrowleaf groundsel (*Senecio triangularis*; FACW). Hydric soil indicators observed within riparian wetlands includes Depleted Dark Surface (F7), and Depleted Matrix (F3). These wetlands are supported by vertical fluctuations in the groundwater table (saturation to the ground surface) and direct inundation from the adjacent stream channel during high flow events and by a hillside seep in the southwest corner of wetland B, characterized by sample point P8. Primary wetland hydrology indicators that were observed in these features include Surface Water (A1), High Water Table (A2), and Saturation (A3), as well as Drainage Patterns (B10) and FAC-neutral Test (D5), which are secondary hydrology indicators. Wetland boundaries were interpreted primarily by following drainage-like topography and interpreting a shift in plant species dominance from woody riparian species to upper montane coniferous forest along upland margins.

5.2 Lakes, Ponds and Streams/ Non Tidal Waters/ Other Waters of the U.S.

Approximately **0.074 acre** or **657 linear feet** of non-wetland other waters, Glenbrook Creek and its tributaries, (stream segments 1, 2, 3, 4, and 5 and open water feature W1) was mapped within the Study Area (Appendices B1 and B2). Glenbrook Creek is a Relatively Permanent Water (RPW) and perennial stream that is directly confluent via surface water to Lake Tahoe, a TNW and therefore is considered jurisdictional by the Corps. These non-wetland other water features have a year round flow regime that persists over drier summer months and distinct topography characteristic of Waters of the U.S., and is easily discerned on aerial photographs and USGS maps, indicating the presence of substantial contributing hydrology. The OHWM of Glenbrook Creek ranges from 4 to 6 feet wide and has two 1-foot wide tributaries. The boundaries of other water segments were determined through observation of the Ordinary High Water Mark (OHWM) and bankfull width along the active floodplain. The OHWM was delineated by GPS data collection and topographic data interpretation and measured by the upper limit of standing and/or flowing water, destruction of terrestrial vegetation, scour, well-defined drainage topography, and shelving.

6.0 CONCLUSIONS

6.1 Waters of the U.S. Including Wetlands

A total of 0.425 acre of jurisdictional wetlands and other waters were mapped within the Study Area. The Study Area has two (2) features with positive wetland indicators ranging in size from less than 0.155 acre to 0.196 acre (Table 2). In addition, there are six (6) other water segments ranging from 0.001 acre to 0.034 acre that were actively flowing at the time of the jurisdictional site survey and exhibited evidence of an OHWM. The wetlands abut Glenbrook Creek, an RPW that is confluent to Lake Tahoe. All jurisdictional wetlands have hydric soils characterized by low chroma soils, a predominance of hydrophytic vegetation with FAC, FACW, and/or OBL classified plants, and wetland hydrology characterized by saturation, ponding, drainage patterns, and passing the FAC-neutral test. The area and length of features mapped on-site that meet the definition of jurisdictional wetlands and other waters per Section 404 of the Clean Water Act are listed in Table 2 below.

Table 2. Summary of Potential Section 404 Jurisdictional Areas within the Study Area.

Map Feature ID	Wetland/Water Type	Study Area Section	Area of Potential Section 404 Jurisdiction			
			Average Width (ft)	Square Feet (sf)	Linear Feet (lf)	Acres (A)
A	Emergent Floodplain	East	--	6,746	--	0.155
B	Riparian Floodplain	East	--	8,528	--	0.196
Subtotal			**--**	***15,274***	**--**	***0.351***
1	Other Waters	West	4	812	203	0.019
2	Other Waters	East	4	578	144	0.013
3	Other Waters	East	6	1,473	246	0.034
4	Other Waters	East	1	24	24	0.001
5	Other Waters	East	1	40	40	0.001
W1	Other Waters	East	--	261	--	0.006
Subtotal			**--**	***3,188***	***657***	***0.074***
TOTAL			**--**	**18,462**	**657**	**0.425**

Impacts to jurisdictional wetlands and waters on site will require a Section 404 permit from the Corps which is being submitted to the Corps concurrent with this report.

6.2 Waters of the State

In conjunction with the Section 404 permit, impacts to all wetlands and waters identified in this report will likely require a Section 401 Water Quality Certification. In Nevada, the Division of Environmental Protection, Bureau of Water Quality Planning (BWQP) is responsible for issuing or denying 401 Water Quality Certification (WQC) for NWPs. Certification is based on a finding that the proposed Section 404 discharge will comply with all pertinent water quality standards. In order to allow certification, special conditions may be required by the State in order to remove or mitigate potential impacts to water quality standards. Such conditions must ultimately be included in the Section 404 permit. In deciding to issue WQC, there needs to be reasonable assurance that the proposed discharge will comply with all applicable State and Federal laws, policies and regulations governing the protection of the beneficial uses of the State's Waters. In determining WQC, the State must make the determination that the NWPs will adequately protect the Waters of the State.

These results are considered to be preliminary until verified by the Corps and/or until any permits are issued by federal and state agencies authorizing activities within this area. The conclusion of this delineation is based on conditions observed at the time of the field surveys conducted on May 31 and June 28, 2012.

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Appendix A: Corps Delineation Data Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: Glenbrook Creek Restoration City/County: Glenbrook / Douglas Sampling Date: 5/31/12

Applicant/Owner: Glenbrook HOA State: NV Sampling Point: P1

Investigator(s): Parravano, Alling Section, Township, Range: S11, T14N, R18E

Landform (hillslope, terrace, etc.): filled channel Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR): MLRA 22A Lat: 39.088290 Long: -119.936152 Datum: NAD83

Soil Map Unit Name: OCA XT complex, 0-15% NWI classification: O

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No _____	Is the Sampled Area within a Wetland? Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks: Sample point collected w/in work area for culvert removal on bank above creek channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix lasiandra	25	✓	FACW
2. Alnus incana	20	✓	FACW
3.			
4.			
	45 = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1. Ribes viscosissimum	5		FAC
2. Salix lasiandra	10	✓	FACW
3. Alnus incana	10	✓	FACW
4. Cornus sericea	5		NI
5. Berberis pinnata	2		NI
	22 = Total Cover		

Herb Stratum (Plot size: _____)			
1. Glechoma hederacea	15	✓	NI
2. Dactylis glomerata	12	✓	UPL
3. Poa pratensis	6		FACU
4. Tragopogon dubius	<1		UPL
5. Galium aparine	<1		FACU
6. Bromus inermis	2		FAC
7. Elymus triticoides	5		FAC
8.			
9.			
10.			
11.			
	42 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 58

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

__ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ 5 - Wetland Non-Vascular Plants[1]

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks:

Overstory contains phreatophytic veg that is sustained by groundwater. Understory species are not hydrophytic, which is indicative of non-wetland conditions.

SOIL

Sampling Point: P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-7	rocky fill						rock	
7-15	7.5YR 2.5/2						silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Upper horizon consists of fill placed during culvert installation. no redox or other hydric indicators in subsoil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): 0

Water Table Present? Yes _____ No ✓ Depth (inches): 7.5

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): 7.5

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

no wetland hydrology observed. Sample point taken on filled bridge over culvert.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: Glenbrook Creek Restoration City/County: Glenbrook/Douglas Sampling Date: 5/31/12
Applicant/Owner: Glenbrook HOA State: NV Sampling Point: P2
Investigator(s): Parravano, Alling Section, Township, Range: S11, T14N, R18E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): — Slope (%): 3
Subregion (LRR): MLRA 22A Lat: 39.086841 Long: -119.932043 Datum: NAD83
Soil Map Unit Name: OCAXT, 0-15% slopes NWI classification: O
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ✓
Hydric Soil Present? Yes ____ No ✓
Wetland Hydrology Present? Yes ____ No ✓
Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks: Upland point @ base of roadway where re-routed stream will discharge from new culvert.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. Salix scouleriana	5	✓	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Heracleum maximum	15	✓	FAC
2. Equisetum arvense	2		ORx
3. Allium campanulor	1		NV
4. Galium triflorum	1		FACU
5. Lactuca serriola	1		FACU
6. Bromus inermis	1		FAC
7. Dactylis glomerata	<1		FACU
8.			
9.			
10.			
11.			
	21 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 79

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: Downed wood, cut branches + wood chips comprise the bare ground.

Sampling Point: P2

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-16	7.5YR 2.5/3	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:
Soil is not hydric

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (LRR A)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (LRR A)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): 0

Water Table Present? Yes _____ No ✓ Depth (inches): 16

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): 16

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Sample point collected on upper terrace above active Creek floodplain. Area does not remain saturated or inundated for 14 consecutive days during avg. rainfall year.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: GCR City/County: Glenbrook / Douglas Sampling Date: 5/31/12
Applicant/Owner: Glenbrook HOA State: NV Sampling Point: P3
Investigator(s): Parravano, Atling Section, Township, Range: S11, T14N, R18E
Landform (hillslope, terrace, etc.): upper terrace Local relief (concave, convex, none): none Slope (%): 3
Subregion (LRR): MLRA 22A Lat: 39.086849 Long: -119.932147 Datum: NAD83
Soil Map Unit Name: OCAXT, 0-15% slopes NWI classification: 0
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:
Upland sample point on upper terrace above Glenbrook Creek

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Osmorhiza occidentalis	15	✓	UPL
2. Heracleum maximum	4		FAC
3. Lactica serriola	2		FACU
4. Equisetum arvense	2		OBL
5. Alnus incana	10	✓	FACW
6. Dactylis glomerata	5		FACU
7. Taraxacum officinale	1		FACU
8. Poa pratensis	<1		FACU
9.			
10.			
11.			
	40 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		
% Bare Ground in Herb Stratum 60			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	10	x 2 =	20
FAC species	4	x 3 =	12
FACU species	9	x 4 =	36
UPL species	15	x 5 =	75
Column Totals:	42 (A)		145 (B)

Prevalence Index = B/A = 3.45

Hydrophytic Vegetation Indicators:
__ 1 - Rapid Test for Hydrophytic Vegetation
__ 2 - Dominance Test is >50%
✓ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

Sampling Point: P3

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12+	5YR 2.5/1	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks: no redox present, but low chroma soils

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): 0

Water Table Present? Yes ___ No ✓ Depth (inches): 22

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): 22

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: GCR City/County: Glenbrook / Douglas Sampling Date: 5/31/12

Applicant/Owner: Glenbrook HOA State: NV Sampling Point: P4

Investigator(s): Parravano, Alling Section, Township, Range: S11, T14N, R18E

Landform (hillslope, terrace, etc.): mid terrace Local relief (concave, convex, none): Convex Slope (%): 7

Subregion (LRR): MLRA 22A Lat: 39.086789 Long: -119.932229 Datum: NAD83

Soil Map Unit Name: OCAXT, 0-15%, slopes NWI classification: —

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: Outer edge of emergent floodplain wetland along Glenbrook Creek active floodplain.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		
Herb Stratum (Plot size: ____)			
1. Equisetum arvense	28	✓	OBL
2. Heracleum maximum	1		FAC
3. Urtica dioica	2		FAC
4. Elymus glaucus	1		UPL
5. Alnus incana	1		FACW
6. Allium campanulatum	<1		NI
7.			
8.			
9.			
10.			
11.			
	34 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 66

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ____ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ____ 3 - Prevalence Index is ≤3.0[1]
- ____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ 5 - Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: Dominated by obligate wetland vegetation. Criterion met.

SOIL

Sampling Point: P4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	7.5YR 2.5/1	97	5YR 3/3	3	C	M	silty loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

high decomposed om matter content. Low chroma soils

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): 0

Water Table Present? Yes ___ No ✓ Depth (inches): >16.

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 8

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Capillary fringe > 8"

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: GCR City/County: Glenbrook / Douglas Sampling Date: 5/3/12
Applicant/Owner: Glenbrook HOA State: NV Sampling Point: P5
Investigator(s): Parravano, Alling Section, Township, Range: S11, T14N, R18E
Landform (hillslope, terrace, etc.): low terrace Local relief (concave, convex, none): concave Slope (%): 4
Subregion (LRR): MLRA 22A Lat: 39.086866 Long: -119.932435 Datum:
Soil Map Unit Name: OCAXT, 0-15% slopes NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ____
Hydric Soil Present? Yes ✓ No ____
Wetland Hydrology Present? Yes ✓ No ____
Is the Sampled Area within a Wetland? Yes ✓ No ____

Remarks: Wetland point collected w/in active creek floodplain.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. Alnus incana	15	✓	FACW
2. Ribes inerme	<1		
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Carex amplifolia	30	✓	OBL
2. Equisetum arvense	35	✓	OBL
3. Equisetum hyemale	8		OBL
4. Glyceria elata	5		FACW
5. Elym macrophyllum	<1		FAC
6. Veronica americana	<1		OBL
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 20

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
__ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:
Dominated by obligate wetland plants.

Sampling Point: P5

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	5YR 2.5/1	100					Silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Low chroma, saturated soils.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): 0

Water Table Present? Yes ___ No ✓ Depth (inches): 7/6

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 5

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Perennially saturated to inundated low terrace along creek channel.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: GCR City/County: Douglas Sampling Date: 5/31/12
Applicant/Owner: Glenbrook HOA State: NV Sampling Point: P6
Investigator(s): Atling, Parravano Section, Township, Range: S11, T14N, R18E
Landform (hillslope, terrace, etc.): upper terrace Local relief (concave, convex, none): flat Slope (%): 4
Subregion (LRR): MLRA 22A Lat: 39.086787 Long: -119.931724 Datum: NAD83
Soil Map Unit Name: OCAXT complex, 0-15% slopes NWI classification: 0
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks: Non-wetland riparian. Point collected on upper terrace above creek 4' north - potential survey pt - rebar/pvc

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus incana	20	✓	FACW
2. Populus tremuloides	15	✓	FACU
3.			
4.			
	35	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. Ribes nevadense	1		FAC
2. Populus tremuloides	5	✓	FACU
3. Alnus incana	3	✓	FACW
4.			
5.			
	9	= Total Cover	
Herb Stratum (Plot size: ____)			
1. Poa pratensis	30	✓	FACU
2. Equisetum arvense	10	✓	OBL
3. Dactylis glomerata	5		UPL
4. Elymus elymoides	15		UPL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	= Total Cover	

% Bare Ground in Herb Stratum 40

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	23	x 2 =	46
FAC species	1	x 3 =	3
FACU species	50	x 4 =	200
UPL species	20	x 5 =	100
Column Totals:	104 (A)		359 (B)

Prevalence Index = B/A = 3.45

Hydrophytic Vegetation Indicators:
___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: Wetland veg criterion not met

SOIL

Sampling Point: P6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-16	5YR2/3	100					Silt loam	~1 cobble

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ___ No ✓

Remarks: No hydric indicators observed

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): 6

Water Table Present? Yes ___ No ✓ Depth (inches): 16

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): 16

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Collected above Glenbrook Creek - no H_2O in pit, no saturation or ox rhizos noted. Dry to 16"

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

6/28/12

Project/Site: GCR City/County: Glenbrook/Douglas Sampling Date: 5/31/12

Applicant/Owner: Glenbrook HOA State: NV Sampling Point: 17

Investigator(s): Alling, Parravano Section, Township, Range: S11, T14N, R18E

Landform (hillslope, terrace, etc.): lower terrace Local relief (concave, convex, none): concave Slope (%):

Subregion (LRR): MLRA 22A Lat: 39.086737 Long: -119.931775 Datum: NAD83

Soil Map Unit Name: OCAXT complex, 0-15% slopes NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: collected w/in active floodplain - dom. by riparian plants

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix lucida ssp lasiandra	10	✓	FACW
2. Alnus sericea	35	✓	FACW
3.			
4.			
	45 = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. Cornus sericea	20	✓	NI
2.			
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Equisetum hyemale	25	✓	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 75

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ____ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ____ 3 - Prevalence Index is ≤3.0[1]
- ____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ 5 - Wetland Non-Vascular Plants[1]
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: Hydrophytic veg is predominant - criteria met.

SOIL

Sampling Point: P7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-	7.5YR 2.5/1.5						loam / ~~fine~~ coarse sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ✓ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Low chroma, criterion met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): 0

Water Table Present? Yes ✓ No ___ Depth (inches): 10

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Saturation to surface; water in pit @ 10"

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region 6/28/12

Project/Site: GCR City/County: Glenbrook/Douglas Sampling Date: 5/31/12
Applicant/Owner: GC HOA State: NV Sampling Point: P8
Investigator(s): Parravano, Alling Section, Township, Range: S11, T14N, R18E
Landform (hillslope, terrace, etc.): hillside seep Local relief (concave, convex, none): convex Slope (%): 8
Subregion (LRR): MLRA 22A Lat: 39.086581 Long: -119.932027 Datum: NAD83
Soil Map Unit Name: OCAXT complex, 0-15% slopes NWI classification: 0
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	Is the Sampled Area within a Wetland? Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: hillside seep > culvert on edge of road

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus incana	25	✓	FACW
2.			
3.			
4.			
	25 = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1. Alnus incana	20	✓	FACW
2. Salix scouleriana	10	~	FAC
3. Cornus sericea	10	✓	NI
4.			
5.			
	40 = Total Cover		
Herb Stratum (Plot size: ____)			
1. Scirpus microcarpus	90	✓	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	____ = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species ____	x 1 =	____
FACW species ____	x 2 =	____
FAC species ____	x 3 =	____
FACU species ____	x 4 =	____
UPL species ____	x 5 =	____
Column Totals: ____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
__ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
__ 3 - Prevalence Index is ≤3.0[1]
__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 - Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

SOIL

Sampling Point: P8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR2/1	100					silt + OM	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ✓ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): 0

Water Table Present? Yes ✓ No ___ Depth (inches): 2

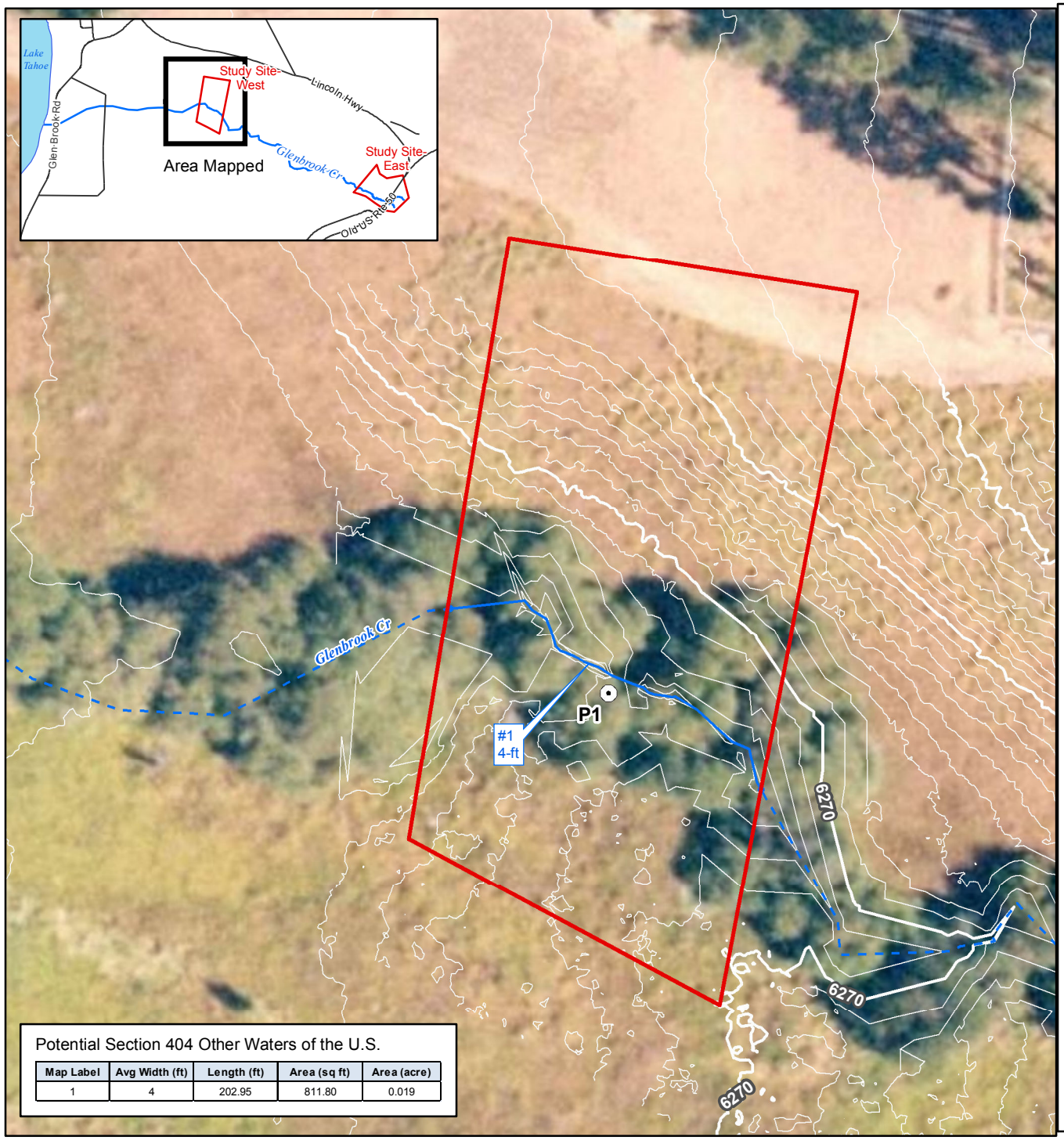
Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix B: Maps of Potential Jurisdictional Wetlands and Waters



NEVADA TAHOE CONSERVATION DISTRICT GLENBROOK CREEK RESTORATION PROJECT

Appendix B1. Preliminary Delineation of Section 404 Jurisdiction

Study Area - West

- Sample Points
- Potential Section 404 Other Waters of the U.S. (Glenbrook Creek)
- Offsite Other Waters of the U.S.
- Study Area (1.31 ac)

0 75
Feet

1:900

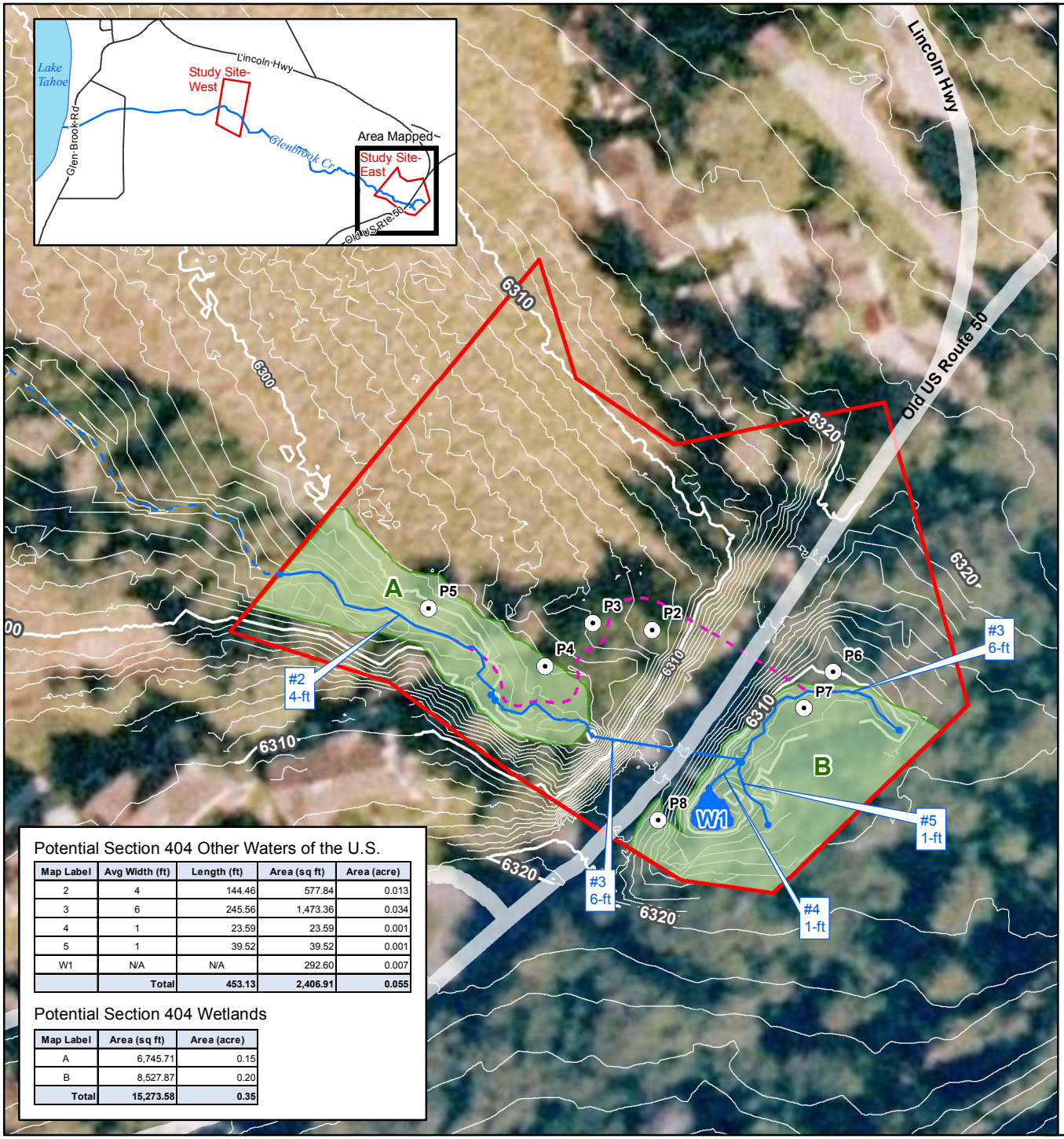
1 inch = 75 feet

Map date: July 30, 2012

HAUGE BRUECK ASSOCIATES

Potential Section 404 Other Waters of the U.S.

Map Label	Avg Width (ft)	Length (ft)	Area (sq ft)	Area (acre)
1	4	202.95	811.80	0.019



Potential Section 404 Other Waters of the U.S.

Map Label	Avg Width (ft)	Length (ft)	Area (sq ft)	Area (acre)
2	4	144.46	577.84	0.013
3	6	245.56	1,473.36	0.034
4	1	23.59	23.59	0.001
5	1	39.52	39.52	0.001
W1	N/A	N/A	292.60	0.007
	Total	**453.13**	**2,406.91**	**0.055**

Potential Section 404 Wetlands

Map Label	Area (sq ft)	Area (acre)
A	6,745.71	0.15
B	8,527.87	0.20
Total	**15,273.58**	**0.35**

NEVADA TAHOE CONSERVATION DISTRICT GLENBROOK CREEK RESTORATION PROJECT

Appendix B2. Preliminary Delineation of Section 404 Jurisdiction

Study Area - East

- Sample Points
- Potential Section 404 Other Waters of the U.S. (Glenbrook Creek)
- Offsite Other Waters of the U.S.
- Open Waters of the U.S. (0.006 ac)
- Potential Section 404 Wetland
- Proposed Creek Alignment
- Study Area (1.40 ac)

0 75
Feet

1:900

1 inch = 75 feet

Map date: July 30, 2012

HAUGE BRUECK ASSOCIATES

Appendix C: List of Plant Species Observed During the Delineation

Appendix C. List of plant species observed on May 31 and June 28, 2012 within the Glenbrook Creek Restoration Study Area vicinity

Scientific Name	Common Name	Wetland Indicator[1]	Native Y/N
ANGIOSPERMS (DICOTYLEDONS)			
APIACEAE	**CARROT FAMILY**		
Cicuta douglasii	Water hemlock	OBL	Y
Ligusticum grayi	Gray's lovage	FAC	Y
Heracleum maximum	Cow parsnip	FAC	Y
Foeniculum vulgare	Fennel	UPL	N
Ozmorhiza occidentalis	Western sweet cicely	UPL	Y
APOCYNACEAE	**DOGBANE FAMILY**		
Apocynum androsaemifolium	Spreading dogbane	UPL	Y
ASTERACEAE	**SUNFLOWER FAMILY**		
Achillea millefolium	Yarrow	FACU	Y
Artemisia cana	Coaltown sagebrush	FACU	Y
Artemisia douglasiana	Mugwort	FACW	Y
Centaurea cyanus	Cornflower	FACU	N
Chrysothamnus viscidiflorus ssp. *viscidiflorus*	Yellow rabbitbrush	UPL	Y
Cirsium vulgare	Bull thistle	FACU	N
Lactuca serriola	Wire lettuce	FACU	N
Senecio triangularis	Arrowleaf groundsel	FACW	Y
Sonchus asper	Prickly sow thistle	FACU	N
Taraxacum officinale	Dandelion	FACU	N
Tragopogon dubius	Yellow salsify	UPL	N
Wyethia mollis	Woolly mules ears	UPL	Y
BERBERIDACEAE	**BARBERRY FAMILY**		
Berberis pinnata	Shiny leaf Oregon grape	NI	N
BETULACEAE	**BIRCH FAMILY**		
Alnus incana ssp. *tenuifolia*	Mountain alder	FACW	Y
BRASSICACEAE	**MUSTARD FAMILY**		
Arabis holboellii	Holboell's rock cress	UPL	Y
Barbarea orthoceras	Winter cress	FACW	Y
Brassica nigra	Black mustard	UPL	N
Descurania incana	Mountain tansy mustard	FACU	Y
Descurania sophia	Flix weed	UPL	N
Lepidium densiflorum var. *macrocarpum*	Dense-flower peppergrass	FACU	Y
Lepidium perfoliatum	Klamath peppergrass	FACU	N
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**		
Symphoricarpos rotundifolius var. *rotundifolius*	Mountain snowberry	UPL	Y
CHENOPODIACEAE	**GOOSEFOOT FAMILY**		
Atriplex triangularis	Fat hen	NI	N
Rumex crispus	Curly dock	FAC	N
CORNACEAE	**DOGWOOD FAMILY**		

[1] Lichvar R. W. and J. T. Kartesz. 2009. North American Digital Flora: National Wetland Plant List, version 2.4.0 (https://wetland_plants.usace.army.mil). U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH, and BONAP, Chapel Hill, NC. (June 22, 2012)

Scientific Name	Common Name	Wetland Indicator[1]	Native Y/N
Cornus sericea ssp. *sericea*	Creek dogwood	NI	Y
FABACEAE	**PEA FAMILY**		
Lupinus grayi	Gray's lupine	UPL	Y
Lupinus polyphyllus var. burkei	Meadow lupine	FAC	Y
Trifolium pratense	Red clover	FACU	N
GROSSULARIACEAE	**GOOSEBERRY FAMILY**		
Ribes aureum	Wax currant	FAC	Y
Ribes inerme var. *inerme*	White-stemmed gooseberry	FAC	Y
Ribes nevadense	Sierra currant	FAC	Y
Ribes viscosissimum	Sticky currant	FAC	Y
LAMIACEAE	**MINT FAMILY**		
Agastache urticifolia	Giant hyssop	FACU	Y
Glechoma hederacea	Creeping Charlie	NI	N
ONAGRACEAE	**EVENING PRIMROSE FAMILY**		
Gayophytum diffusum ssp. *parviflorum*	Gayophytum	UPL	Y
PAEONIACEAE	**PEONY FAMILY**		
Paeonia brownii	Brown's peony	UPL	Y
POLYGONACEAE	**BUCKWHEAT FAMILY**		
Polygonum douglasii	Douglas' knotweed	FACU	Y
ROSACEAE	**ROSE FAMILY**		
Geum macrophyllum	Largeleaf avens	FAC	Y
Potentilla glandulosa var. *ashlandica*	Sticky cinquefoil	FAC	Y
Rosa woodsii var. *ultramontana*	Mountain rose	FAC	Y
Rubus parviflorus	Thimbleberry	FACU	Y
RUBIACEAEA	**MADDER FAMILY**		
Galium aparine	Goose-grass	FACU	Y
Galium triflorum	Sweet scented bedstraw	FACU	Y
SALICACEAE	**WILLOW FAMILY**		
Populus tremuloides	Quaking aspen	FACU	Y
Salix lasiandra ssp. *lasiandra*	Shining willow	FACW	Y
Salix scouleriana	Scouler's willow	FAC	Y
SAPINDACEAE	**SOAPBERRY FAMILY**		
Acer sp.	Maple (cultivated)	NI	N
SCROPHULARIACEAE	**FIGWORT FAMILY**		
Penstemon gracilentus	Slender penstemon	UPL	Y
Verbascum thapsus	Common mullein	FACU	N
Veronica americana	American speedwell	OBL	Y
URTICACEAE	**NETTLE FAMILE**		
Urtica dioica	Stinging nettle	FAC	Y
ANGIOSPERMS (MONOCOTYLEDONS)			
CYPERACEAE	**SEDGE FAMILY**		
Carex amplifolia	Big-leaf sedge	OBL	Y
Carex nebrascensis	Nebraska sedge	OBL	Y
Carex praegracilis	Many-ribbed sedge	FACW	Y
Scirpus microcarpus	Small-fruited bulrush	OBL	Y
JUNCACEAE	**RUSH FAMILY**		
Juncus balticus	Baltic rush	FACW	Y
Juncus nevadensis	Sierra rush	FACW	Y
LILIACEAE	**LILY FAMILY**		
Allium campanulatum	Sierra onion	NI	Y

Scientific Name	Common Name	Wetland Indicator[1]	Native Y/N
Smilacena stellata	Star Solomon's seal	NI	Y
POACEAE	**GRASS FAMILY**		
Agrostis sp.	bentgrass		
Agrostis stolonifera	Creeping bentgrass	FACW	Y
Bromus carinatus var. carinatus	Mountain brome	UPL	Y
Bromus inermis ssp. inermis	Smooth brome	FAC	N
Bromus tectorum	Cheat grass	UPL	N
Dactylis glomerata	Orchard grass	UPL	N
Elymus elymoides var. californicus	Squirrel tail grass	UPL	Y
Elymus glaucus	Blue wildrye	UPL	Y
Ellymus trachycaulus ssp. subsecundus	Sender wheatgrass	FAC	Y
Elymus triticoides	Beardless wildrye	FAC	Y
Festuca idahoensis	Idaho fescue	FACU	Y
Glyceria elata	Tall manna grass	FACW	Y
Hordeum brachyanterum	Meadow barley	FACW	Y
Poa pratensis	Kentucky bluegrass	FACU	N
GYMNOSPERMS			
PINACEAE	**PINE FAMILY**		
Abies concolor	White fir	UPL	Y
Pinus jeffreyi	Jeffrey pine	UPL	Y
SEEDLESS VASCULAR PLANTS			
EQUISETACEAE	**HORSETAIL FAMILY**		
Equisetum arvense	Common horsetail	OBL	Y
Equisetum hyemale	Rough horsetail	OBL	Y

Appendix D: Representative Photographs of the Study Area

Photo 1: View of P1 in non-wetland riparian portion of Glenbrook Creek on fill soils within western portion of Study Area. May 28, 2012

Photo 2: View of upland sample point P2 within proposed creek alignment, facing east. May 28, 2012.

Photo 3: View of upland sample point P3 on upper terrace of Glenbrook Creek, facing northwest. May 28, 2012.

Photo 4: View of wetland sample point P4 showing low chroma soils/depleted matrix, collected along upper boundary of emergent floodplain wetland along Glenbrook Creek. May 28, 2012.

Photo 5: View of wetland sample point P5 with tall manna grass and scouring rush collected within low terrace of Glenbrook Creek. May 28, 2012.

Photo 6: View of upland sample point P6 upslope of Glenbrook Creek channel. May 28, 2012.

Photo 7: View of wetland sample point P7 at within active floodplain of Glenbrook Creek. May 28, 2012.

Photo 8: View of wetland sample point P8 collected within small-fruited bulrush dominated hillside seep. May 28, 2012.

Photo 9: View of area to be restored by realignment of creek channel. June 28, 2012.

Photo 10: View of actively flowing creek channel mapped as other waters at the culvert opening under Old U.S. Route 50. June 28, 2012.

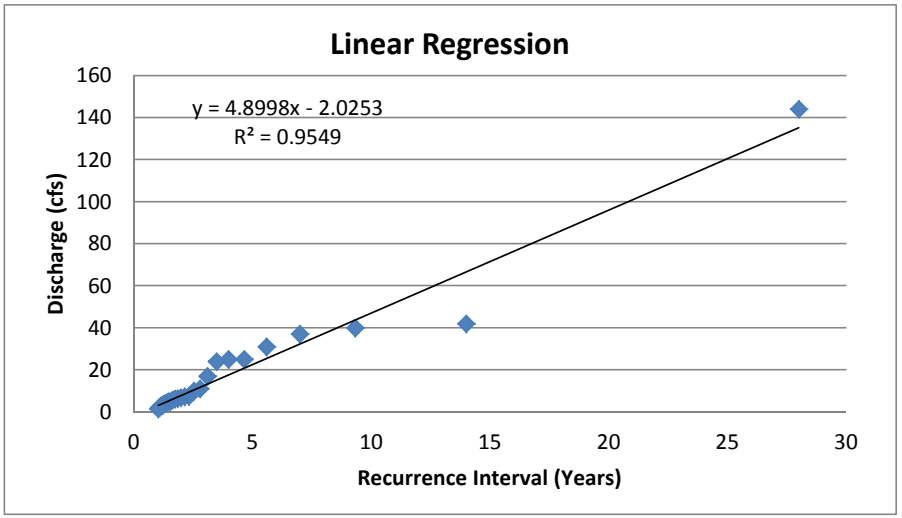
Photo 11: View of rabbitbrush scrub, ruderal grassland, and riparian woodland plant communities within the Study Area. June 28, 2012.

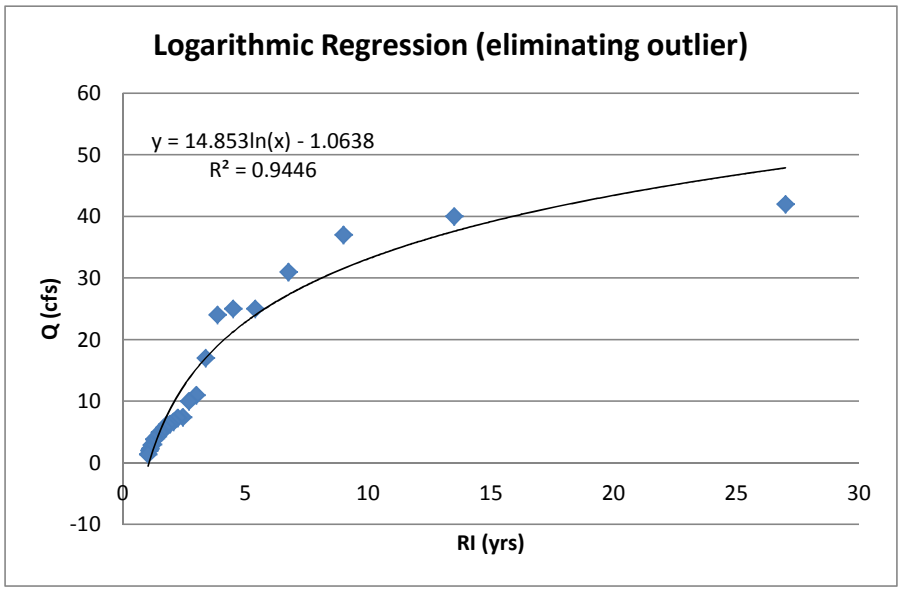
Photo 12: View of area to be restored downstream of existing culvert crossing, facing west. June 28, 2012.

APPENDIX D
Engineering Calculations

Calculation of Discharge Frequency for Glenbrook Creek

Rank	Recurrence Interval	Discharge (cfs)
1	28	144
2	14	42
3	9.33333333	40
4	7	37
5	5.6	31
6	4.66666667	25
7	4	25
8	3.5	24
9	3.11111111	17
10	2.8	11
11	2.54545455	10
12	2.33333333	7.4
13	2.15384615	7.3
14	2	6.7
15	1.86666667	6.3
16	1.75	6.2
17	1.64705882	5.7
18	1.55555556	5
19	1.47368421	4.9
20	1.4	4.3
21	1.33333333	4
22	1.27272727	3.8
23	1.2173913	3
24	1.16666667	2.9
25	1.12	2.3
26	1.07692308	2
27	1.03703704	1.4





Linear Regression Results

Recurrence	Discharge (cfs)
1	2.8745
2	7.7743
5	22.4737
10	46.9727
20	95.9707
25	120.4697
50	242.9647
100	487.9547

Logarithmic Regression Results

Recurrence	Discharge (cfs)
1	-1.0638
2	9.231515
5	22.84118
10	33.1365
20	43.43181
25	46.74616
50	57.04148
100	67.33679

Final Calculations

Recurrence (yr)	**Discharge (cfs)**	**Notes**
2	9	avg between 2 estimates
20	70	avg between 2 estimates
100	221	From USGS Report

Mannings Roughness Calculations for Proposed Bankfull Channel

Project: Glenbrook Creek
Project #: 12-001
Date: 5/7/2012
Calculated by: B.M.S.

Instructions: Enter variables in RED cells only

Design equations to determine roughness coefficient of typical channel section

Bankfull Flows (Q=9 cfs)

Mussetter (1989)

Equation for steep, boulder conditions

$(8/f)^{0.5} = 1.11\ (d/D_{84})^{0.46}(D_{84}/D_{50})^{-0.85}\ S^{-0.39}$

$n = 0.0926\ R^{1/6}\ f^{1/2}$

Therefore: $\mathbf{n = 0.236\ R^{1/6}\ (d/D_{84})^{-0.46}\ (D_{84}/D_{50})^{0.85}\ S^{0.39}}$

d = hydraulic depth Area/Top Width
S = slope
R = hydraulic radius

Equation developed for:
d/D_{84} range (0.24 to 3.72)
D_{50} range (0.1 to 2.1 feet)
S range (0.54 to 16.8 percent)

S =	0.04	
R =	0.75	ft
d =	0.85	ft
D_{84} =	1.5	ft
D_{50} =	0.8	ft
d/D_{84} =	0.57	

n= 0.14

1.) Bathurst, J.C., 1985, Flow resistance estimation in mountain rivers, Journal of Hydraulic Engineering, ASCE, Vol. 111, No.4

2.) California Department of Fish and Game (CDFG). 2009. Fish Passage Design and Implementation: Part XII of the California Salmonid Stream Habitat Restoration Manual. Sacramento, CA, CA Department of Fish and Game.

3.) U.S. Department of the Interior Bureau of Reclamation. 2007. Rock Ramp Design Guidelines.

4.) Julien, P.Y. 2002. River Mechanics. Cambridge University Press, Cambridge, United Kingdon

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Monday, Aug 20 2012

Bankfull Channel @ 4% (2-yr)

Trapezoidal

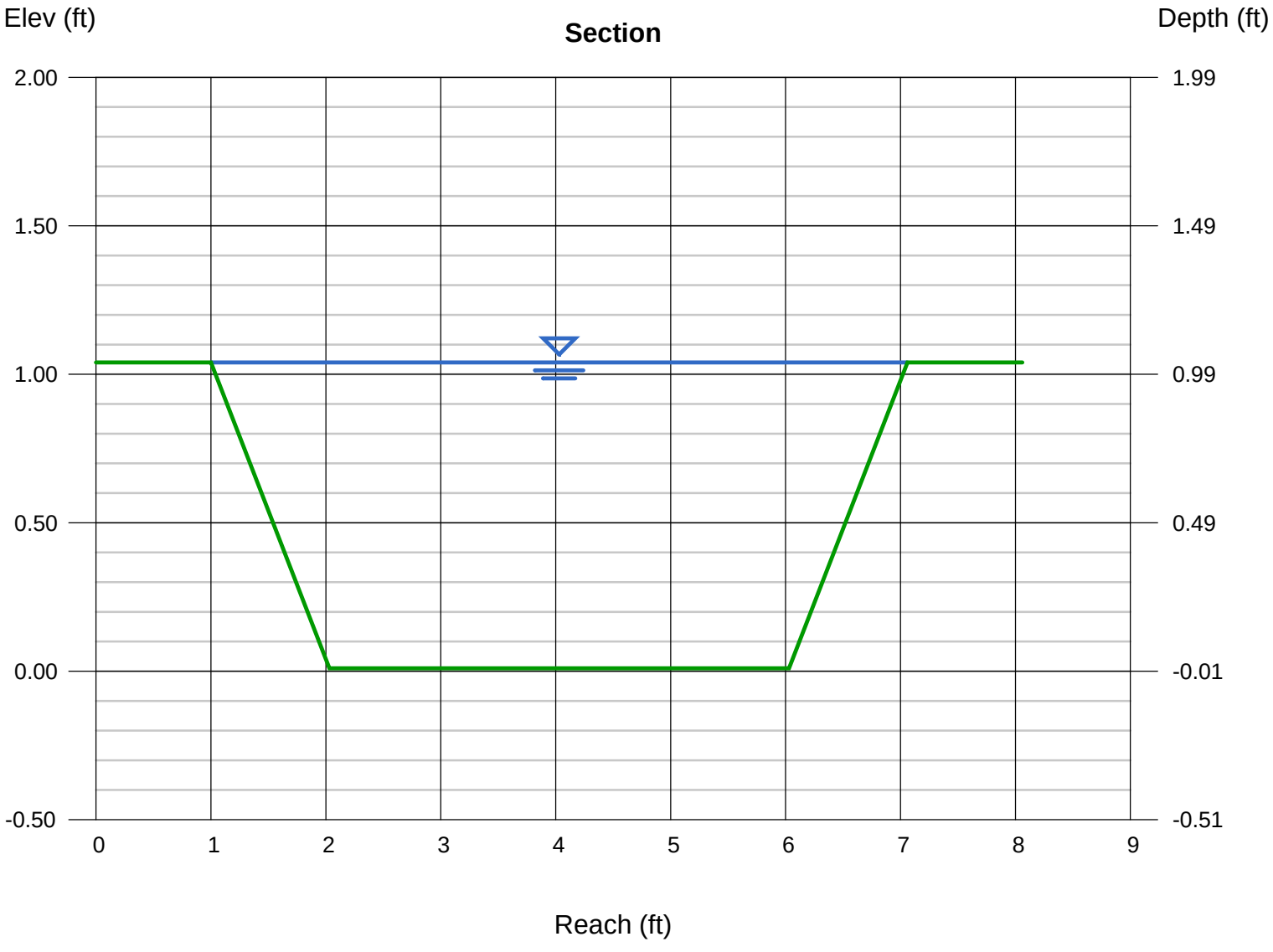
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 1.03
Invert Elev (ft)	= 0.01
Slope (%)	= 4.00
N-Value	= 0.140

Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.00

Highlighted

Depth (ft)	= 1.03
Q (cfs)	= 9.000
Area (sqft)	= 5.18
Velocity (ft/s)	= 1.74
Wetted Perim (ft)	= 6.91
Crit Depth, Yc (ft)	= 0.52
Top Width (ft)	= 6.06
EGL (ft)	= 1.08



Culvert Report

12'-wide Arch Culvert @ 4% (100-yr flow)

Invert Elev Dn (ft)	=	6304.05
Pipe Length (ft)	=	68.00
Slope (%)	=	4.00
Invert Elev Up (ft)	=	6306.77
Rise (in)	=	62.0
Shape	=	Arch
Span (in)	=	124.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Arch Corrugated Metal
Culvert Entrance	=	Mitered to slope (A)
Coeff. K,M,c,Y,k	=	0.03, 1, 0.0463, 0.75, 0.7

Embankment

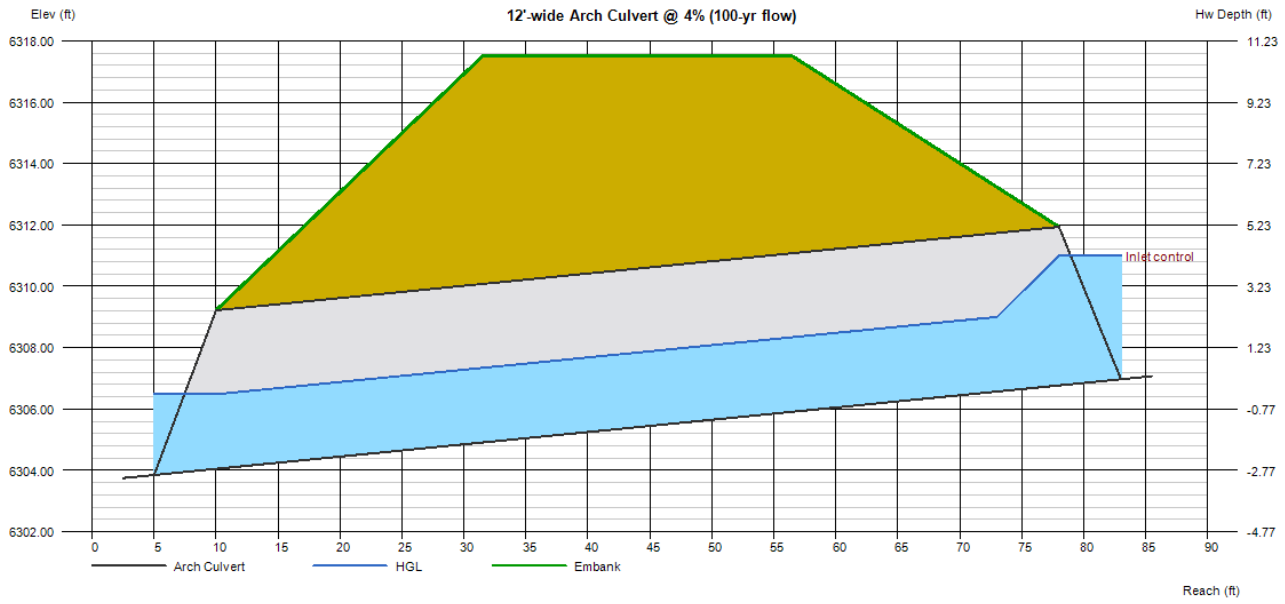
Top Elevation (ft)	=	6317.50
Top Width (ft)	=	25.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	221.00
Qmax (cfs)	=	221.00
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	221.00
Qpipe (cfs)	=	221.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.15
Veloc Up (ft/s)	=	9.15
HGL Dn (ft)	=	6306.48
HGL Up (ft)	=	6309.20
Hw Elev (ft)	=	6311.01
Hw/D (ft)	=	0.82
Flow Regime	=	Inlet Control



Engineered Streambed Material Calculations

Project: Glenbrook Creek
Project #: 12-001
Date: 5/7/2012
Calculated by: B.M.S.

Instructions: Enter variables in RED cells only

Calculations to determine the gradation and thickness of engineered streambed material used in the roughened channel

1. Inputs

Proposed Channel Conditions Site Data		
Design Flow*	60	cfs
Channel Width =	6	ft
q =	10.0	cu.ft./sec ft
gravity, g	32.2	ft/sec^2
Slope, S	0.04	ft/ft

* 60 cfs will be contained within channel banks during 100-yr event (204 cfs).

Proposed Culvert Conditions Site Data		
Design Flow	204	cfs
Channel Width =	12	ft
q =	17.0	cu.ft./sec ft
gravity, g	32.2	ft/sec^2
Slope, S	0.04	ft/ft

2. Equations to Calculate D_{50} particle size

Bathhurst (1987)

developed for: slope (0.23 to 9%)
particle dia. (0.35 to 11 inches)

D_{50} = 3.56 q^2/3 S^.75 / g^1/3

	Channel	Culvert
D_{50} =	0.5 ft	0.7 ft

Robinson et al. (1998)

developed for: slope (2% to 40%)
particle dia. (0.6 to 11 inches)

$D_{50} = [q_{design} / (8.07 \times 10^{-6} S^{-0.58})]^{0.529}$

	Channel	Culvert
q_{design} (m^3/s/m) =	0.93	1.58
D_{50} (mm) =	177	235
D_{50} =	0.6 ft	0.8 ft

Abt and Johnson (1991)

developed for: slope (1% to 20%)
particle dia. (1 to 6 inches)

D_{50} = 0.436 q_{sizing}^0.56 S^0.43
q_{sizing} = q * sizing factor
sizing factor = 1.35

	Channel	Culvert
D_{50} =	0.5 ft	0.6 ft
Choose D_{50} =	0.5 ft	0.7 ft

3. Develop Grain Size Distribution Utilizing the Calculated D_{50}

Washinton Department of Fish and Wildlife Grain Size Distribution (WDFW, 2003)

D_{84}/D_{100} =	0.4
D_{84}/D_{50} =	2.5
D_{84}/D_{16} =	8

WDFW Substrate Gradation		
D_{100} =	3.1	ft
D_{84} =	1.3	ft
D_{50} =	0.5	ft
D_{16} =	0.48	in
D_8 =	0.10	in

Note: WDFW gradation above is based on wide variety of stream beds in different environments. The D_{84}/D_{100} ratio of 0.4 may give too large of boulder size. Judgment should be made to adjust size to something reasonable for the site. ACOE EM 1110-2-1601 suggests using $D_{100}=2xD_{50}$. If using ACOE steep slope methods to size substrate then $D_{84} = 1.5D_{30}$ (WDFW, 2003). The largest rock should not be greater in size than 1/4 of the active channel width.

Rock Structures: Use D_{84} to D_{100}
Engineered Streambed Material: Use <D_{84}
Bankline Rock: Use D_{50} to D_{84}

Resulting Engineered Streambed Material Gradation

Size Class	Particle Diamter	
D_{100} =	2.0	ft
D_{84} =	1.5	ft
D_{50} =	0.8	ft
D_{16} =	4.0	in
D_8 =	0.08	in

Justification

Choose largest size of Engineered Streambed Material to be equal to the D_{84} calculated using the WDFW gradation. This size exceeds the ACOE recommendation of $D_{100}=2 \times D_{50}$.

4. ESM Thickness

Thickness greater or equal to max($1.5XD_{50}$ or D_{100}) (ACOE EM 1110-2-1601)
or if D_{100} is set to protrude above surface by 1/3 then use $0.67D_{100}$ (Flosi et.al.)

T = 2.0 ft

Note: Use thickness of 2 feet within culvert. Otherwise thickness is about 1 foot with large rocks (1' to 2' dia) distributed through the channel and along t

5. References

1.) U.S. Department of the Interior Bureau of Reclamation. 2007. Rock Ramp Design Guidelines.
2.) Washington Department of Fish and Wildlife. 2003 Design of Road Culverts for Fish Passage
3.) U.S. Army Corps of Engineers. 1994. Hydraulic Design of Flood Control Channels, EM-1110-2-1601
4.) California Department of Fish and Game (CDFG). 2009. Fish Passage Design and Implementation: Part XII of the California Salmonid Stream Habitat Restoration Manual. Sacramento, CA, CA Department of Fish and Game.

APPENDIX E
Seed Mixes

Riparian Mix

Scientific Name	Common Name	PLS Lbs/Acre
Glyceria elata	Tall manna grass	1.00
Leymus triticoides	Creeping wildrye	5.00
Mimulus guttatus	Yellow Monkeyflower	0.05
Scirpus microcarpus	Small-fruited bulrush	1.00
Juncus balticus	Baltic rush	0.10
Agastache urticifolia	Sierra horsemint	0.25
Potentilla gracilis	Cinquefoil	0.10
Agrostis stolonifera	Creeping bentgrass	1.00
Rosa woodsii	Woods rose	0.50
Penstemon rydbergii	Penstemon	0.50
Carex nebraskensis	Nebraska sedge	0.50
Delphinium glaucum	Sierra Larkspur	0.25
Ribes aureum	Golden currant	0.25
Lupine polyphyllus	Lupine	0.25
	TOTALS	10.75

Upland Mix

Scientific Name	Common Name	PLS Lbs/Acre
Bromus carinatus var. carinatus	Mountain brome	4.00
Elymus glaucus	Blue wildrye	3.00
Elymus elymoides var. californicus	Squirrel tail grass	2.00
Artemisia tridentata ssp. *vaseyana*	Mountain Big Sagebrush	0.25
Purshia tridentata	Antelope Bitterbrush	1.00
Achillea millefolium	Yarrow	0.25
Paeonia brownii	Brown's peony	0.25
Linum lewisii	Blue Flax	0.25
Eschscholzia californica	California Poppy	0.25
Eriogonum umbellatum ssp. *polyanthum*	Sulfur Flowered Buckwheat	0.25
Gaillardia pulchella	Indian Blanketflower	0.25
Lupinus argenteus	Silvery Lupine	0.25
Wyethia mollis	Mule's Ears	1.00
	TOTAL	13.00

Containers

Scientific Name	Common Name	Wetland Indicator	Native Y/N
Cornus sericea ssp. *sericea*	Creek dogwood	NI	Y
Ribes nevadense	Sierra currant	FAC	Y
Betula papyrifera	White Birch	FAC	N
Populus tremuloides	Quaking Aspen	UPL	Y
Amelanchier alnifolia	Serviceberry	FACU	Y