

Truckee Meadows Regional Storm Water Quality Management Program

Storm Water Monitoring and Sample Analysis Plan

FINAL

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Prepared for:
The Truckee Meadows Storm Water Permit Coordinating Committee
(NPDES MS4 Discharge Permit No. NVS000001)

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Acronyms and Abbreviations

303(d)	Clean Water Act Section Specifying the Preparation of Nevada's List of Impaired Waters
BMP	Best Management Practice
CASQA	California Stormwater Quality Association
CFR	Code of Federal Regulations
CMP	Coordinated Monitoring Plan
CWA	Clean Water Act
DRI	Desert Research Institute
EMC	Event Mean Concentration
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
LA	Load Allocation
LID	Low Impact Development
MCL	Maximum Contaminant Level
MEP	Maximum Extent Practicable
mg/L	Milligrams per Liter
MGD	Million Gallons per Day
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
NDEP	Nevada Division of Environmental Protection
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of wildlife
NPDES	National Pollutant Discharge Elimination System
NSHE	Nevada System of Higher Education
NTD	North Truckee Drain
PLPT	Pyramid Lake Paiute Tribe
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
SAP	Sample and Analysis Plan
SWMP	Storm Water Management Program
SWPCC	Storm Water Permit Coordinating Committee
SWPPP	Storm Water Pollution Prevention Plan
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TM	Truckee Meadows
TMDL	Total Maximum Daily Load

TMWA	Truckee Meadows Water Authority
TMWRF	Truckee Meadows Water Reclamation Facility
TN	Total Nitrogen
TP	Total Phosphorus
TRFMA	Truckee River Flood Management Authority
TRFP	Truckee River Flood Project
TRMP	Truckee River Monitoring Program
TRIG	Truckee River Information Gateway
TSS	Total Suspended Solids
UNCE	University of Nevada Cooperative Extension
UNR	University of Nevada, Reno
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
WCDWR	Washoe County Department of Water Resources
WCDHD	Washoe County District Health Department
WLA	Waste Load Allocation
WRCC	Western Regional Climate Center
WRWC	Western Regional Water Commission

Section 1 Introduction

Monitoring ambient and storm water quality is an important component in most Storm Water Management Programs (SWMPs). With sufficient, accurate and representative data, determinations and assessments can be made pertaining to the effectiveness of the program and highlight any need for new or revised storm water Best Management Practices (BMPs). Since 2003, storm event water quality samples have been collected as part of the overall Truckee Meadows Regional Storm Water Quality Management Program. Each October, a revised Sample Analysis Plan (SAP) is submitted to the Nevada Division of Environmental Protection (NDEP) that outlines the general sampling program and approach. Presented in this SAP document is a description of the storm water sampling activities to be conducted by (or under the direction of) the Truckee Meadows Storm Water Permit Coordinating Committee (SWPCC) beginning January 1, 2013.

Presented in Section 1, is an introduction to storm water management in the Truckee Meadows, a summary of the permit language pertaining to monitoring, and a discussion of some of the other monitoring programs being conducted that are indirectly associated with this program. Section 1 concludes with a discussion of how this document is organized.

1.1 Storm Water Management in the Truckee Meadows

The discharge of municipal storm water runoff within the Truckee Meadows urbanized area is regulated under a single discharge permit, jointly issued to the cities of Reno, Sparks and Washoe County. NDEP issued a Municipal Separate Storm Sewer System (MS4) discharge permit to all three entities as co-permittees (Permit No. NVS000001, effective May 26, 2010, hereafter referenced as the "Permit"). The Permit cycle is five years in length, requiring re-application and re-issuance by May 26, 2015. Administration of the Permit is the responsibility of the SWPCC. The SWPCC is made up of two members from each of the three entities and have an Interlocal Agreement in place to define each party's responsibilities.

The Permit allows the City of Reno, the City of Sparks, and Washoe County to discharge municipal storm water runoff, and requires the co-permittees to develop, administer, implement and enforce a SWMP. The SWMP is a comprehensive program that has been developed over the past 15 years through a series of meetings and workshops attended by local government representatives, area professionals, and private citizens. The SWMP has been designed to address the unique political, socioeconomic, geographic and climatic conditions of the Truckee Meadows, as well as the conditions of the Permit. The most recent version of the Truckee Meadow Storm Water Management Program document was issued in December of

2011. Presented in the SWMP document is a description of the various programs and activities that collectively help prevent storm water pollution to the maximum extent practicable (MEP).

1.2 Permit Requirements Relating to Monitoring

Section V.A of the Permit outlines the requirements for Stormwater Monitoring. No specific sampling locations or collection frequencies are specified in the Permit. Section V.A.1 requires the permittees to submit a Stormwater Monitoring Plan to NDEP each year, on or before October 1. It is important to note that "monitoring" is largely defined as the regular observation, recording of events and activities and is not exclusively sample collection for water quality determinations. Numerous monitoring activities carried out by the co-permittees are described in the SWMP document. Outlined in this document are the monitoring efforts specifically related to water sample collection activities. Permit Section V.A.2 lists sampling specifics to be followed when collecting, analyzing and reporting of any water samples collected. Section V.A of the permit in presented in the highlighted box below (blue text boxes are used throughout the document to indicate the exact Permit language).

V.	**STORMWATER MONITORING, RECORDKEEPING & ANNUAL REPORT**
V.A.	**Stormwater Monitoring**
V.A.1	The Permittees shall submit a Stormwater Monitoring Plan to NDEP for the following year on or before October 1 each year. In developing the plan, the Permittees must evaluate and update as necessary how monitoring may assist in making decisions about program compliance, the appropriateness of identified BMPs, and progress toward achieving identified measurable goals. Pending submittal of the annual monitoring plan, the Permittees shall continue to implement the existing monitoring plan.
V.A.2	When the Permittees conduct monitoring at the Permittees' MS4, the Permittees are required to comply with the following:
V.A.2.a	Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. This requirement does not prevent Permittees from analyzing or reporting samples that are representative of a limited situation (e.g. concentration at peak flow);
V.A.2.b	Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, unless other procedures are approved by NDEP.
V.A.2.c	Records of monitoring information shall include:
V.A.2.c.i	The date, exact place, and time of sampling or measurements;
V.A.2.c.ii	The names(s) of the individual(s) who performed the sampling or measurements;
V.A.2.c.iii	The date(s) analyses were performed;
V.A.2.c.iv	The name(s) of the individual(s) who performed the analyses;
V.A.2.c.v	The analytical techniques or methods used; and
V.A.2.c.vi	The results of such analyses
V.A.2.d	Analyses shall be performed by a State of Nevada-certified laboratory. Laboratory reports shall be provided if requested by NDEP.
V.A.2.e	If the Permittees perform stormwater monitoring more frequently than required by the Stormwater Monitoring Plan, the results of such monitoring shall be reported in the Annual Report.

Recordkeeping requirements can be found in section V.B of the Permit. Section V.B.1 of the Permit specifies that the co-permittees must retain records that are associated with any monitoring and sampling activities for at least three years. This includes records of water quality field instrument calibration.

V.B. Recordkeeping	
V.B.1	The Permittees must retain records of all monitoring information, including: all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, a copy of the NPDES permit, and records of all data used to complete the application for this permit, for a period of at least three (3) years from the termination date of this permit. This period may be extended at the direction of NDEP at any time.

Section IV.C requires the co-permittees to evaluate characterization data previously submitted (presumably in the Annual Report to NDEP), and evaluate if the current sampling program should be modified to improve the characterization of stormwater discharge, effects of BMPs or ambient water quality. This review can be found in Section 2.5.2 of the SWMP document.

IV.C. Characterization Data	
IV.C.1	The updated SWMP shall evaluate characterization data previously submitted and include additional data collected in the same manner, and evaluate whether existing data collection programs should be modified to improve characterization of stormwater discharges, effects of BMPs, or ambient water quality. This information shall be submitted for approval as part of the Annual Monitoring Plan required in Part V.A.

Inferences of a monitoring component or where monitoring may potentially assist in satisfying the permit requirement can be found in Section II.A (Impaired Waters), Section II.B (Total Maximum Daily Load), Section IV.G (Illicit Discharge and Detection) and Section IV.H (Industrial Facility Monitoring and Control) of the Permit. The latter two programs are well developed and fully described in the SWMP.

1.3 Present Storm Water Monitoring Approach

As described in the 2010 SAP document, there are essentially two different sampling activities presently being performed: 1) scheduled quarterly tributary monitoring, 2) unscheduled storm event sampling of a single tributary. Tributary grab samples are collected quarterly from 12 fixed sites on six tributaries of the Truckee River (Table 1-1). In general, the monitoring locations are located upstream and downstream of urban development for each tributary. Chalk Creek contains a single sampling site in the middle reach (perennial flow region). Samples are not collected in the upper reaches of Chalk Creek due to intermittent, ephemeral stream flow. Prior to 2010, the monitoring effort included the tributaries and sites listed in Table 1-1 with the exception of Alum Creek, Chalk Creek and Steamboat Creek at the Narrows.

Storm event samples are collected using ISCO™ automatic samplers. One of the six tributaries listed in Table 1-1 is selected each year for storm event sampling. The selected tributary is sampled for one full year during storm events, with a minimum of two sampling events

representing one wet season storm and one dry season storm, if possible. The tributary selected for storm water sampling events is identified each year in the Annual Report.

Table 1-1. 2010 SAP Monitoring Site Summary Information

Tributary	Sampling Location	Urban Area	Sampling Frequency	WQ Parameters
1. Steamboat Creek	Rhodes Rd	Upstream	Quarterly	Flow Rate (Q) Total Nitrogen (TN) Total Phosphorus (TP) Total Suspended Solids (TSS) Total Dissolved Solids (TDS) Temperature (Temp.) Specific Conductance (EC) pH Dissolved Oxygen (DO)
	Narrows	Midstream		
	Clean Water Way	Downstream		
2. Whites Creek	Timberline Dr	Upstream		
	Old Virginia Hwy	Downstream		
3. Thomas Creek	Timberline Dr	Upstream		
	S. Meadows Pkwy	Downstream		
4. North Truckee Drain	Orr Ditch	Upstream		
	Kleppe Ln.	Downstream		
5. Chalk Creek	Chalk Bluff	Downstream		
6. Alum Creek	Steamboat Ditch	Upstream		
	Truckee River	Downstream		

The ISCO™ samplers are set up to collect water samples at regular intervals into 24 discrete bottles. Based on the duration of the storm event, multiple bottle sets are sometimes required (greater than 24 samples taken). During the storm event sampling, stream flow is measured and recorded using a portable level recorder (often correlated with stream gauge stations). Based on the tributary flow rate data, a storm hydrograph is developed. The hydrograph is then used to assist in the preparation of composite sample splits for water quality determinations. Composite samples representing the different regions of the hydrograph including the base flow, rising limb, peak discharge, falling limb and return are prepared from the discrete samples.

Tributary and storm event monitoring consists of both field and laboratory measurements. In the field, DO, pH, EC, water temperature and flow rate are measured and recorded. Grab (tributary) or composite (storm event) water samples are collected and analyzed for TDS, TSS, TP and TN (individual analyses of nitrate, nitrite and total Kjeldahl nitrogen (TKN), reported as total nitrogen) at a local, certified laboratory.

1.4 Truckee River Monitoring

An extensive number of water quality studies and monitoring efforts have and continue to be conducted on the Truckee River and its tributaries. Recently, the Truckee River Coordinated Monitoring Program (CMP) was established to identify all of the different agencies and groups that conduct various types of monitoring activities on the Truckee River (Truckee River Memorandum of Understanding Group, 2010). The motivation behind the CMP was the need for better data sharing and efficiencies among the resource management agencies and non-profit organizations involved in the general management and stewardship of the Truckee River.

In 2010, these agencies and organizations developed and signed a memorandum of understanding (MOU) that sets goals for improving the exchange of river monitoring data and other related activities. Groups collecting water quality or flow measurements are listed in Table 1-2.

Table 1-2. Agencies Currently Conducting Monitoring or Water Quality Studies on the Truckee River and Tributaries

Agency	Purpose of Monitoring
Truckee Meadows Water Reclamation Facility (TMWRF)	CWA, NPDES Permit
Nevada Division of Environmental Protection (NDEP)	CWA, Identifying impaired waters
Truckee Meadows Water Authority (TMWA)	Safe Drinking Water Act compliance
Truckee River Flood Management Authority (TRFMA)	Monitor flow data
Truckee Meadows Watershed Committee (TMWC)	CWA, NPDES MS4 Permit
Pyramid Lake Paiute Tribe (PLPT)	Vigilance
Desert Research Institute (DRI)	Research
Tahoe Truckee Sanitation District (T-TSA)	NPDES Permit
University of Nevada, Reno (UNR)	Research
United States Geological Survey (USGS)	Monitor flow data

The main objectives of the CMP are to find efficiencies in sampling efforts, share data, and to facilitate a better understanding of health and processes in the Truckee River and its tributaries. Outlined in the CMP document are definitions and protocols to clarify procedures and nomenclature, a general basis for data consolidation and format (metadata), and information on what monitoring related data are being collected, by whom, and the frequency of collection. The CMP sets forth a common monitoring site naming protocol and sampling and analysis definitions intended to clarify reporting procedures.

Historically, both the Truckee Meadows Water Reclamation Facility (TMWRF) and staff from the Desert Research Institute (DRI) have conducted major monitoring programs on the Truckee River. TMWRFs monitoring efforts have consisted of: 1) monthly grab samples at nine sites; 2) quarterly sampling of benthic macroinvertebrates at four sites; and, 3) continuous (hourly) monitoring, using water quality sondes, at two sites (DRI, 2011). The TMWRF monitoring program is largely driven by NPDES discharge permit requirements.

Since the late 1960's, DRI has conducted baseline water quality monitoring in the Truckee River Basin (DRI, 2011). Up until the late 1980's, the program consisted of over 30 sites on the main-stem and tributaries. In 2010 the collection program consisted of sample collection at six sites in California and three in Nevada. In the past, DRI's Truckee River Monitoring Program (TRMP) has been funded by the United States Environmental Protection Agency (USEPA) and the Nevada System of Higher Education (NSHE). The primary objective of DRI's existing TRMP is to

provide ambient water quality data to several stakeholders in the Truckee River Basin (DRI, 2010).

Starting this year (2012), a large portion of the water quality monitoring efforts have been conducted by DRI. In response to TMWRF and NSHE budget shortfalls, DRI was awarded grant funds to conduct monitoring on the Truckee River at some of the sites that were scheduled to be discontinued for budget reasons. The new Integrated Water Quality Monitoring Plan encompasses much of the historic DRI program along with key elements from the TMWRF program. The monitoring program consists of four basic components: 1) review of historic river data collected on the main-stem Truckee; 2) monthly "grab" samples at 13 locations on the main-stem of the Truckee River; 3) maintenance of one continuous monitoring site at Marble Bluff Dam; and, 4) quarterly field collection of benthic macroinvertebrates at four sites on the main-stem. Grab samples are analyzed for most routine inorganic determinations and metals.

1.5 Document Organization

This Storm Water Monitoring and Sample Analysis Plan document is organized as follows:

- **Section 1 – Introduction**: Presented in Section 1 is an introduction to storm water management in the Truckee Meadows, a brief review of the existing storm water monitoring program, a summary of monitoring efforts on the Truckee River, and details of the document organization.

- **Section 2 – Storm Water Monitoring Activities**: Outlined in Section 2 are the goals and objectives of this monitoring and sampling plan. In this section is a description of the three different monitoring approaches – Tributary, Outfall and Special Studies – along with appropriate details of each program.

- **Section 3 – Methods and Procedures**: Presented in Section 3 is a description of the methods and procedures to be used in collecting samples. Outlined in this section are details pertaining to laboratory methods, sample identification, event preparation, sampling activities, field measurements, reporting, data handling and project quality control requirements.

- **Section 4 – References**: Presented in Section 4 is a listing of the various documents used and referenced in this document.

Appendices

- A – Outfall Descriptions
- B – Sampling Location Maps

Section 2 Storm Water Monitoring Activities

Significant efforts have been made in the past five years to deploy automatic samplers on the major tributaries to the Truckee River in order to characterize water quality during storm events. Capturing event runoff samples has been largely elusive; therefore, there is a lack of fundamental data with respect to where the significant discharges are and where resources need to be spent. The proposed approach described in this SAP is the "grab" sampling of storm water runoff from approximately 24 different sites (tributaries and outfalls) during rain events. Although the utility of grab samples is understood to be limited, the results can be used to identify problem areas and to better understand what is occurring within the MS4 permit area. The intention is to transition into automated sample collection as soon as practicable in priority locations. Data collected this year will drive next year's decisions and refine the approach to monitoring.

Presented in Section 2 is a description of the proposed storm water monitoring activities. Program goals and objectives have been established and three sampling programs developed to facilitate goal attainment. Presented in this section are the program goals and objectives, a tributary monitoring program, an outfall monitoring program, and a special studies program. Sampling procedures and methods are discussed in the next section of this document.

2.1 Storm Water Monitoring Goals

Results from a storm water monitoring program can be used to determine the effectiveness of control measures and BMPs and ultimately the success of the overall storm water management program (SWMP). Storm water quality sampling provides quantitative (i.e., numeric) data to determine the extent of pollutant concentrations in runoff. There are a variety of reasons that storm water sampling is important. After careful deliberation, the motivation and overall goal of the Truckee Meadows Storm Water Sampling Program is:

> *"Through monitoring, research and investigation, develop a better understanding of how runoff affects the receiving waters within the MS4 Permit area over time."*

In support of this overall program goal, four storm water monitoring objectives have been identified:

1. Continue to characterize the background and rain event water quality in the major tributaries to the Truckee;
2. Collect the data necessary to improve our understanding of storm water effects on the 303(d) and TMDL listed constituents;

3. Measure the background and rain event water quality in selected outfalls, catchments and land use types within the MS4 permit area;

4. Conduct special studies and investigations as the needs arise and funding is available to better understand storm water issues in the area.

Three different monitoring (sample collection) activities have been developed to accomplish the above objectives:

1. Tributary Monitoring;

2. Outfall Storm Event Monitoring.

3. Special Studies and Projects

Although not technically a monitoring program, the SWPCC has identified the desire and utility in conducting special studies and investigations as the needs arise and funding is available. At this time, no special studies are underway, however, special studies will be considered as the third component of the storm water monitoring program activities. Each of the three monitoring program activities will be described in the following subsections.

2.2 Tributary Monitoring

This monitoring effort very is similar to the tributary monitoring effort described in the 2010 SAP document. The SWPCC recommended continuing the existing tributary monitoring effort, collecting upstream and downstream samples on the six major tributaries, but modifying the sampling frequency, analytical parameters, and add storm event grab sampling. The Tributary Monitoring program has two components:

1. Semi-annual tributary sample collection (scheduled, dry weather)

2. Rain event grab sample collection (wet weather)

Both components involve grab sample collection at the same 12 sampling locations, but at different times. The semi-annual tributary sample collection can be scheduled, while the rain event grab sample collection cannot. Monitoring locations, sampling frequency, and analytical parameters are discussed in the following subsections. Methods and procedures are presented in Section 3 of this SAP document.

2.2.1 Sampling Locations – Tributaries

Under the direction of the SWPCC, staff members from the City of Reno and Washoe County have been collecting samples at 12 fixed sites on six tributaries to the Truckee River. The six tributaries are: Steamboat Creek, Whites Creek, Thomas Creek, Alum Creek, Chalk Creek, and the North Truckee Drain. The intent has been to establish an understanding of nonpoint source pollution entering waterways from urbanized areas, by bracketing development between

sample locations. Ideally, there is one sampling location upstream of urban development and one downstream (or within urban development) to identify changes that may be attributable to urbanization. These sites were selected on the basis of existing data, the need for additional data, representativeness of the entire watershed, and proximity to existing stream flow gage equipment.

There are two exceptions to the goal of bracketing urbanized areas between sampling sites. The first exception is Chalk Creek, which is an ephemeral stream which has transitioned to perennial flows in its lower reaches within the past few decades. The area above development and partially downstream through some residential areas remains ephemeral in nature and does not allow for an upstream sample on a regular basis. Steamboat Creek is the second exception, which has three sampling points. In order to better differentiate inputs to Steamboat Creek, a third sampling location at "the narrows" was added in 2010. Geothermal activity in the Steamboat Creek watershed impacts the creek's water quality. The 12 monitoring locations along with the water quality parameters to be monitored, frequency and the stream flow measurement requirements are summarized in Table 2-1. A map showing the location of the Tributary Monitoring sites is included as Figure B-1 in Appendix B of this SAP document.

Table 2-1. Overview of the Tributary Monitoring Effort

Task, Item or Activity	Description
Sampling Site	1. Steamboat Creek @ Rhodes Road 2. Steamboat Creek @ the Narrows 3. Steamboat Creek @ Clean Water Way 4. Whites Creek @ Timberline Dr. 5. Whites Creek @ Old Virginia Hwy 6. Thomas Creek @ Timberline Dr. 7. Thomas Creek @ S. Meadows Pkwy 8. North Truckee Drain @ Orr Ditch 9. North Truckee Drain @ Kleppe Ln. 10. Chalk Creek @ Chalk Bluff 11. Alum Creek @ Steamboat Ditch 12. Alum Creek @ Truckee River
Sample Type	Grab
Sampling Frequency	2/year, scheduled (non-rain event) and 2/year, unscheduled (rain events)
Standard Analytical Parameters	TDS, TSS, TP, OP, TN and Field WQ (Temp, EC, pH, DO, Turbidity)
Additional Site Specific Parameters	Steamboat Creek @ Rhodes Road – E. Coli Whites Creek @ Timberline Dr. – E. Coli Whites Creek @ Old Virginia Hwy – E. Coli Alum Creek @ Steamboat Ditch – E. Coli Alum Creek @ Truckee River – E. Coli Chalk Creek @ Chalk Bluff – NO3
Flow Measurement	Yes (where possible)

2.2.2 Water Quality Parameters – Tributaries

Water quality parameters to be monitored include both laboratory and field measurements. Field measurements of water temperature (temp), electrical conductivity (EC), pH, dissolved oxygen (DO), and turbidity (turb) will be performed at all sampling sites during all sampling events (rain and non-rain events). Laboratory parameters to be measured will vary by sampling site. As listed in Table 2-1, there are both standard and site specific analytes. Samples will be collected for the standard analytical parameters at the sampling sites during sampling events (rain and non-rain events). Some of the tributaries are noted in Nevada's 303(d) list as impaired for E. Coli and Nitrate (NO3), selected constituents will be added to the analytical list for Steamboat Creek (at Rhodes Rd.), Whites, Alum, and Chalk Creek (see Table 2-1).

2.2.3 Flow Measurement – Tributaries

Where possible, stream flow rate at the time of sample collection will be measured or recorded. Several of the tributaries have stream flow gages in the vicinity. Chalk Creek has a weir at its sampling location. Many of the sampling sites require measuring the flow rate manually using a portable velocity meter and measuring the channel geometry. Tributary sampling locations and flow collection method are summarized in Table 2-2. It is anticipated that during rain events the tributaries may be rain swollen. Flow will be measured at the time of sample collection only when conditions safely allow.

Table 2-2. Tributary Sampling Locations and Flow Measurement Method

Tributary	Sampling Location	Upstream/ Downstream	Gage?	Flow Measurement	Owner	Future
Steamboat Creek	@ Rhodes	Upstream	Yes	USGS (Real Time)	TRFP	
	@ Narrows	Midstream	Yes	USGS (Real Time)	USGS	
	@ Clean Water Way	Downstream	Yes	USGS (Read Onsite)	WCDWR/ TMWA	
Whites Creek	@ Timberline	Upstream	Yes	Real Time	Washoe County	
	@ Old Virginia	Downstream	No	Manual		
Thomas Creek	@ Timberline	Upstream	No	Manual		TRFP future Gage install?
	@ S. Meadows	Downstream	No	Manual	Washoe County	
N. Truckee Drain	@ Orr Ditch	Upstream	Yes	USGS (Real Time)	TRFP	
	@ Kleppe	Downstream	Yes	USGS (Read Onsite)	Sparks	Abandon or relocate in the next few years
Chalk Creek	@ Chalk Bluff	Downstream	No	Weir	Reno	
Alum Creek	@ Steamboat Ditch	Upstream	No	Manual		
	@ Truckee River	Downstream	Yes	Weir or Manual	UNR	

2.2.4 Sampling Frequency – Tributaries

It is the intention of this SAP to collect two storm and two non-storm event samples at each of the 12 locations listed in Table 2-1 each year. Local precipitation records indicate that the "wet season" in the Truckee Meadows is between November and May, and the "dry season" is between June and October. Depending on the year, some of the tributaries may be dry or hardly flowing. For the non-rain event sampling a winter sample will be collected sometime in February and a summer sample sometime in August each year. Rain event samples will be collected when possible during active, rain related discharge. Sampling frequencies (two storm and two non-storm event samples) are targets. Every effort will be made to collect these samples, however, the lack of rain or dry tributaries may prevent collection.

2.2.5 Future Modifications and Changes – Tributaries

There are several anticipated changes or refinements to this tributary monitoring component of the SAP. Future changes to the SAP will be provided to NDEP each October 1st each year as required by the Permit. Some of the anticipated refinements are important and will be phased in as soon as practical. Two such anticipated refinements to the Tributary Monitoring Program are:

1. The SWPCC recognizes that grab sample collection for storm water monitoring is not optimal. Little is known about the water quality in these 12 tributaries during rain events. Grab sampling makes it possible to collect a lot of data quickly and efficiently. Grab samples will provide a snapshot of water quality in the 6 important tributaries and perhaps illuminate troublesome watersheds or areas with higher contaminant loading. However, as monitoring progresses this sampling season, the field team will consider where and how best to incorporate automatic samplers in the subsequent years. Based on the results of the grab samples and field observations, some of the tributary sites may be considered for permanent sampling locations so that ultimately Event Mean Concentrations (EMCs) can be measured.

2. The co-permittees are required by the Permit to "evaluate whether stormwater discharges from any part of the MS4 contributes directly or indirectly to the listing of a waterbody on the most current 303(d) list (i.e., impaired waterbody)". The addition of E. Coli and nitrate to the analyte list in Table 2-1 was to provide insight on the changes in concentration during rain events so that an evaluation can be made. It is expected that after one year of monitoring, this question can be answered and sample collection for E. Coli and nitrate discontinued.

2.3 Outfall Storm Event Monitoring

Under this program, grab samples will be collected from 10 outfalls within the MS4 Permit area during rain events. The objective of this effort is to provide a snapshot of water quality in the water being discharged. The 10 outfalls to be monitored this year were selected by Reno, Sparks and Washoe county staff based on size, location, land use and the drainage size. Outfall locations, sampling frequency, and analytical parameters are summarized in Table 2-3 and

discussed in the following subsections. Methods and procedures to be used are presented in Section 3 of this SAP document. A map showing the location of the outfalls is presented as Figure B-2 in Appendix B of this SAP document.

Table 2-3. Overview of the Outfall Monitoring Effort

Task, Item or Activity	Description
Outfall Name	1. Alum Creek at Chrissie Caughlin Park 2. Oxbow Nature Park 3. Dickerson Road 4. Vine and Second 5. Arlington (South) 6. Fisherman's Park II 7. Paradise Pond/Galletti Way 8. Mary Wahl Ditch 9. Cottonwood Park (west) 10. Greg Street (East)
Sample Type	Grab (during rain events)
Sampling Frequency	Target 2/year
Standard Analytical Parameters	TDS, TSS, TP, OP, TN, NO3, E. Coli Field WQ (Temp, EC, pH, DO, Turbidity)
Flow Measurement	Were possible and safe, otherwise visual estimates only

2.3.1 Sampling Locations – Outfalls

Historically, each year staff members from the Cities of Reno and Sparks perform a "river walk" inspecting the condition of the storm water outfalls to the Truckee River. The Cities maintain records of their observations, photographs and GPS locations of each outfall. Using this data, staff reviewed these outfalls and selected 10 for monitoring this year (3 in Sparks, and 7 in Reno, with one falling largely in the jurisdiction of the County). Outfalls not selected for monitoring this year will be placed on a list for future monitoring. A detailed description of the outfalls to be monitored this year is presented in Appendix A (Outfall Descriptions).

The outfalls selected for monitoring this year range from 36 to 72 inch diameter pipes, 3 by 6 foot box culverts, a creek and one drainage ditch. For many of the outfalls, it is unlikely that samples can be collected right at the discharge to the Truckee during rain events. The outfalls have been studied and scouted and the sampling points have been identified and listed in Appendix A. For many of the outfalls, the sampling location is the first manhole upstream of the discharge point to the Truckee River. At this time, it is expected that all 10 of the outfalls can be safely sampled at the points described in Appendix A. Every effort will be made to collect the outfall rain-event samples described in this SAP. In the event that unforeseen obstacles or the lack of precipitation prevents sample collection, NDEP will be notified and the issues described in the Annual Report to NDEP.

2.3.2 Water Quality Parameters – Outfalls

Water quality parameters to be monitored include both laboratory and field measurements. Field measurements include the usual suite of temp, EC, pH, DO, and turbidity determinations. Laboratory parameters to be measured will be the same for all samples. Laboratory parameters to be monitored are listed in Table 2-3.

2.3.3 Flow Measurement – Outfalls

It is desirable to know the flow rate of the outfalls at the time of sampling. Where possible, the flow rate will be measured using a portable velocity, top-setting wading rod and a tape measure. However, many of the sampling locations are manholes and do not allow for direct flow measurement. At other outfall sites the ability to safely measure flow rate is doubtful. Therefore, only a visual estimation of flow rate at the outfall sampling sites is required under this SAP.

2.3.4 Sampling Frequency – Outfalls

Storm water samples from the outfalls listed in Table 2-3 and described in Appendix A are to be collected during periods of active storm event driven discharge (note that some of the outfalls may discharge during non-rain events) . An attempt to collect the "first flush" for each outfall will be made so that the assumed "worst case" may be assessed. The target effort is to collect samples two times per year (different storms). This level of sampling may not be possible due to dry weather or other site constraints. Ideally, after a successful sampling of a storm event, a dry period of 10 days should occur before another storm event is sampled. This guideline of waiting 10 days between storms may be waved due to calendar restrictions (i.e., late in the sampling season and the need for two observations), previous success, the long term weather forecast, and other professional judgment.

2.3.5 Future Modifications and Changes – Outfalls

There are several anticipated changes or optimizations to this outfall monitoring effort. Sample results and field observations are expected to largely guide future decisions. In the event that this first year sample collection effort shows that particular outfalls (or drainage areas) are troublesome (from a flow or water quality perspective), additional resources or sampling activities may be allocated in the following year. As required by the Permit, NDEP will be notified of any changes and an updated SAP document submitted each October 1st. A few of the anticipated enhancements are listed below.

1. If the data indicates that a particular outfall is the source of excessive pollution, the sampling effort in the following year will likely be modified to collect samples upstream in an effort to identify the areas of significant contributions or loading.

2. If the data collected this year indicates that a particular outfall is responsible for only minor pollutant contributions, monitoring of that outfall may be discontinued and a new outfall selected.

3. Some of the 10 outfalls selected may discharge during dry weather. In this event, consideration will be given to collect samples to characterize the non-rain event water quality.

4. As monitoring progresses this sampling season, the field team will consider where and how best to incorporate automatic sampling and flow rate measurement in the following years.

5. Over time, it is anticipated that outfall sampling will progress up the various catchments and branches, ultimately allowing for the storm water quality characterization of various land use types within the MS4 permit area.

2.4 Special Studies and Projects

Over the past years, numerous special projects have been conducted to improve runoff water quality within the MS4 permit area. These projects have provided valuable insight and have improved the public's understanding of local water quality. The SWPCC has identified the desire to continue special studies and investigations as the needs arise and money is available. Example studies and projects include:

- Characterize the inflows and tributaries to Steamboat Creek
- Monitor the influx of boron and/or E. Coli to Steamboat Creek
- Alum Creek watershed characterization study
- Sparks Marina inflow study
- First flush study
- Boynton Slough watershed characterization study

A listing of desirable projects will be maintained by the SWPCC. Each year an effort will be made to apply for grant funding for new projects to improve the overall understanding of local storm water related issues and solutions.

Section 3 Methods and Procedures

Details relating to sampling, analysis, handling, reporting of program samples and data are presented in this Section. Field and laboratory methods for data collection are specified. Also in this section are the data quality objectives and quality assurance (QA) procedures in place to assure that the data collected are of high quality and form the basis of sound decisions.

3.1 Sample and Analysis Requirements

The procedures and methods used to collect, process, measure and deliver samples to the laboratory are important steps in insuring that high quality data are collected. In the following subsections, laboratory requirements, analytical methodology, sampling containers and approved holding times are specified.

3.1.1 Laboratory Selection

Section V.A.2.c.v of the Permit specifies that laboratory analyses be performed by a State of Nevada-certified laboratory. At this time, a laboratory has not been selected. It is the desire to select a single laboratory to provide services for the entire monitoring season.

3.1.2 Analytical Methods

Section V.A.2.b of the Permit requires that any samples submitted for laboratory analysis be analyzed using EPA approved methodology. Required analytical for both field and laboratory determinations are listed in Table 3-1. Methods listed were supplied by Alpha Analytical, inc., of Reno Nevada. For several of the required parameters listed in Table 3-1 there are multiple approved analytical methods. The selected support laboratory may submit alternate methodologies (than those specified in Table 3-1) to the SWPCC for approval.

3.1.3 Sample Containers and Preservatives

Required sampling containers vary with the parameter(s) being tested. The volume required, container material and preservative differ by analytical parameter. For this sampling effort, the required sampling container type (i.e. plastic or glass), minimum sample volume and the required preservative are listed in Table 3-1. Sample containers are to be supplied by the contract laboratory and certified as “clean” by the laboratory or manufacturer.

Table 3-1. Analytical Parameters, Abbreviations, Reporting Limits, Analytical Methods, Containers, Sample Volume, Preservative and Holding Times

Parameter (Field)	Abbreviation	Units	Reporting Limit[a]	Analytical Method[b]	Container Material	Volume Required	Preservative	Holding Time
Electrical Conductance	EC	µmho/cm	1	EPA 120.1	N/A (Direct)	N/A[f] (Direct)	None (Field)	None
pH	pH	S.U.[e]	0.1	EPA 150.1	N/A (Direct)	N/A (Direct)	None (Field)	None
Turbidity	Turb	NTU	0.1	EPA 180.1	N/A (Direct)	N/A (Direct)	None (Field)	None
Temperature	Temp	°C	1	EPA 170.1	N/A (Direct)	N/A (Direct)	None (Field)	None
Dissolved Oxygen	DO	mg/L	0.1	EPA 360.1	N/A (Direct)	N/A (Direct)	None (Field)	None
Parameter (Laboratory)	**Abbreviation**	**Units**	**Reporting Limit**	**Analytical Method[c]**	**Container Material**	**Volume Required**	**Preservative**	**Holding Time**
Total Dissolved Solids	TDS	mg/L	1	SM 2540C	Poly[d]	1000 mL	< 4 ºC	7 days
Total Suspended Solids	TSS	mg/L	1	SM 2540D	Poly	1000 mL	< 4 ºC	7 days
Nitrate Nitrogen	NO_3	mg-N/L	0.1	EPA 300.0	Poly	200 mL	Sulfuric Acid	28 days
Total Nitrogen	TN	mg-N/L	0.1	EPA 351.3	Poly	500 mL	Sulfuric Acid	28 days
Total Phosphorus	TP	mg-P/L	0.03	EPA 365.3	Poly	500 mL	Sulfuric Acid	28 days
Ortho-Phosphate	OP	mg-P/L	0.03	EPA 300.0	Poly	200 mL	< 4 ºC	48 hours
E. Coli	E. Coli	Col/100mL[g]	P/A[h]	EPA 1603	Poly (Sterile)	200-500 mL	< 4 ºC[i]	8 hours

Notes

[a] Required laboratory reporting limit. For the field determinations the reporting limit refers to required instrument resolution
[b] To the extent possible, EPA methodology will be followed in the field
[c] Analytical Method reference courtesy of Alpha Analytical, Inc.; EPA = EPA Methods for Water Analysis, SM = Standard Methods for the Examination of Water and Wastewater
[d] Poly = plastic, linear polyethylene
[e] S.U. = Standard Units
[f] N/A = Not Applicable for this determination
[g] Colonies per 100 mL of sample
[h] P/A = Presence or absence with enumeration
[i] De-chlorination (thiosulfate) not required

3.1.4 Holding Times

Each analytical parameter has an approved holding time. Holding times are calculated from the time of sample collection to the beginning of analysis in the laboratory. Project holding times are listed in Table 3-1.

3.2 Sample Identification

All samples collected must be clearly labeled with the appropriate information. The sample identification numbering format needs to be consistent throughout the monitoring season. These requirements are specified in this sub-section.

3.2.1 Sample Identification, Labeling and Bottle Sets

The Truckee River Coordinated Monitoring Program recommends a naming convention of "River Name at/below Geographic Name" (The Truckee River Memorandum of Understanding Group, 2010). Both Tributary and Outfall monitoring efforts will follow this sample naming convention. Sample site identification for the Tributary Monitoring effort is shown in Table 3-2 and Table 3-3 for the Outfall Monitoring effort. Site abbreviations listed are subject to revision.

Bottle sets will be pre-assembled prior to field sampling events. Sample bottles will have pre-affixed labels. Labels will have a blank for the sampling crew to write in, the sample location, sampler's name, date, time and any preservative. As a function of the analytical parameters, the required sample bottle sets consist of two or three different containers per sampling location. Required sample bottle sets are shown in Tables 3-2 and 3-3.

Table 3-2. Sample Identification and Bottle Requirements for the Tributary Monitoring Effort

Sample Site Identification		Laboratory Determinations	Sampling Container
Sample ID	**Abbreviation**		
Steamboat Creek @ the Narrows Steamboat Creek @ Clean Water Way Thomas Creek @ Timberline Dr. Thomas Creek @ S. Meadows Pkwy North Truckee Drain @ Orr Ditch North Truckee Drain @ Kleppe Ln.	SBC@NAR SBC@CWW TC@TLD TC@SMP NDT@ORD NTD@KLP	TDS, TSS, OP	2000 mL poly, no-preservative
		TP, TN	1000 mL poly, H_2SO_4
Steamboat Creek @ Rhodes Road Whites Creek @ Timberline Dr. Whites Creek @ Old Virginia Hwy Alum Creek @ Steamboat Ditch Alum Creek @ Truckee River	SBC@RHR WC@TLD WC@OVH AC@SBC AC@TR	TDS, TSS, OP	2000 mL poly, no-preservative
		TP, TN	1000 mL poly, H_2SO_4
		E. Coli	500 mL poly, sterile
Chalk Creek @ Chalk Bluff	CR@CB	TDS, TSS, OP	2000 mL poly, no-preservative
		TP, TN, NO3	1000 mL poly, H_2SO_4

Table 3-3. Sample Site Identification & Bottle Set Requirements for the Outfall Monitoring Effort

Sample Site Identification		Laboratory Determinations	Sampling Container
Outfall	**ID Number**		
Alum Creek at Chrissie Caughlin Park	E-25	TDS, TSS, OP	2000 mL poly, no-preservative
Oxbow Nature Park	C-24		
Dickerson Road	C-22		
Vine and Second	D-19	TP, TN, NO3	1000 mL poly, H_2SO_4
Arlington (South)	H-19		
Fisherman's Park II	D-16		
Paradise Park/Galletti Way	C-15		
Mary Wahl Ditch	SDOE-008936	E. Coli	500 poly, sterile
Cottonwood Park (west)	SDOE-008957		
Greg Street (East)	SDOE-008960		

3.2.2 Sample Count

Sample collection frequency for the Tributary and Outfall Monitoring efforts was described in Sections 2.2.4 and 2.3.3, respectively. For the Tributary Monitoring Effort, the required laboratory analytical suite varies by the sampling location (see Table 2-1). Presented in Table 3-4 is a breakdown of the number of samples to be collected (targeted) under this SAP by monitoring effort and analytical suite. The number of sampling events per year is a target value, since they depend on rain events and flowing water. Note that the number of samples to be collected includes the addition of QC samples (see Section 3.6).

Table 3-4. Estimated Number of Samples to be Collected by Monitoring Effort

Monitoring Effort	Sampling Events per Year	Number of Sampling Sites	Laboratory Parameters	Total Sample Count
Tributaries – Dry Weather	2	6	TDS, TSS, OP, TN, TP	12
	2	5	TDS, TSS, OP, TN, TP, E. Coli	10
	2	1	TDS, TSS, OP, TN, TP, NO3	2
	2	2	QC Samples: Field duplicate & blank TDS, TSS, OP, TN, TP, NO3, E. Coli	4
Tributaries – Wet Weather	2	6	TDS, TSS, OP, TN, TP	12
	2	5	TDS, TSS, OP, TN, TP, E. Coli	10
	2	1	TDS, TSS, OP, TN, TP, NO3	2
Outfalls	2	10	TDS, TSS, OP, TN, TP, NO3, E. Coli	40
	2	2	QC Samples: Field duplicate & blank TDS, TSS, OP, TN, TP, NO3, E. Coli	4
			Total Number of Samples =	76

3.2.3 Chain-of-Custody Forms

To assist in tracking and maintaining sample integrity, of the samples collected and handled will be under proper chain-of-custody (C-of-C) procedures. The C-of-C forms will be supplied by the laboratory and are to be signed by the sampler at the time the samples are transferred into the custody of the laboratory. The sampling team will retain a copy of the C-of-C form. The form is the primary mechanism to instruct the laboratory what determinations are to be made, the samples ID, any special notes, data and times collected and the contact person.

3.3 Event Preparation

The sampling team will closely track weather systems and be as ready as possible. Because of the unpredictability of rainfall, it is critical that all necessary preparations (bottles, coolers, labels, data sheets, and equipment) are made prior to storm water collection. Outlined in this sub-section are the requirements for weather tracking, project communications, equipment, and logistical preparations to be made prior to sampling.

3.3.1 Storm Event Tracking

Storm events will be tracked by the sampling team using a variety of resources. Resources to be used include National Weather Service Broadcasts, local weather television, radio forecasts, internet real-time rain gauges, and other contacts in the Truckee Meadows. At this time, a subscription to a commercial monitoring and forecast service is not anticipated. As a candidate storm approaches, radar observations and rainfall totals in the outlying (preceding) areas will be monitored. The sampling team leader will make the determination for mobilization.

Often, rain events in the Truckee Meadows are spotty and location specific. It is conceivable that storm event sample collection may be equally spotty, with rain event sampling possible at only a few of the selected sites. Every effort will be made to collect the samples described in this plan. As a function of season, rainfall intensity and antecedent soil moisture, no minimum rainfall amount has been established for samples collection efforts to proceed.

3.3.2 Communication Plan

At this time it is not known if sampling will be conducted by City/County staff, a contractor, or both. Once the team is identified, a team leader will be selected and a call list assembled. The call list will include telephone numbers and email address for the sampling team, Reno, Sparks and Washoe County personnel and contacts at the analytical laboratory.

3.3.3 Pre-Event Preparation

Pre-run tasks include supply acquisition, inventories, equipment maintenance, gathering and labeling sample bottle and various other tasks. Items to gather in advance include safety equipment, bottles, sampling arms, rope, portable instruments, ice chests, data sheets, and markers. If possible, a day before an anticipated sampling event the field instruments can be pre-calibrated and the coolers and equipment loaded. Some of the information on the C-of-C forms can be filled out in advance (site ID, analytical parameters, etc.).

3.3.4 Field Equipment Calibration

All field instruments and meters will be calibrated and maintained in accordance with the manufacturer's instruction and approved EPA methods. A record of calibration activities will be kept of both the pre and post-calibration activities.

3.3.5 Data Sheets

Data sheets will be created for both field and office use. Section V.A.2.c of the permit specifies that monitoring records must include:

> V.A.2.c.i The date, exact place, and time of sampling or measurements;
> V.A.2.c.ii The names(s) of the individual(s) who performed the sampling or measurements;
> V.A.2.c.iii The date(s) analyses were performed;
> V.A.2.c.iv The name(s) of the individual(s) who performed the analyses;
> V.A.2.c.v The analytical techniques or methods used; and
> V.A.2.c.vi The results of such analyses.

Data Sheets anticipated to be developed include pages for:

1. Field Water Quality Readings
2. Stream Flow Record
3. Visual Observations
4. Instrument Calibration Worksheet

3.4 Sampling Event Activities

The methods and procedures used to collect, measure, process and deliver samples to the laboratories are important in ensuring that high quality data are collected. In the following subsections, sample collection, handling, processing, documentation and transport are outlined.

3.4.1 Grab Sampling

At this time, all samples collected will be grab samples. Depending on the nature and location of the outfall or the flow in the tributary being sampled, direct immersion of the sampling containers is likely not possible. A surrogate sample container or device may be used to collect a sample and then to fill the sample bottles. Surrogate containers may be a bucket on a rope, a bottle on the end of a pole, or possibly a portable pump and hose. In all cases, the surrogate container will be triple rinsed with the water being sampled before a sample is collected. The sample in the surrogate container will be carefully mixed while filling the sampling bottles.

All personnel involved with sample collection will wear gloves and be trained on approved sampling methodologies. Sample bottles received from the laboratory are certified as "clean" and do not require rinsing with the sample being collected. Only one of the sampling containers contains a preservative (sulfuric acid (H_2SO_4) for the preservation of TN, TP and nitrate). Care is required when filling this bottle so as not to overfill and dilute the concentration of the

preservative. Depending on the preference and experience of the sampling team, the sulfuric acid preservative can be added to the container by the field team after filling using a dropper bottle. No field filtration is required.

3.4.2 Sample Processing

Upon collection, samples will immediately be placed into a cooler and the lid closed. All samples will be kept on ice until delivery to the laboratory. Ice will be checked and replaced regularly to ensure that the samples are maintained as close to 4°C as possible. Importantly, a closed ice chest limits sample exposure to sunlight (especially important for E. Coli samples).

3.4.3 Visual Observations

In addition to sample collection, the sampling team is required to make visual observations and notes at each of the sampling sites. Flow rate of the discharge needs to be estimated by the team. Some typical observations of the runoff itself include the presence of floating and suspended materials, oil and grease, discoloration, turbidity, odor, or foam. The data sheet will include space for recording the date, time and location of the observations along with the names of the personnel performing the inspection. Where possible, photographs will be taken.

3.4.4 Field Measurements

Field water quality (WQ) measurements of temperature, pH, conductivity turbidity and dissolved oxygen will be recorded at the time of sampling. As previously described, sample collection may entail the use of a surrogate container. Field chemistry determinations will be made from a portion removed from the same bucket, after the laboratory samples have been collected. Dissolved oxygen determination will be made first, so that the contents can be mixed prior to turbidity determinations.

Where possible, for continuity in measurement technique, one team member will be given the primary responsibility of conducting the field WQ measurements. That person is responsible for ensuring all instruments are calibrated, that calibration is checked and verified throughout the day, and that all samples have been measured and recorded accurately. These measurements, as well as the calibration record, will be recorded on the Field WQ Data Sheet.

Included in the routine analysis of field WQ samples is the analysis of a field duplicate. Samples sent to the laboratory as field duplicates will be processed in duplicate in the field. QC samples will be discussed in detail in Section 3.6.

3.4.5 Data Recording and Handling

Field data and observations will be recorded on individual, pre-printed data sheets (see 3.3.5). The required sheets for each site will be pre-assembled and placed in an envelope. Upon arriving at each site, one set of blank sheets will be removed from the envelope and placed on a clipboard. This is necessary because the weather is expected to be poor and the data sheets will likely get wet. Upon return to the vehicle the sheets will be placed into a second envelope. When the sampling day has concluded the care of the field data sheets has the highest priority

of care. As soon as possible, the raw field data sheets will be scanned and the originals carefully filed. File management of the sampling records includes a complete electronic backup of the raw and working files.

3.4.6 Sample Transport and Chain-of-Custody Forms

Samples will be delivered to the laboratory by the sampling team and kept on ice until they are surrendered into laboratory custody. Throughout the day, the sampling team will be providing periodic updates to the contract laboratory and making any necessary logistical arrangements. E. Coli samples must be delivered to the laboratory the same day they are collected and with sufficient time for the laboratory to process (8 hour holding time). Therefore, sample sites requiring E. Coli determinations should be scheduled first and delivered early. All other samples can be held overnight (at <4°C) if need be and if proper custody can be maintained.

Chain-of-custody forms have spaces for the documentation of sampling date, sample identification, preservative and analyses required for each sample set. A copy of the completed C-of-C form will be retained by the sampling team once the laboratory receiving clerk has signed.

3.5 Post Event Activities

Post sampling event activities include ensuring the documentation is in order (data sheets scanned, data entered, photographs downloaded, etc.), field equipment post calibration is performed, instruments and equipment are cleaned and maintained. Annual monitoring reports are required to be submitted annually to NDEP (as part of the Truckee Meadows Storm Water Program Annual Report). The reporting requirement has yet to be fully defined. Post sampling event activities also include data validation and QC activities that are discussed in Section 3.6.

3.5.1 Post Event Report

At the conclusion of a sampling event the sampling team will put together a brief post-event report. The report will include the names of the individuals performing the work, dates, times, and any important observations. The report is to include precipitation data (time and amount) and if possible flow data and hydrographs from selected gages. The data does not need to be analyzed, but simply gathered and placed in the project directory while the activities and observations are still recent.

3.5.2 Field Equipment Post-Calibration

Field instruments will be calibrated before, during (calibration check) and after use in the field. The post sampling event calibration should be conducted as soon as possible following sampling activities. All calibration activities will be recorded and the records kept. After calibration, the instruments and equipment (buckets and sampling devices) should be cleaned and decontaminated.

3.5.3 Data Handling

As soon as possible following a sampling event, the data from the field sheets should be entered into a single Excel file so that any changes or critical observations at a particular site are apparent. All files and sheets should be consolidated into a single directory and filed accordingly. Post sampling event activities include ensuring that the documentation is in order (data sheets scanned, data entered, photographs downloaded, etc.). Post event data handling records include making back up and duplicate records. Both electronic and paper duplicates should be maintained.

3.5.4 Reporting

The nature and content of the reporting obligations for the storm water monitoring activities described in this document have yet to be fully defined. If city staff members are responsible for monitoring, the monitoring report will likely be a section in the Annual Report to NDEP. If a consultant or contractor is responsible for monitoring, the reports will likely be event based, with monthly SWPCC updates and a final report.

Regardless of the sampling team, an annual written monitoring summary should be prepared and all field and laboratory results summarized in tables and graphs. Any trends or trouble areas should be noted, with a proposed action plan for consideration for the following monitoring season.

3.6 QA/QC Project Plan

Presented in the following subsection are the quality control/quality assurance (QA/QC) requirements associated with both field and laboratory activities. Field QC samples are collected (blanks and duplicates) and the results used to evaluate potential contamination and sampling handling issues. Laboratory QC activities provide information needed to assess data precision, accuracy and potential sample contamination. Outlined in this section are the recommended monitoring program QC activities including data assessment and validation.

3.6.1 Field QC Activities

Field quality assurance for this project includes the following:

- Use of experienced sampling team trained in the procedures to be followed;
- Adherence to approved methods and procedures;
- Calibration of field equipment and instruments;
- Field analysis of duplicates and reference materials (portable meters);
- Complete documentation of sampling and observations;
- The collection of duplicate samples and field blanks for laboratory analysis.

Field QA/QC checks will include the collection and analysis of field equipment duplicate determinations and calibration checks and the collection of field duplicates and bottle blanks. No field equipment blank sample preparation and trip blanks are planned at this time. Field QC samples are routinely submitted “blind” to the laboratory (no special markings on the sample

bottle labels or the C-of-C form to indicate the nature of the sample). Important field QC sample types and activities are presented and defined below.

Field Equipment Duplicate Determinations. A field duplicate is the measurement (using all of the different portable meters) of the same sample twice. The normal sample measurement progression is to be followed (i.e. measure DO and Temp first, followed Turbidity, pH and EC) and then repeated. At least one field duplicate should be collected each sampling event. Feedback will be used to assess analytical variability attributable to collection, technique and instrument variability.

Reference Material Calibration Checks. A reference material is a calibration solution from a source different than the solutions used for calibration. At least once a day in the field the calibration of the portable instruments should be checked using a commercially available reference material and the value recorded. Reference materials are available for verifying pH, EC and turbidity readings (there are no reference materials for DO and temperature).

Field Duplicate Samples. At least twice during the monitoring season a duplicate sample is to be collected and submitted to the laboratory. Field duplicates allow for the assessment of precision in both the field and laboratory activities.

Bottle Blanks. Bottle blanks are prepared by pouring de-ionized water directly into the sample containers, without the use of a secondary container. Both the bottles and the de-ionized water will be obtained from the contract laboratory. Bottle blanks are to be prepared twice per monitoring season. Bottle blanks allow evaluation of the contract laboratory clean procedures and verifies that the bottles obtained from the laboratory are clean and free from contamination.

3.6.2 Laboratory QC Activities

Commercial laboratories routinely integrate a number of QC checks in each determination. As part of the data assessment, this information will be requested and reviewed alongside the analytical results. In selecting the laboratory, a review of their QC program will be made by the sampling team.

As a minimum, the lab analytical quality assurance will include the following:

- Employing analytical chemists trained in the procedures to be followed;
- Adherence to documented procedures and methods (see Section 3.1.1);
- Strict adherence to a ELAP/NELP approved QA/QC program;
- Calibration of analytical instruments; and
- Complete documentation of sample tracking and analysis.

Routine laboratory QC checks must include the use of laboratory generated duplicates, method blanks, matrix spikes/matrix spike duplicates (MS/MSDs), and laboratory control samples (LCSs). These QA/QC requirements are discussed below.

Laboratory Duplicates. The laboratory will generate and analyze a laboratory replicate (duplicate or laboratory split) approximately every 10 samples processed (typical). Replicate analyses results are evaluated by calculating the relative percent difference (RPD) between the two sets of results. This statistic is typically the basis for the assessment of laboratory precision. The result must fall within the laboratory's self-generated upper and lower control limits. For this project, the reports will be reviewed to insured that the duplicate results fall within these control limits.

Method Blanks. The laboratory will run method blanks to determine the level of contamination associated with laboratory reagents and equipment. A method blank is a sample of a known matrix that has been subjected to the same complete analytical procedure as the submitted sample to determine if contamination has been introduced into the samples during processing. Blank analysis results will be checked against reporting limits for the analytes. Results should be less than the reporting limits for each analyte.

Matrix Spikes/Matrix Spike Duplicate (MS/MSD). MS/MSDs are used to assess the accuracy and precision of the laboratory's analytical methods and to evaluate potential chemical interferences present in a particular batch of storm water. The laboratory prepares matrix spike samples by splitting off three aliquots of the environmental sample and adding known amounts of target analytes to two of the three environmental sample aliquots. The results of the un-spiked environmental sample are then compared to the MS sample analysis results, and "percent recovery" of each spike is calculated to determine the accuracy of the analysis. The results of the MS analyses are compared to the calculated RPD as an additional measure of analytical precision. The result must fall within the laboratory's self-generated upper and lower control limits. For this project, the reports will be reviewed to insured that the MS/MSD results fall within these control limits.

Laboratory Control Samples (Matrix Spikes). Laboratory control samples (LCSs) involve spiking known amounts of the analyte(s) of interest into a known, clean matrix to assess the matrix effect on spike recoveries. High or low recoveries of analyte(s) in the LCSs may be caused by interferences in the sample matrix. Laboratory control samples assess these possible matrix affects because the matrix used is known to be free from interferences. Typically, LCSs are analyzed at a frequency of one per batch of twenty or fewer samples. The result must fall within the laboratory's self-generated upper and lower control limits. For this project, the reports will be reviewed to insured that the MS/MSD results fall within these control limits.

3.6.3 Data Quality Objectives (DQOs)

Data collected must be of sufficient quality to support the project goals and objectives. Numeric data quality objectives (DQOs) have been established for both field and analytical laboratory data collected and evaluated under this SAP. Various assessments (outlined in the following sections) of the data will be made as soon as the data are reported. Data that are not of sufficient quality will still be included in the monitoring database but will be preceded by a flag, or "qualifier" code. The following DQO objectives have been established:

DQO for Holding Time. Laboratory analysis of samples must be performed within the approved holding time (as listed in Table 3-1). The numerical DQO for holding time attainment is 100 percent (i.e., 100 percent of the project samples must be analyzed within approved sample holding times). All laboratory reports must be reviewed for holding time compliance.

DQO for Reporting Limit. A fundamental DQO is that the laboratory can (and does) provide results of sufficient resolution (i.e. reporting limit) so that assessments can be made. Table 3-1 lists the required project reporting limits for each parameter. The DQO for compliance with established reporting limits is 100 percent. As the data are tabulated after each event, the reporting limits will be checked and verified. Prior to collecting any monitoring samples, the contract laboratory will be supplied with a list of required reporting limits.

Blank Contamination. Depending on the level, contamination of a field or laboratory blank may result in the qualification of the data and the loss of utility (i.e. how the data can be used and interpreted). So called "hits" in blank samples will be tabulated after each event. A DQO for blank contamination is that 95 percent of the blanks are below the laboratories practical quantitation limit (PQL).

Analytical DQOs for Precision and Accuracy. Listed in Table 3-5 are the numeric DQOs for field and laboratory duplicate and spikes (standard addition) determinations. These data quality objectives are based on those typically used. Control limits used by the contract laboratory will supersede the target values listed in Table 3.5. Precision can be assessed by replicate determinations such as matrix duplicates (MD), digestion duplicates, run duplicates, field duplicates and matrix spike duplicates (MSD). Accuracy can be measured by the use of standard reference materials (SRMs), laboratory control samples (LCS) and performance evaluation (PE) samples.

3.6.4 Data Assessments and Validation

The project team shall designate a team member to perform the QC review. The laboratory results will be reviewed for achieving the DQOs. The analytical review will consist of:

- Conformity with the C-of-C form;
- Completeness of laboratory data report;
- Holding times met;
- Blank contamination (field and method blanks);
- Analytical accuracy met (MS/MSD and LCS recoveries);
- Precision met (MSD and laboratory sample duplicate RPDs);

The laboratory will be requested to provide results in electronic format to minimize paper. A team designee will review the reports and maintain an electronic database (Excel). If blank contamination is present, holding times are exceeded, or other QC issues exist, the data will be evaluated and qualified according to USEPA data qualifier guidelines. Data qualifier will be included in the database, preceding the entry to indicate determinations outside of acceptable QA limits.

Table 3-5. Numerical Data Quality Objectives for Field and Laboratory QC Sample Analysis

Parameter	Units	Control Samples[a] (Confidence Interval)	Matrix Spikes[b] (% Recovery)	Matrix Duplicates (RPD)[c]
Conductivity – Field	μS	True ± 10%	N/A	10%
pH – Field	S.U.	True ± 10%	N/A	10%
Temperature – Field	°C	N/A	N/A	10%
Turbidity – Field	NTU	True ± 10%	N/A	10%
Dissolved Oxygen	mg/L	N/A	N/A	10%
TDS	mg/	85 – 120%	80 – 120%	15%
TSS	mg/L	80 – 120%	80 – 120%	20%
Nitrate Nitrogen	mg-N/L	80 – 120%	80 – 120%	20%
Total Nitrogen	mg-N/L	80 – 120%	80 – 120%	20%
Phosphorus, Total	mg-P/L	80 – 120%	80 – 120%	20%
Phosphorus, Ortho	mg-P/L	80 – 120%	80 – 120%	20%
E. Coli	Col/100 mL	N/A	N/A	50%

[a] Control samples include standard reference materials and laboratory control samples. Laboratory control limits can supersede this range.
[b] No samples will be spiked in the field
[c] RPD = Relative Percent Difference (RPD = (a-b)/((a+b)/2)*100 =, where a is the 1st data point and b the 2nd)
N/A Not Applicable

3.6.5 Data Qualifiers

Qualifier and reason codes issued to field and laboratory determinations for QC failures will preceded the entry in the data base. Abbreviations and qualifier codes to be used are summarized in Table 3.6. The use and issuance of data qualifiers is discussed in detail in EPA's Guidance on Environmental Data Verification and Data Validation (EPA, 2002).

As example, any samples analyzed outside of the specified holding times will be considered "estimated" and issued the "J" data qualifier and an "h" reason code. For blank contamination, the results in the database would be preceded by a "U" (anomalous) qualifier and a "w" reason code.

Table 3-6. Data Qualifiers and Reason Codes for use in the Monitoring Results Database

Qualifier Code	Reason Assigned
U	The analyte was analyzed for, but was not detected above the revised or elevated sample quantitation limit (background/blank contamination)
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample (duplicate imprecision)
UJ	The analyte was not detected above the revised/elevated quantitation limit (blank contamination) and the associated value is approximate (poor duplicate agreement).
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. No determinations or assessments are to be made with this observation.
A	Special note 1
B	Special note 2
Reason Code	**Reason Assigned**
c	Laboratory calibration failure; poor or unstable response
d	Laboratory duplicate or control sample imprecision
l	Laboratory control sample recovery failure
o	Laboratory blank contamination
h	Holding time violation
f	Field duplicate imprecision
w	Bottle blank contamination
x	Equipment blank contamination
y	Trip blank contamination
z	Method blank contamination
r	Result reported was above the specified reporting limit
t	Dissolved concentration significantly exceeded the total concentration

Section 4 References

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Appendix A Outfall Descriptions

Table A-1. Outfalls Selected to be Monitored Under this Program

Number	Outfall ID	Location
1	Reno E-25	Alum Creek at Chrissie Caughlin Park
2	Reno C-24	Oxbow Nature Park
3	Reno C-22	Dickerson Road
4	Reno D-19	Vine and Second
5	Reno H-19	Island Drive at Arlington Avenue
6	Reno D-16	Fisherman's Park II
7	Reno C-15	Paradise Pond/Galletti Way
8	Sparks SDOE-008936	Mary Wahl Ditch
9	Sparks SDOE-008957	Cottonwood Park (west)
10	Sparks SDOE-008960	Greg Street (East)

SAP Outfall Sampling Site #:	**1**
Site Name	Alum Creek at Chrissie Caughlin Park
Type	Natural drainage way
City/County Site Designation	Reno C-E25
Sampling Location	Alum Creek at the turf to wild-land transition, SW of the foot bridge on the west end of the lower portion of Chrissie Caughlin Park adjacent to the Truckee River.
Driving Directions to the Sampling Location	From Mayberry Drive (Reno, NV) turn north on River Run Parkway, right on Riverberry Drive, Left on Idlewild Drive and park in the Chrissie Caughlin Park parking lot. On foot, walk west on the Truckee River bike path, cross over the foot bridge and climb down to the creek to the left. See Figures A1-1 and A1-2
Sampling Site Coordinates (approx.)	Latitude: 39.510858 Longitude: -119.855553
General Drainage Area Description	Mixed residential, turf and undeveloped land
Sampling Access	Natural (unlined, i.e. earthen) creek (Alum) channel (See Figures A1-2 and A1-3)
Sampling method	The exact methods and procedures to be used for this site are a function of the size of the rain event and the corresponding flow rate of the creek. It is assumed that a sample can be collected using waders and hand held sampling bottles. In the event of high creek flow, a sample can be collected by lowering a bucket on a rope from the foot bridge
Flow Rate Estimation	This is one of a few outfall locations that flow rate can be measured using a portable velocity meter and tape measure stretched across the tributary if conditions are safe. Flow rate is to be measured using a portable velocity meter (Marsh McBirney or equivalent, and associated staff for depth measurements) and recording the channel width (i.e., geometry)
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list (and emergency call list)
Specialized Tools and Equipment	For this site, the tools and equipment are those typically associated with open channel flow (creek) sampling during rain events (i.e., high flow - waders, bucket, rope, surrogate sampling containers, mixing wands, tethered buckets/containers, rope, and telescoping-bottle-sampler devices)
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control at this site is not required. This is a public (city owned) sampling site. he general sampling precautions are those associated with high flow sampling activities (staff endangered with being swept downstream)
Site Specific Notes (keys, private property, approvals and credentials)	None. This sampling site is on public land (city park)
Other Notes	The primary precaution (identified at this time) is those associated with the collection of WQ samples and flow measurement during “high” flow conditions (events where there is a risk that personnel may loose footing and be swept down stream). In this event (high flow), samples will be collected from the foot bridge using a bucket and rope.

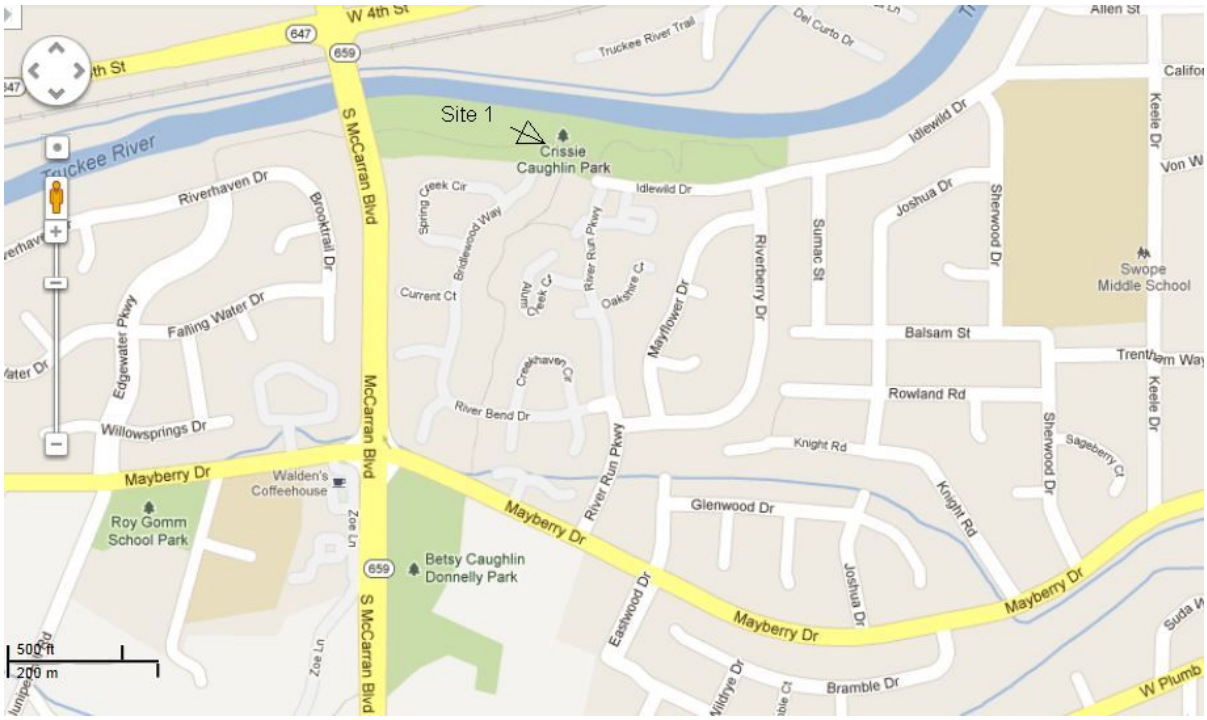

Figure A1-1. Road Map Showing the Approximate Location of Sampling Site 1



Figure A1-2. Photograph Showing the Approximate Sampling Location (Site 1)



Figure A1-3. Photograph of the Site 1 Sample Collection Location (Alum Creek at the Edge of the Turf in the Foreground)



Figure A1-4. Photograph of Alum Creek Looking North to the Confluence with the Truckee River

SAP Outfall Sampling Site #:	**2**
Site Name	Oxbow Nature Park
Type	Storm sewer/outfall
City/County Site Designation	Reno C-24
Sampling Location	Manhole in a private field accessible from Oxbow Nature Park
Driving Directions to the Sampling Location	From Keystone Avenue (Reno, NV) turn west on 2nd Street and proceed approximately 1 mile until the street ends at Oxbow Nature Park (note that Second Street turns into Dickerson Road around mile 0.5). See Figure A2-1 for driving direction assistance. Park in the far western corner of the park next to a locked gate (see Figure A2-4). Unlock the gate and walk up the dirt road approximately 100 ft. to a manhole labeled Storm Sewer (See Figure A2-5). Remove the lid (see below, tools required) and collect a sample
Sampling Site Coordinates (approx.)	Latitude: 39.518994 Longitude: -119.847431
General Drainage Area Description	Mixed residential, light commercial/industrial and undeveloped land
Sampling Access	Manhole (locked, see tools below)
Sampling method	Lower a container down into the manhole and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Attempt to estimate velocity (ft/s), channel geometry and approximate flow rate
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	The manhole at this site is located behind a locked gate and the lid is bolted down. The sampling team will need to carry a key to the gate and a 5/8" socket wrench. Sampling equipment includes bucket, rope, surrogate sampling containers, flashlight, and telescoping-bottle-sampler
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control at this site is not required. This is a public (city owned) park, however, the entrance gate is locked at sunset. Wintertime hours of operation are unknown. The sampling team may have to park at the entrance and walk in (see Figure A2-3). Private property (railroad) gate within the park locked 24/7. During site reconnaissance in late October, evidence of bear activity was noted. Use appropriate caution when visiting this site. A manhole lid that is bolted down generally indicates that it is subject to surge (to prevent the lid from being blown off during high flow events). If there is any reason to believe this is the case during a sampling event, do not unbolt the lid.
Site Specific Notes (keys, private property, approvals and credentials)	A key to the private gate inside the park is required to access the manhole
Other Notes	The storm sewer empties into the Truckee River underneath one of the parks observation platforms (see Figure A2-2). If the flow is high, it is likely that a sample can be collected from the platform. However, at low flows a sample collected from here is likely not representative.

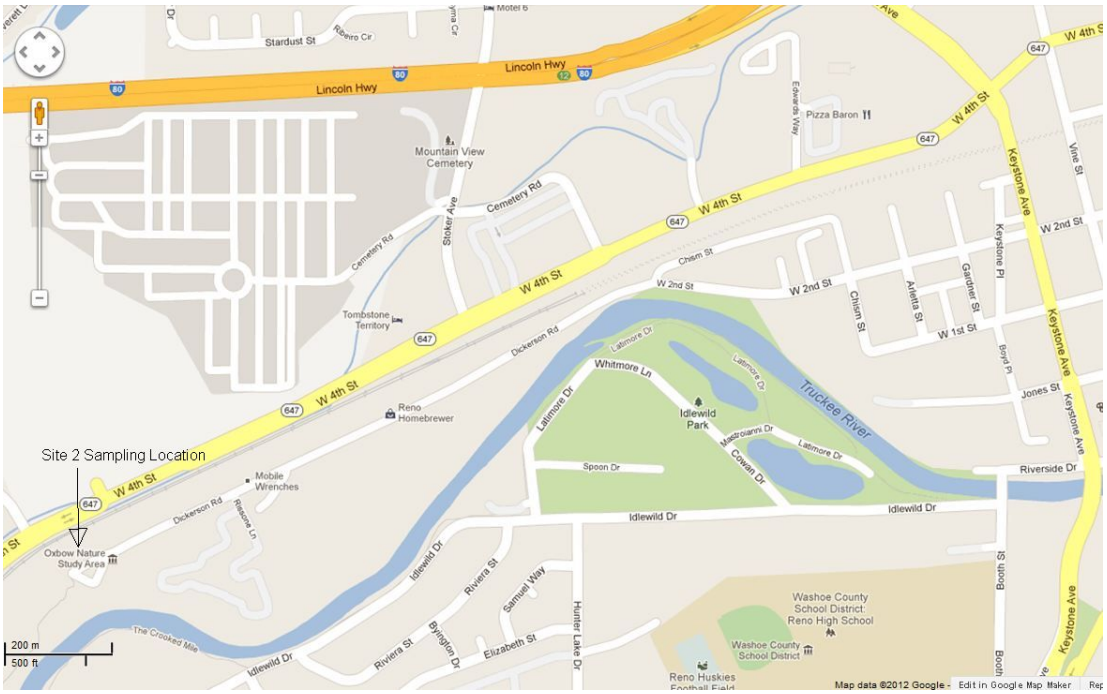

Figure A2-1. Road Map Showing the Approximate Location of Sampling Site 2



Figure A2-2. Photograph Showing the Approximate Sampling Location (Site 2)



Figure A2-3. Photograph of the Entrance to the Oxbow Nature Park



Figure A2-4. Photograph of the Private Locked Gate (Sampling Manhole is Located Approximately 100 feet Beyond this Gate)



Figure A2-5. Photograph of the Manhole Looking Back Towards the Gate and Park

SAP Outfall Sampling Site #:	**3**
Site Name	Dickerson Road
Type	Storm sewer/outfall
City/County Site Designation	Reno C-22
Sampling Location	Manhole located in an unpaved pullout on the south side of Dickerson Road next to a large cottonwood snag. The storm sewer discharges into the Truckee River approximately 30 feet to the southeast
Driving Directions to the Sampling Location	From Keystone Avenue (Reno, NV) turn west on 2nd Street and proceed approximately 0.5 mile (note that Second Street turns into Dickerson Road). See Figure A3-1 for driving direction assistance. Park in the pullout (see Figures A3-3 and A3-4).
Sampling Site Coordinates (approx.)	Latitude: 39.523108 Longitude: -119.835522
General Drainage Area Description	Mixed residential, light industrial and undeveloped land
Sampling Access	Manhole
Sampling method	Lower a container down into the manhole and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Attempt to estimate velocity (ft/s) and channel geometry
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	Manhole cover puller, and possibly a sledge hammer and pick. The manhole cover is not bolted. Other sampling equipment include those typical of sampling a 12' deep manhole – i.e., bucket, rope, surrogate sampling containers, flashlight, and/or telescoping-bottle-sampler
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control at this site is not required. This is a wide dirt pullout. Use caution when lifting the manhole cover.
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	None

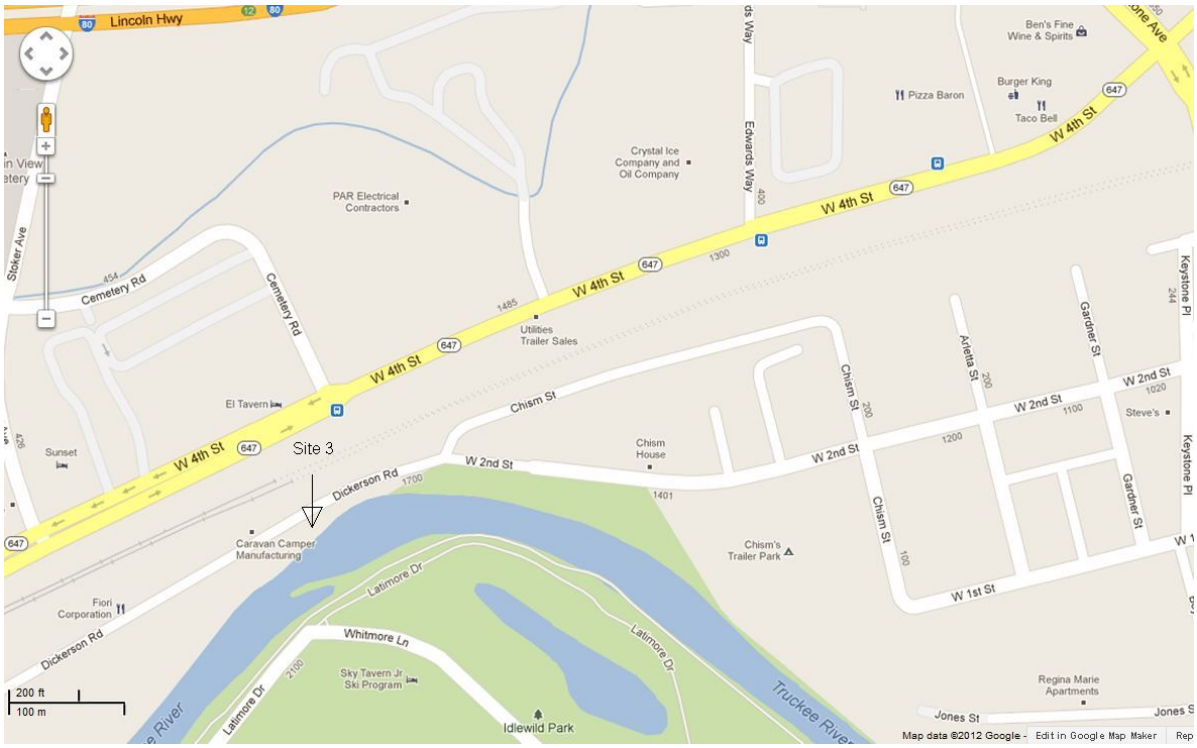

Figure A3-1. Road Map Showing the Approximate Location of Sampling Site 3



Figure A3-2. Photograph Showing the Approximate Sampling Location (Site 3)



Figure A3-3. Photograph of the Manhole and Dickerson Road Looking North



Figure A3-4. Photograph of the Manhole Looking South Towards the Truckee River

SAP Outfall Sampling Site #:	**4**
Site Name	Vine and Second
Type	Storm Sewer
City/County Site Designation	Reno D-19
Sampling Location	This outfall to the Truckee River is a box culvert immediately east of Arlington Avenue on the north side of the river under the bridge. Sampling access for this outfall is a manhole in the middle of Vine Street, just north of 2nd Street and south of the Train Trench
Driving Directions to the Sampling Location	From I-80, exit south on Keystone Avenue and turn east on 4th street. From 4th street turn south on Vine Street, cross over the Train Trench and park. The Manhole is located in the middle of Vine Street adjacent an alley between 2nd Street and the Train Trench
Sampling Site Coordinates (approx.)	Latitude: 39.525742 Longitude: -119.824744
General Drainage Area Description	Primarily residential with minimal light commercial
Sampling Access	Manhole
Sampling method	Lower a container down into the manhole and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Attempt to estimate velocity (ft/s), channel geometry and approximate flow rate
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	Manhole cover puller, and possibly a sledge hammer and pick are necessary for this site. The manhole cover is not bolted. Other sampling equipment include those typical of sampling a 12' deep manhole – i.e., bucket, rope, surrogate sampling containers, flashlight, and/or telescoping-bottle-sampler
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control is required. Traffic control activities should be in accordance with the *Standard Specifications for Public Works Construction* (Orange Book), latest edition, and the most current edition of the *Manual on Uniform Traffic Control Devices* (MUTCD). Submit a traffic control plan to the City of Reno prior to the first sampling event. At a minimum, truck mounted caution lights, safety cones, and vests are likely required
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	Use caution working in the middle of the street

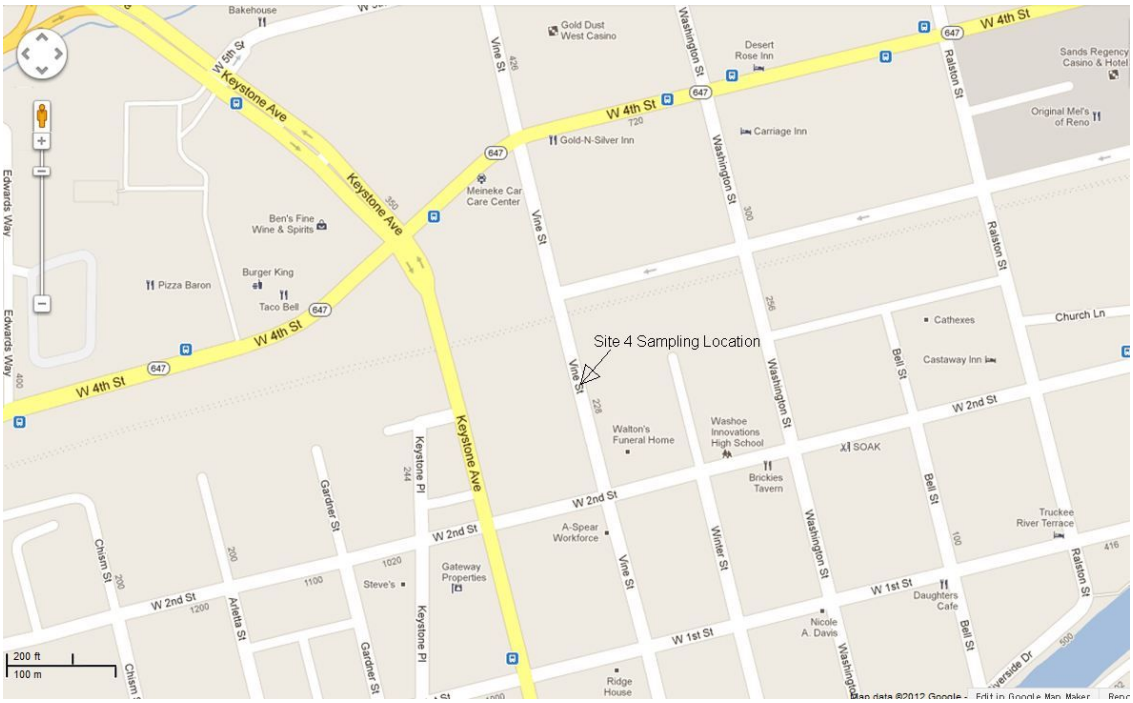

Figure A4-1. Road Map Showing the Approximate Location of Sampling Site 4

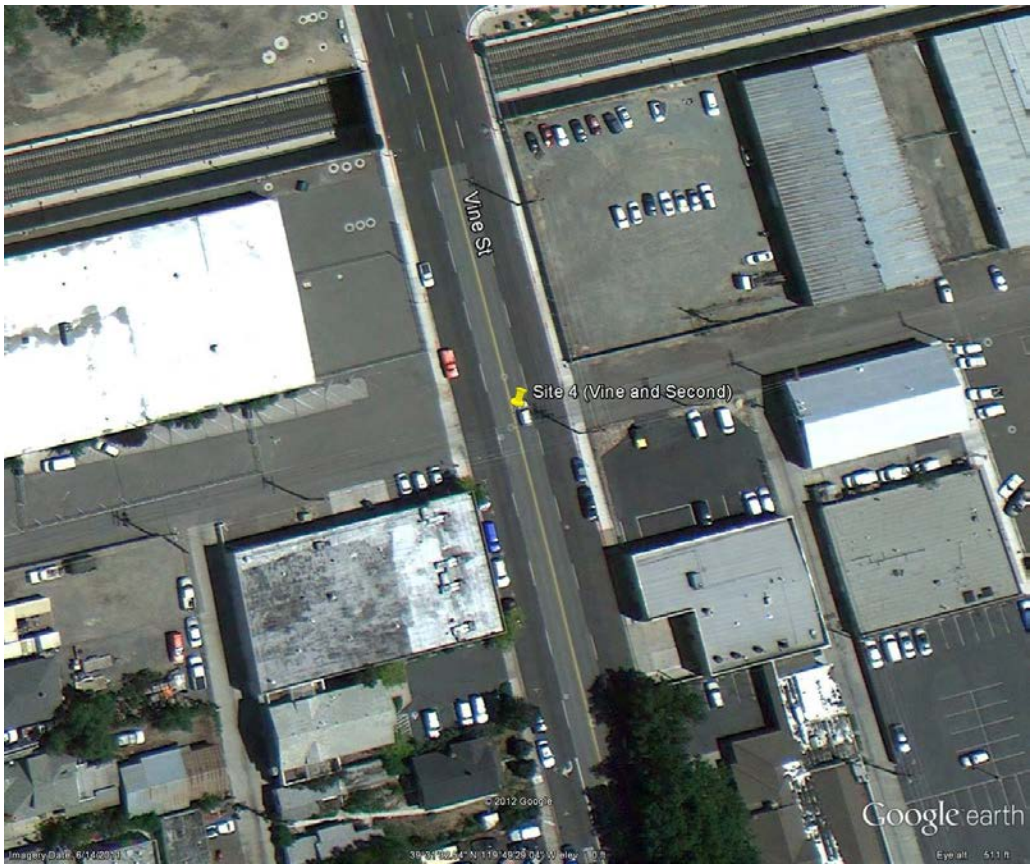

Figure A4-2. Photograph Showing the Approximate Sampling Location (Site 4)



Figure A4-3. Photograph of the Manhole in Vine Street, Looking North towards the Train Trench (Blue Fencing)



Figure A4-4. Photograph of the Manhole in Vine Street, Looking East towards Downtown Reno and the Alley Way

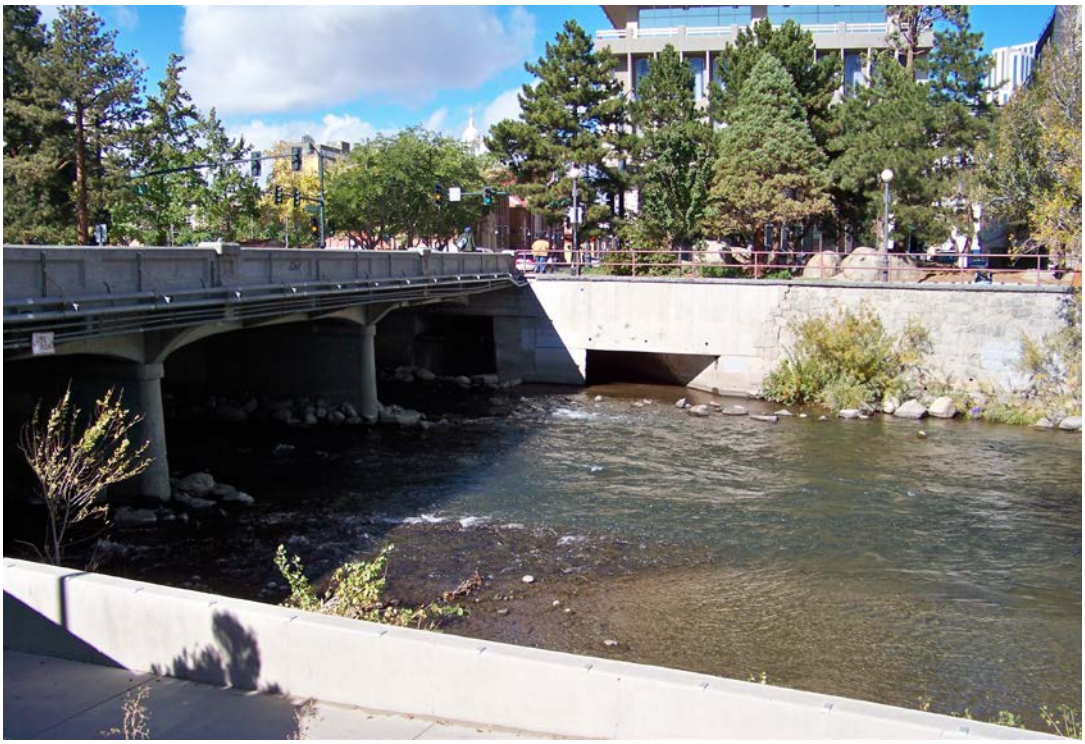

Figure A4-5. Photograph of the Site 4 Outfall to the Truckee River (not the box culvert in the light, but the one to the left under the bridge)

SAP Outfall Sampling Site #:	**5**
Site Name	Island Drive at Arlington Avenue
Type	Storm Sewer
City/County Site Designation	Reno H-19
Sampling Location	Outfall to the Truckee River (36" pipe) immediately east of Arlington Avenue on the south side of the river (see Figure A5-1). Access is from the walk way that runs parallel to Island Drive.
Driving Directions to the Sampling Location	Arlington avenue in downtown Reno and Wingfield Park. Best parking may be in Barbara Bennett Park (SW corner of the intersection of the Truckee River and Arlington Ave). Park and use the cross walk
Sampling Site Coordinates (approx.)	Latitude: 39.523594 Longitude: -119.816156
General Drainage Area Description	Mixed residential and commercial
Sampling Access	Box culvert on the river wall as it empties to the Truckee River
Sampling method	From the river walk, lower a container (i.e., bucket on a rope or bottle with telescoping rod) down into the flow
Flow Rate Estimation	Estimate velocity (ft/s), channel geometry and flow rate
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	None
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control is not required. Cross in the crosswalk and wear high visibility safety vests
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	None



Figure A5-1. Road Map Showing the Approximate Location of Sampling Site 5



Figure A5-2. Photograph Showing the Approximate Sampling Location (Site 5)



Figure A5-3. Photograph of the Site 5 Outfall Located on the Corner of Island Drive and Arlington Avenue

SAP Outfall Sampling Site #:	**6**
Site Name	Fisherman's Park II
Type	Storm sewer/outfall
City/County Site Designation	Reno D-16
Sampling Location	Pipe outfall (48" diameter) located along the Truckee River Bike Path between Kietzke Lane and I-580 (US-395) on the north side of the river.
Driving Directions to the Sampling Location	Park at Fisherman's Park II and walk approximately 300 feet east along the bike path and under the Kietzke Lane bridge/overpass. The outfall is situated just under the path, between the Kietzke Lane and I-580 bridges. Note that access to Fisherman's Park II is from the westbound lanes of Kietzke only.
Sampling Site Coordinates (approx.)	Latitude: 39.531181 Longitude: -119.786922
General Drainage Area Description	Primarily commercial and industrial
Sampling Access	Open pipe
Sampling method	Lower a container down into the flow and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Attempt to estimate velocity (ft/s), channel geometry and approximate flow rate
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	None. Sampling equipment includes bucket, rope, surrogate sampling containers, mixing wands, flashlight, and telescoping-bottle-sampler
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control at this site is not required. This is a public (city owned) park. Underpasses may be inhabited by homeless folks, especially during rain events. Use appropriate caution.
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	Easy access

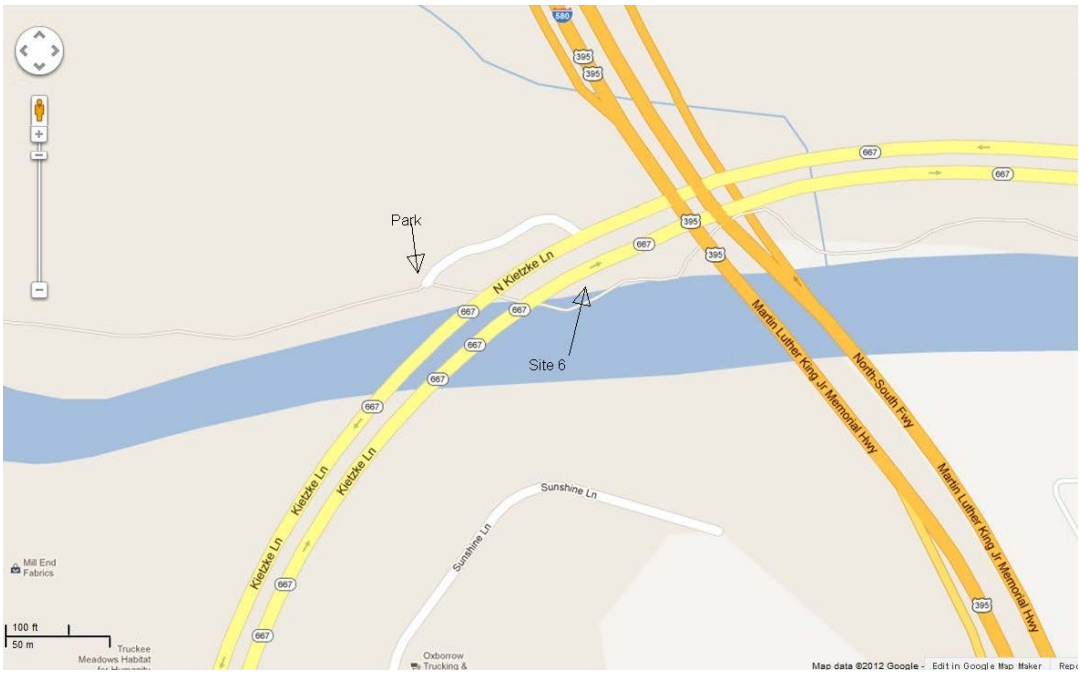

Figure A6-1. Road Map Showing the Approximate Location of Sampling Site 6



Figure A6-2. Photograph Showing the Approximate Sampling Location (Site 6)



Figure A6-3. Photograph of the Outfall at Site 6



Figure A6-4. Photograph of the Truckee River Bike Path and Kietzke Ln. Bridge

SAP Outfall Sampling Site #:	**7**
Site Name	Paradise Pond/Galletti Way
Type	Pond Overflow Structure
City/County Site Designation	Reno D-16
Sampling Location	The actual outfall to the Truckee River is a 48" pipe located at Fisherman's Park I (near Galletti Way, Reno). However, the discharge originates approximately 0.94 miles north at Teglia's Paradise Park. The storm sewer is sealed from the overflow structure at the Park to the outfall at the Truckee River. Paradise Park is operated as a multiple use park by the City of Reno and consists of a series (4) of interconnected, manmade ponds with a surface area of approximately 24 ac (NDOW, 2012). These four ponds collect stormwater runoff from a variety of sources (mostly commercial and residential) as well as groundwater accumulations. The sampling location for this site is a concrete overflow structure located in the southwest corner of Teglia's Paradise Ponds Park. This overflow structure is concrete, with access from both sides as well as from the top.
Driving Directions to the Sampling Location	The park is located at the corner El Rancho Drive and Oddie Blvd., in Reno, NV. From Oddie Blvd., drive south on El Rancho and turn right on Elementary Drive. Park in the parking lot located on the immediate right hand. The sampling location is the overflow structure in the southwest most corner of the pond.
Sampling Site Coordinates (approx.)	Latitude: 39.541092 Longitude: -119.777078
General Drainage Area Description	Mixed residential and commercial
Sampling Access	Concrete overflow structure
Sampling method	Lower a container down into the flow and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Footing at this site is solid. Flow can likely be gauged using a tape measure, top setting rod and portable velocity meter.
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	None. Bring items associated with sample collection in open channel flow situations (rope, waders, containers, etc.)
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control at this site is not required. There is a large paved parking lot adjacent to the sampling site. This lot is expected to be largely empty during rain events. Park and access the sampling site from the side walk.
Site Specific Notes (keys, private property, approvals and credentials)	None. This site is a public park
Other Notes	There are four interconnected ponds that receive inflow from several different storm drains. The ponds must fill up in order for discharge to occur. Depending on the water level of the ponds, an appreciable rain event may be required before active discharge can be expected. A significant lag time between precipitation and discharge can be expected to occur.

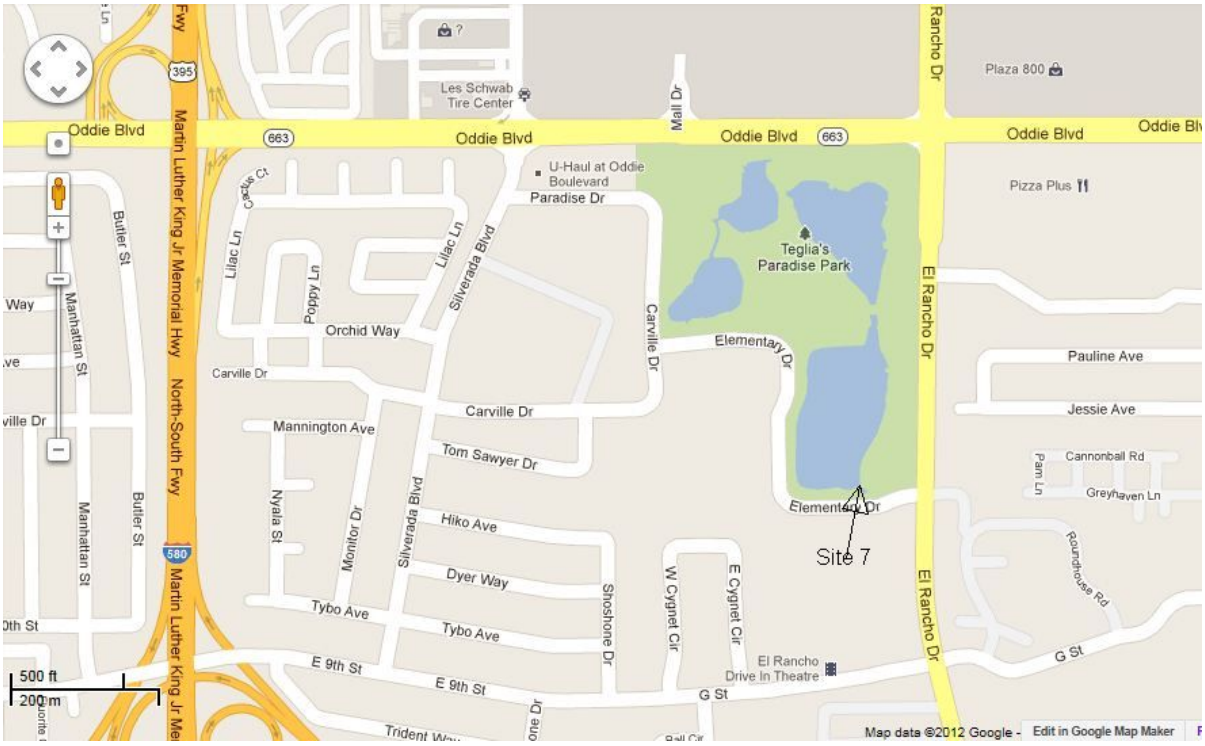

Figure A7-1. Road Map Showing the Approximate Location of Sampling Site 7

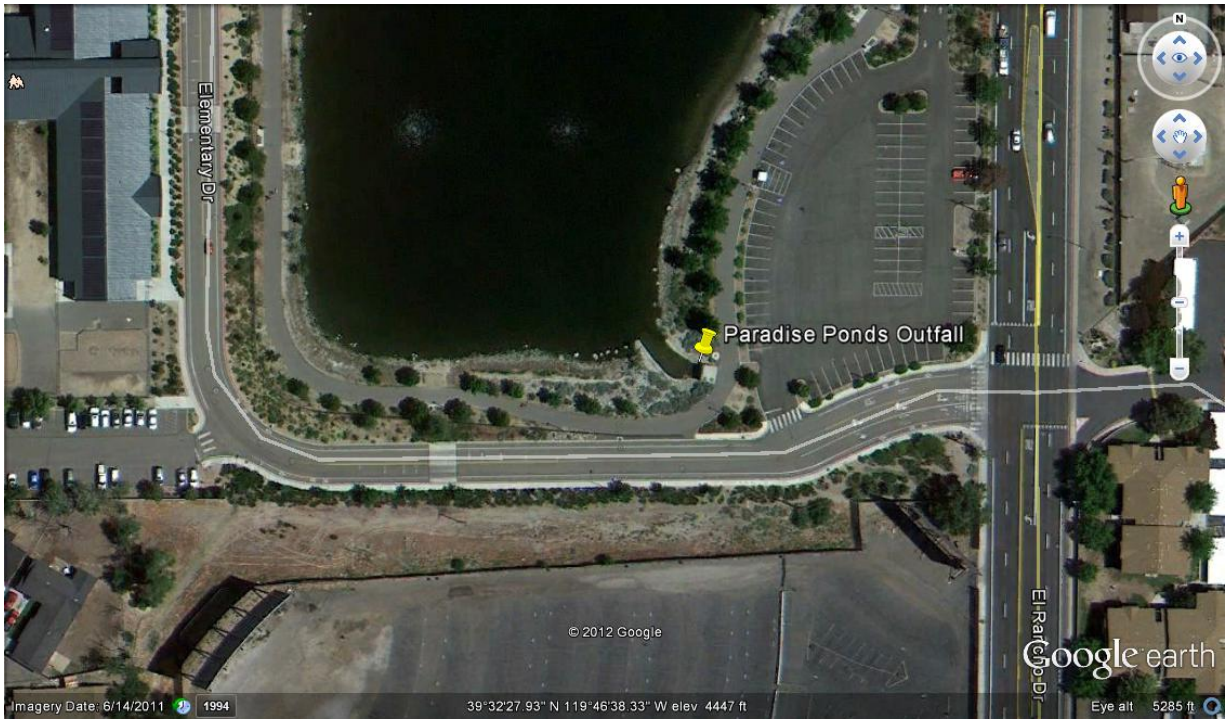

Figure A7-2. Photograph Showing the Approximate Sampling Location (Site 7)



Figure A7-3. Photograph on Top of the Overflow Structure (Sampling Location) at Site 7



Figure A7-4. Photograph of the Overflow Structure from the Pond at Site 7

SAP Outfall Sampling Site #:	**8**
Site Name	Mary Wahl Ditch
Type	Drainage Ditch
City/County Site Designation	Sparks SDOE-008936
Sampling Location	Ditch (open channel) sampled at north end of the culvert crossing under Coney Island Drive
Driving Directions to the Sampling Location	From Rock Blvd., head west on E. Greg St. and make a right on Marietta Way and left on Coney Island Drive. The sampling location is approximately 400 feet east of the intersection of Marietta Way and Coney Island Drive on the north side. The ditch runs north/south alongside 1650 Coney Island Dr. From this location, the Mary Wahl ditch is an open channel to the north and underground from this point south to the Truckee River.
Sampling Site Coordinates (approx.)	Latitude: 39.519264 Longitude: -119.752661
General Drainage Area Description	Commercial and industrial
Sampling Access	From on top of the 72" pipe/culvert or from the ditch edges
Sampling method	Lower a container down into the flow and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod. In low flow conditions the sampler can wade into the ditch to collect a sample
Flow Rate Estimation	Estimate velocity (ft/s), channel geometry and flow rate. In low flow conditions, the flow rate at this site can be gauged using a portable velocity meter, top setting rod and tape measure
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	None
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control not required. Park alongside Coney Island Drive and wear high visibility safety vests
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	Easy sampling location

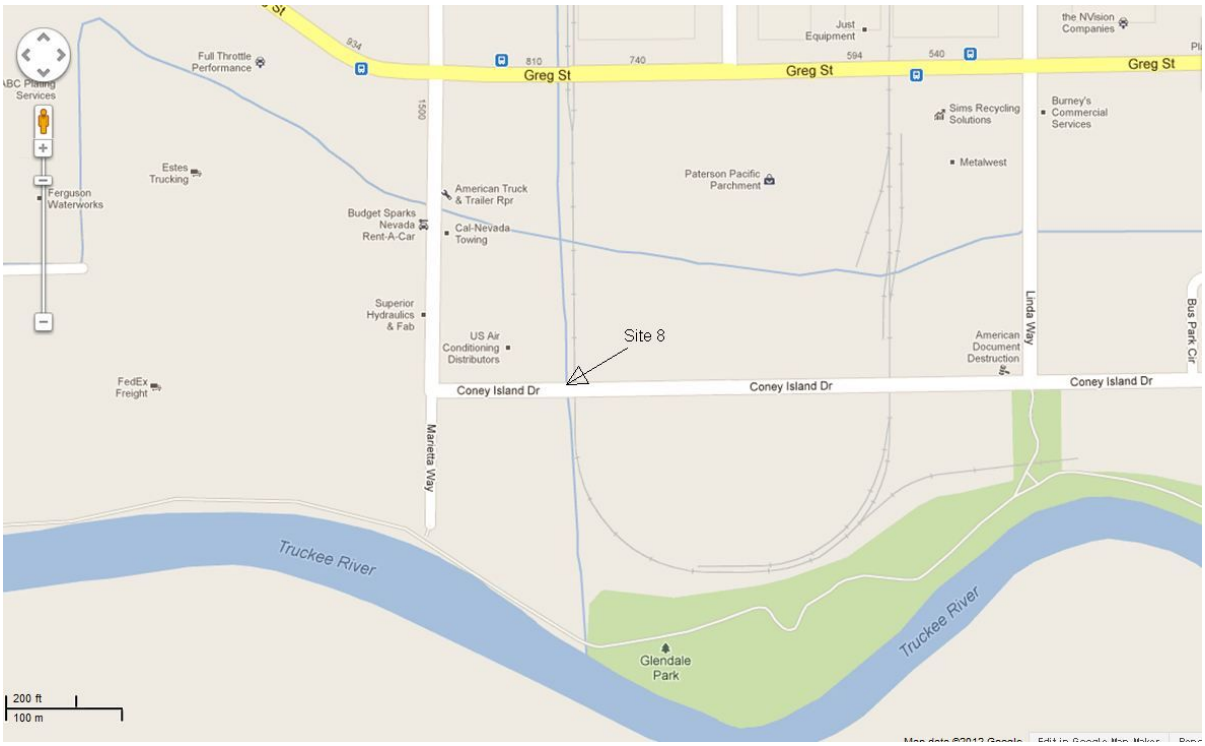

Figure A8-1. Road Map Showing the Approximate Location of Sampling Site 8



Figure A8-2. Photograph Showing the Approximate Sampling Location (Site 8)



Figure A8-3. Photograph of the Mary Wahl Ditch Looking North (Sampling Location at Site 8)



Figure A8-4. Photograph of the Culvert Crossing under Coney Island Drive at Site 8

SAP Outfall Sampling Site #:	**9**
Site Name	Cottonwood Park (west)
Type	Manhole
City/County Site Designation	Sparks SDOE-008957
Sampling Location	Manhole in the center of Spice Island Drive
Driving Directions to the Sampling Location	From S. McCarran Blvd. turn east on E. Greg St. and make a right on to Spice Island Drive. The sampling location is a manhole in the center of Spice Island Drive approximately 0.5 miles SW of the intersection of E. Greg St. and Spice Island Dr.
Sampling Site Coordinates (approx.)	Latitude: 39.514747 Longitude: -119.73405
General Drainage Area Description	Commercial and industrial
Sampling Access	Manhole
Sampling method	Lower a container down into the manhole and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Attempt to estimate velocity (ft/s), channel geometry and approximate flow rate
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	Manhole cover puller, and possibly a sledge hammer and pick are necessary for this site. The manhole cover is not bolted. Other sampling equipment include those typical of sampling a 12' deep manhole – i.e., bucket, rope, surrogate sampling containers, flashlight, and/or telescoping-bottle-sampler
Traffic Control, Special Requirements, Advisements, Notes and precautions	Traffic control is required. Traffic control activities should be in accordance with the *Standard Specifications for Public Works Construction* (Orange Book), latest edition, and the most current edition of the *Manual on Uniform Traffic Control Devices* (MUTCD). Submit a traffic control plan to the City of Sparks prior to the first sampling event. At a minimum, truck mounted caution lights, safety cones, and vests are likely required
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	Use caution working in the middle of the street

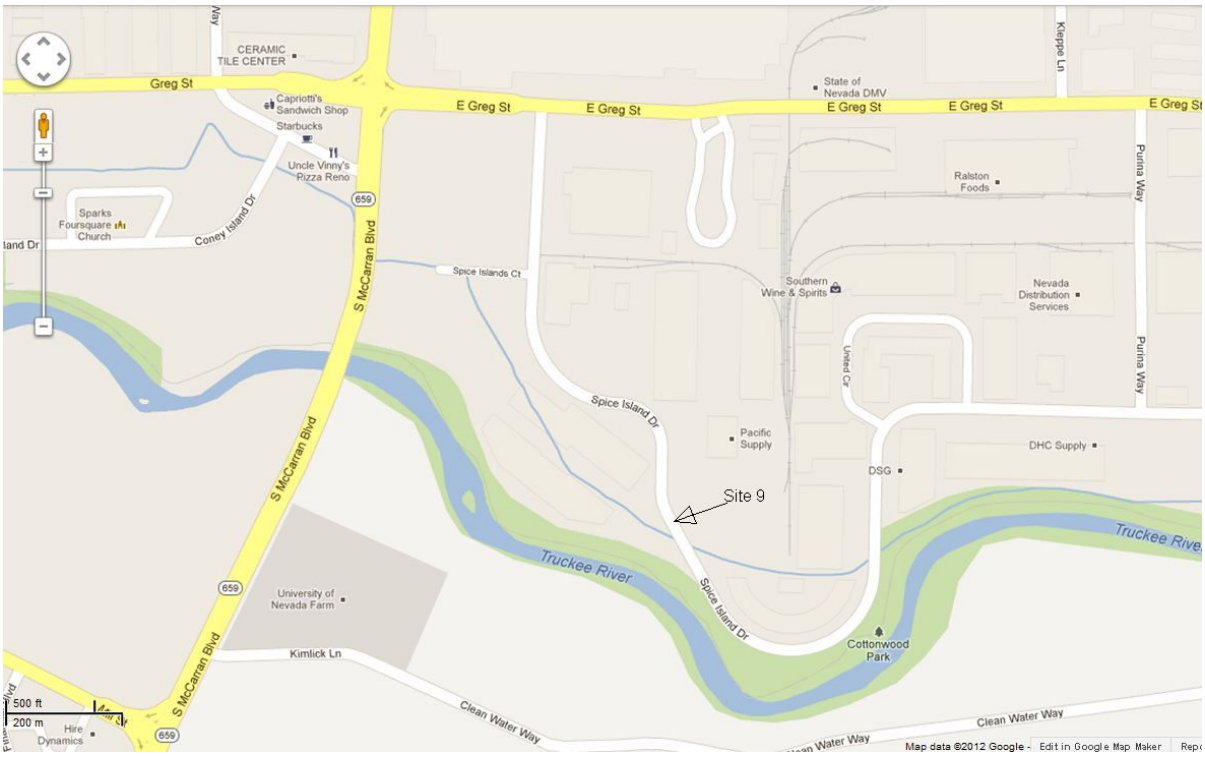

Figure A9-1. Road Map Showing the Approximate Location of Sampling Site 9

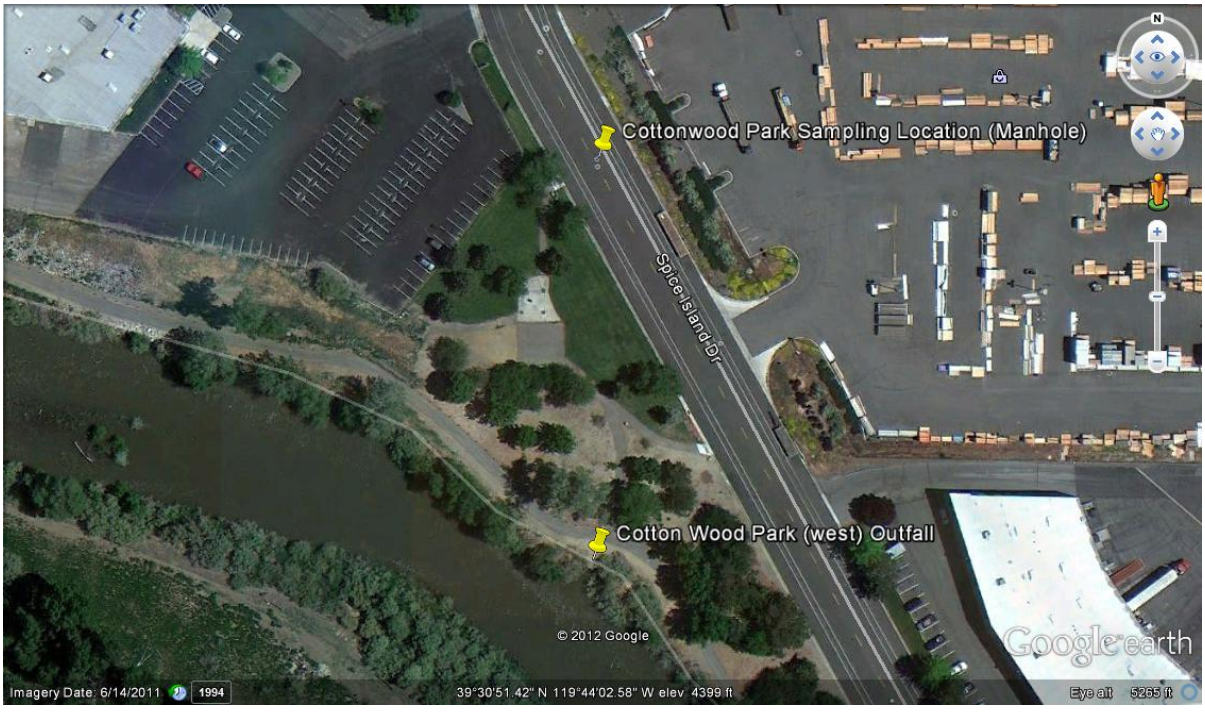

Figure A9-2. Photograph Showing the Location of the Sampling Manhole Relative to the River Outfall and the Western Edge of Cottonwood Park (Site 9)



Figure A9-3. Photograph of the General Location of the Manhole in the Center of Spice Island Drive (Site 9, photograph taken from Cottonwood Park looking northwest)



Figure A9-4. Photograph of the Manhole Located in the Center of Spice Island Drive

SAP Outfall Sampling Site #:	**10**
Site Name	Greg Street (East)
Type	Manhole
City/County Site Designation	Sparks SDOE-008960
Sampling Location	Manhole in the center of a small (un-named) access road
Driving Directions to the Sampling Location	From S. McCarran Blvd. turn east on E. Greg St for approximately 1.25 miles and turn right at the American Ready-Mix sign (1475 E. Greg St.). Proceed south on the un-named road approximately 800 ft. to the entrance of American Ready-Mix. The manhole is located in the street and labeled "Storm – Drain"
Sampling Site Coordinates (approx.)	Latitude: 39.519356 Longitude: -119.71615
General Drainage Area Description	Commercial and industrial
Sampling Access	Manhole
Sampling method	Lower a container down into the manhole and retrieve a sample. Sampling device may be a bucket on a rope or a container on a telescoping rod
Flow Rate Estimation	Attempt to estimate velocity (ft/s), channel geometry and approximate flow rate
Standard Supplies and Equipment	Sample bottles (and back-up sets), labels, C-of-C forms, ice-chest, ice, gloves, markers, data sheets, portable WQ meters (pH, DO, EC, Temp, Turb. and associated calibrants, wipes, cuvettes, containers and tubes), surrogate containers, splitting and mixing equipment and devices, mixing wands or rods, DI water, funnels, extra bottle caps, zip bags, rope, tarps, umbrellas, safety vests, vehicle lights, credentials, cold weather gear, cell phones, and contact list
Specialized Tools and Equipment	Manhole cover puller, and possibly a sledge hammer and pick are necessary for this site. The manhole cover is not bolted. Other sampling equipment include those typical of sampling a 12' deep manhole – i.e., bucket, rope, surrogate sampling containers, flashlight, and/or telescoping-bottle-sampler
Traffic Control, Special Requirements, Advisements, Notes and precautions	Full traffic control is not required at this location, however it is an active driveway. Cement truck traffic and some automobile traffic can be expected. Safety cones, vests and flagging are advised
Site Specific Notes (keys, private property, approvals and credentials)	None
Other Notes	Use caution working in the middle of the street

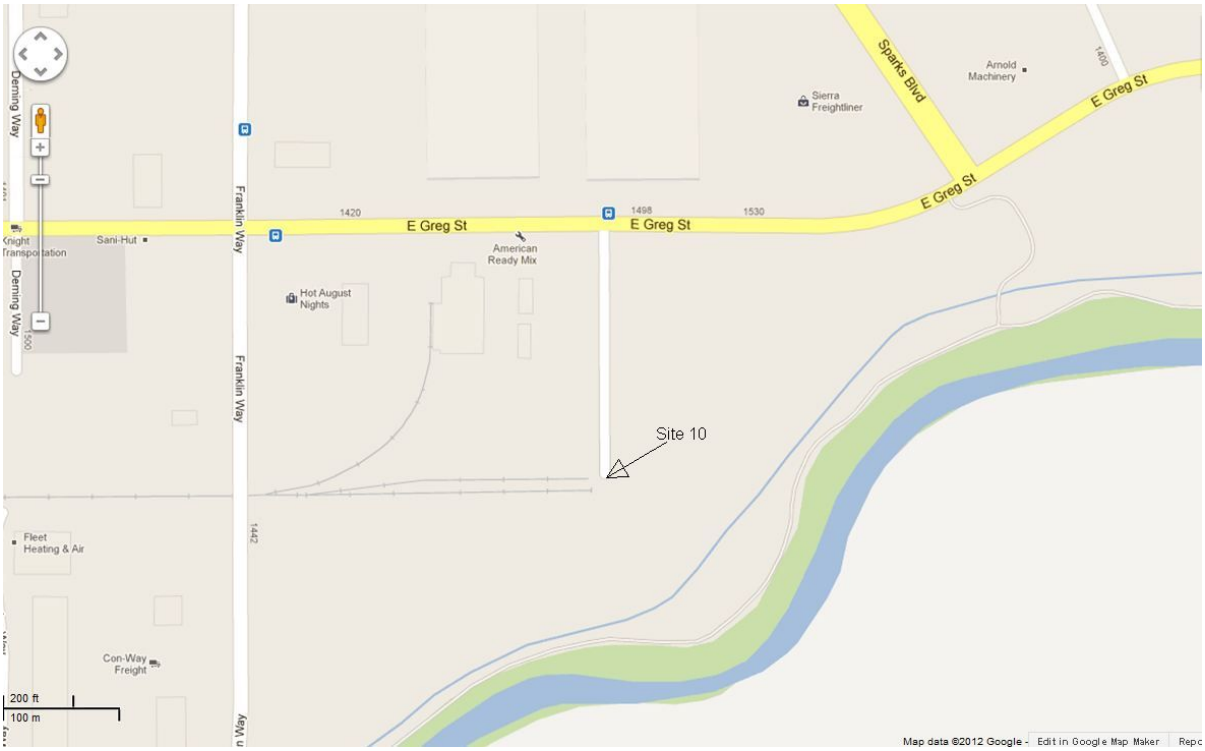

Figure A10-1. Road Map Showing the Approximate Location of Sampling Site 10



Figure A10-2. Photograph Showing the Location of the Sampling Manhole Relative to the American Ready-Mix Plant (Site 10)



Figure A10-3. Photograph of Sampling Manhole in the Center of the Entrance Road to the American Ready-Mix Plant (Site 10, 1475 E. Greg St., Sparks)



Figure A10-4. Photograph of the Site 10 Manhole (Sample Location)

Appendix B Sampling Location Maps

Maps

Figure B-1. Map of the Tributary Monitoring Sampling Sites

Figure B-2. Map of the Outfall Monitoring Sampling sites

Figure B-1. Map of the Tributary Monitoring Sampling Sites

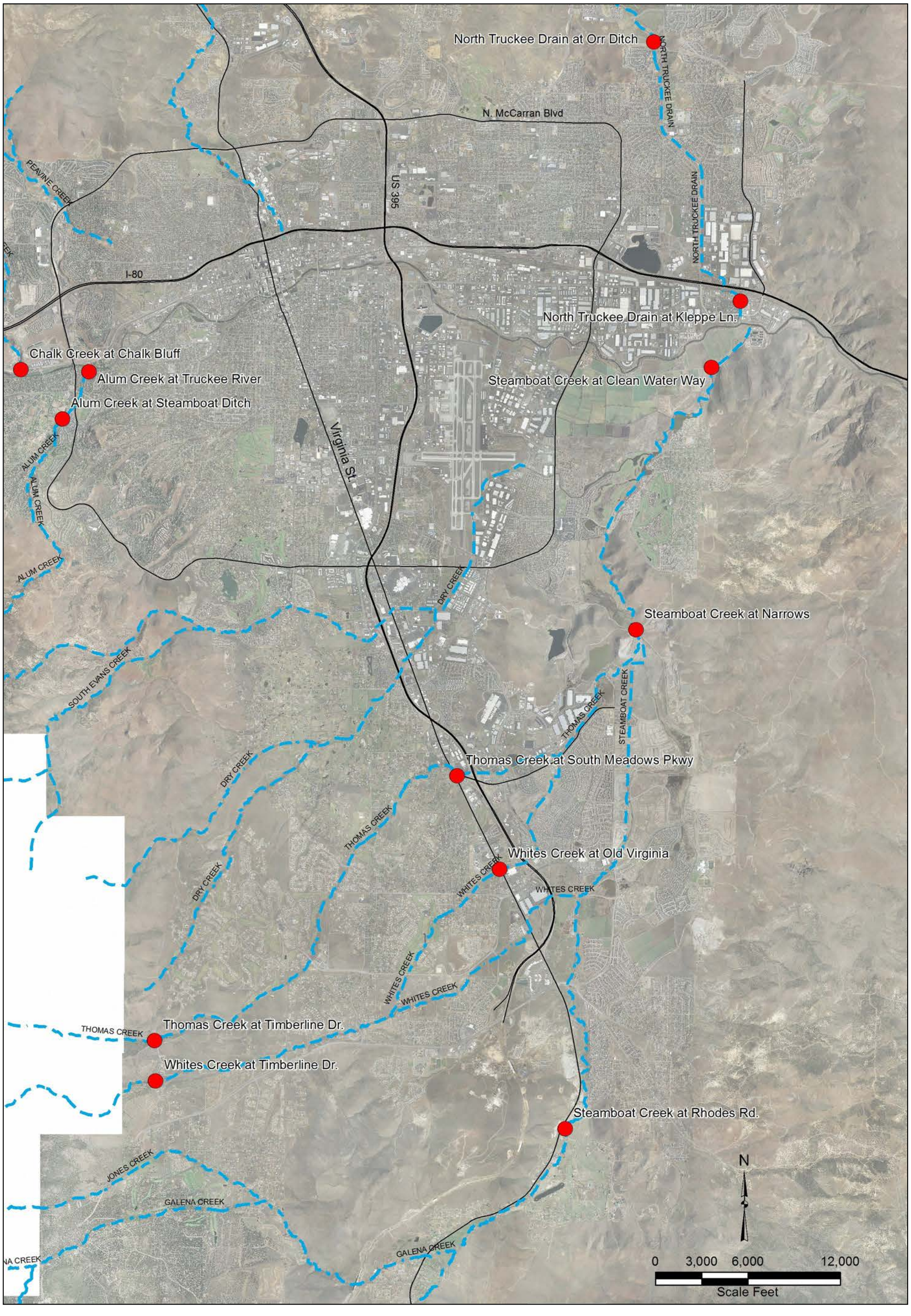

Figure B-2. Map of the Outfall Monitoring Sampling Sites

