Supplemental Guide to Storm Water Management for Contractors

APPENDIX A

Supplemental Guide to Storm Water Management for Contractors

- ☐ Storm Drain Design Manual
- ☐ SWPPP Review Criteria/Checklists
- ☐ Construction BMP fact sheets
- ☐ Special Environmental Considerations/303d list
- ☐ Standard Details
- ☐ Construction Inspection Form (from State)
- ☐ Inspection Authority
- ☐ Enforcement Procedures
- ☐ NOT Procedures
- ☐ LID Handbook & Water Quality
- ☐ Maintenance Agreement

DESIGN MANUAL

STORM WATER DRAINAGE DESIGN MANUAL

Prepared for

Alpine City
20 North Main Street
Alpine, Utah 84004

Prepared by

Bowen, Collins & Associates
756 East 12200 South
Draper, UT 84020

February 2010

ALPINE CITY
STORM WATER DRAINAGE
DESIGN MANUAL

February 2010

TABLE OF CONTENTS

Table of Contents
(continued)

TABLES

SECTION 1
PURPOSE

This manual has been prepared to document the approval process, design standards and regulations, and hydrologic and hydraulic computation methods for evaluating and designing storm drain and flood control facilities in Alpine City (City). The objective of this manual is to ensure that drainage planning and facility design for small areas and local developments within the City are consistent with the City's Storm Drain Master Plan. All drainage projects shall conform to requirements in this Storm Water Drainage Design Manual, the City's Storm Drain Master Plan, and shall be approved by City personnel.

SECTION 2
APPROVAL PROCEDURE

2.1 INTRODUCTION

The following procedures shall be followed for evaluating the need for and designing storm water facilities.

2.2 CONCEPTUAL DRAINAGE PLAN

A Conceptual Drainage Plan and Report is required for all multi-lot developments and single lot developments larger than 0.5 acres. The report shall contain the following information:

1. General description of the development, including location (township, range, section, subdivision and lot).

2. General description of property, area, existing site conditions including all existing drainage facilities such as ditches, canals, washes, swales structures, storm drains, springs, detention and retention basins, and any proposed modifications to drainage facilities.

3. General description of off-site drainage features and characteristics upstream and downstream of the site and any known drainage problems.

4. General description of existing and proposed on-site drainage features, characteristics and facilities.

5. General description of the proposed facilities that will be used to manage on-site and off-site storm water runoff associated with the development.

6. General description of master planned drainage facilities and proposed drainage features and how the development and proposed drainage facilities conform to the storm drain master plan.

7. Preliminary Drainage Calculations if required by the City Engineer. See Section 3 for design criteria.

8. Estimate of minimum depth to groundwater level on the site.

One or more drawings shall also be submitted. The drawing(s) shall include:

1. Existing and proposed property lines.

2. Existing and proposed topography (2-foot maximum contour interval) extending at least 100 feet beyond the site.

3. Existing and proposed streets, easements, and rights-of-way.

4. Existing drainage and irrigation facilities.

5. FEMA floodplain and floodway.

6. Required setbacks for structures from the center line of streams and washes, if applicable.

7. Drainage basin boundaries and subbasin boundaries on a topographical map.

8. Existing flow patterns and paths.

9. Proposed flow patterns and paths.

10. Location of proposed drainage facilities including: storm drain pipes, inlets, manholes, cleanouts, swales, channels, and retention and detention basins.

11. Location of drainage easements required.

12. Other relevant drainage features

13. Scale, north arrow, legend, title block showing project name, date, preparers name, seal and signature.

The Conceptual Drainage Plan shall be submitted to the City for review and approval prior to the development of the Final Drainage Design Plan and Report.

2.3 FINAL DRAINAGE PLAN AND REPORT

A final Drainage Plan and Report is required for all proposed developments and shall be prepared by a professional civil engineer registered in the State of Utah. The report portion of the Drainage Plan and Report shall contain the following:

1. Title page showing project name, date, preparer's name, seal and signature.

2. Description of the development, including location (township, range, section, subdivision and lot).

3. Description of property, area, existing site conditions including all existing drainage facilities such as ditches, canals, washes, swales structures, storm drains, springs, detention and retention basins.

4. Description of off-site drainage features and characteristics upstream and downstream of the site and any known drainage problems.

5. A description of proposed facilities that will be used to manage on-site and off-site storm water runoff associated with the development, including calculations used to estimate runoff and size storm water facilities. See Section 3 for design criteria and Section 4 for approved rainfall-runoff computation methods.

6. Description of existing and proposed on-site drainage features, characteristics and facilities.

7. Description of master planned drainage facilities and how the development and proposed drainage facilities conform to the storm drain master plan.

8. Description of downstream receiving facilities for storm water discharges and the capacities of those facilities. Include calculations.

9. Description of existing FEMA floodplain, if applicable.

10. Description of other drainage studies that affect the site.

11. Preliminary drawings of proposed drainage facilities that also show existing storm drain facilities on or adjacent to the site.

12. Description of compliance with applicable flood control requirements and FEMA requirements, if applicable.

13. Description of design runoff computations. See Section 4 for approved rainfall-runoff computation methods.

14. Design calculations to support inlet spacing and sizing of facilities. Include a description of drainage facility design computations. See Section 3 for design criteria.

15. Description of any needed drainage easements or rights-of-way.

16. Description of FEMA floodway and floodplain calculations if applicable.

17. Description of field work performed to estimate minimum depth to groundwater at the site.

18. Conclusions stating compliance with drainage requirements and opinion of effectiveness of proposed drainage facilities and accuracy of calculations. See Section 3 for design criteria.

19. Appendices showing all applicable reference information.

One or more 22-inch by 34-inch drawings shall be submitted with the Drainage Plan and Report showing the following information if applicable.

1. Existing and proposed property lines.

2. Existing and proposed topography (2-foot maximum contour interval) extending at least 100 feet beyond the site.

3. Existing and proposed streets, easements, and rights-of-way.

4. Existing drainage and irrigation facilities.

5. FEMA floodplain and floodway.

6. Required setbacks for structures from the center line of streams and washes, if applicable.

7. Drainage basin boundaries and subbasin boundaries on a topographical map.

8. Existing flow patterns and paths.

9. Proposed flow patterns and paths.

10. Location and size of proposed drainage facilities including: storm drain pipes, inlets, manholes, cleanouts, swales, channels, and retention and detention basins. Include spot elevations of proposed grade, flowline and top, back curb.

11. Details of proposed storm drain facilities, including storm drain inlets. Include maintenance and monitoring plan for storage facilities.

12. Details of proposed improvements to existing irrigation facilities and any facilities to be used to manage high groundwater conditions on the site.

13. Location of drainage easements required.

14. Other relevant drainage features.

15. Scale, north arrow, legend, title block showing project name, date, preparers name, seal and signature.

SECTION 3
DESIGN STANDARDS AND REGULATIONS FOR STORM DRAIN FACILITIES

3.1 DESIGN STORM

3.1.1 FREQUENCY

Storm drain facilities shall be designed to include major and minor conveyance facilities as described below:

Minor System

Minor system facilities shall be designed to collect and convey storm water runoff from a storm with a return frequency of 10 years. Minor system facilities include local catch basins, storm drain pipes and manholes.

Major System

Major system facilities shall be designed to collect and convey storm water runoff from a storm with a return frequency of 100 years. Major system facilities include:

- Streets
- Storm drain pipes to regional facilities
- Open Channels
- Culverts and Bridges
- Detention and Retention Basins

The design storm frequency listed in the following table shall be used to design the storm drain facilities indicated.

3.1.2 DEPTH AND INTENSITY

The depth-duration-frequency and an intensity-duration-frequency tables in Appendix A shall be used to estimate the rainfall depth or intensity of the design storm.

3.1.3 DISTRIBUTION AND DURATION

In order to evaluate and design storm drain conveyance facilities (i.e. pipes, culverts)), the 3-hour synthetic storm durations shall be evaluated. The maximum peak flow from these three storm durations shall be used to evaluate and design the conveyance facility.

In order to evaluate and design storm drain storage facilities (i.e. detention basins), the 3-, 6- and 24-hour synthetic storm durations shall be evaluated. The maximum peak volume from these three storm durations shall be used to evaluate and design the storage facility.

Storm distributions for the 3-, 6- and 24-hour storms are provided in Appendix B.

3.2 POST-CONSTRUCTION PEAK DISCHARGE

Post-construction peak discharges for the design recurrence interval (see Section 3.1.1) shall not be greater than the pre-construction peak discharges for the same recurrence interval. However, under no circumstances shall the peak discharge be greater than 0.07 cfs per acre.

3.3 STORAGE FACILITIES

All storage facilities (retention and detention basins) shall be designed according to the following criteria:

1. Designed to drain at a controlled rate, not to exceed 0.07 cfs per acre.

2. Contain the design flood event (see Section 3.1.1) with a minimum of 1 foot of freeboard.

3. Maximum side slope is 4H:1V.

4. Landscaping and sprinklers shall be installed upon recommendation of the Development Review Committee and the Planning Commission to the City Council.

5. Provide a plan to maintain and monitor the facility.

6. Provide vehicular access to the facility.

7. Design an emergency overflow spillway to safely discharge runoff from the facility assuming the outlet is inoperable or the inflow exceeds the outlet capacity.

8. The volume requirements shall not be reduced based on infiltration due to percolation.

9. Access must be provided to the storage facility in order to maintain it.

3.4 PIPELINES

1. Storm drain pipelines shall be located within the street right-of-way or a dedicated easement.

2. Storm drain pipelines shall be designed to convey the design discharge (see Section 3.1.1) under full pipe capacity, but with no surcharging.

3. The minimum allowable pipe diameter is 15 inches.

4. Acceptable pipe materials include: reinforced concrete, nonreinforced concrete, and HDPE.

3.5 INLETS AND OUTLETS

A concrete apron shall be constructed around inlets to allow sediment to be easily cleaned up.

Storm drain pipe that discharges to an earth-lined channel shall be stabilized to mitigate erosion potential.

3.6 MANHOLES AND CLEANOUT STRUCTURES

1. A Manhole or cleanout structure shall be located at the upstream end of the storm drain pipe and at all changes in pipe size, horizontal alignment, slope and material of the storm sewer.

2. Maximum horizontal distance between manholes is 400 feet.

3.7 ROADWAY DRAINAGE

1. Roads must provide for routing of the 100-year flood discharge to adequate downstream conveyance facilities.

2. The 100-year flood flows in streets should be contained within street right-of-way.

3. Provision shall be made to allow runoff within the street to enter any downstream detention basins or other such facilities.

4. Downhill cul-de-sacs and dead ends will not be allowed unless specifically approved by the City Engineer.

5. Special consideration shall be given to downhill "T' intersections to ensure that flooding will not occur outside of the right-of-way.

3.8 INLETS

1. Storm drain catch basins or inlets shall generally be located on both sides of the street.

2. Inlet spacing and configuration shall be designed to collect runoff from a 10-year design storm.

3. Inlet spacing shall also be designed to meet the design spread requirements from the FHA Urban Drainage Manual as shown in Table 3-1.

4. As a general rule, inlets shall be installed at intervals not to exceed 400 feet. Inlet spacing shall be addressed during the design phase.

Table 3-1
Design Gutter Spread

Street Classification	Design Frequency	Design Gutter Spread
High Volume		
< 45 MPH	10-Year	Shoulder plus 3 feet
> 45 MPH	10-Year	Shoulder
Sag Point	50-Year	Shoulder plus 3 feet
Collector		
< 45 MPH	10-Year	½ Driving Lane
> 45 MPH	10-Year	Shoulder
Sag Point	10-Year	½ Driving Lane
Local Streets	10-Year	½ Driving Lane

3.9 STORM WATER TREATMENT

1. Storm water treatment for oil and grease shall be provided at all sites with more than 6 parking spaces.

2. Engineer design and calculations shall be submitted showing the effectiveness of the treatment.

3. Provide a maintenance plan for the storm water treatment facility.

3.10 CULVERTS

1. The minimum culvert size is 24 inches.

2. Culverts shall be designed to convey the 100-year flood event without overtopping the road.

3. A culvert blockage factor of 50 percent shall be used for culverts placed in drainages with upstream debris producing potential as determined by the City.

4. Backwater surface computations upstream of culverts shall be performed and shown to be non-damaging to upstream properties.

5. Improvements must be installed at entrance and exit structures to minimize erosion and accommodate maintenance.

3.11 BRIDGES

1. Bridges must pass the 100-year flood event with a minimum of 2 feet of freeboard.

2. Local and regional scour analyses shall be performed on the structure, upstream and downstream. All potential scour shall be properly mitigated.

3.12 OPEN CHANNELS

Open channels shall be designed to meeting the following criteria:

1. Convey the 100-year flood event with a minimum freeboard of 1 foot.

2. Have low maintenance requirements.

3. Provide maintenance access through easements the entire channel length

4. Sideslope of 2H:1V or flatter.

5. Bank stabilization shall be designed to minimize erosion and maintenance.

6. Irrigation ditches located in areas of new development shall be enclosed (pipe or culvert).

3.13 FLOODPLAINS

Development in and near FEMA identified floodplains shall be in accordance with the City's Flood Damage Prevention Overlay.

SECTION 4
RAINFALL-RUNOFF COMPUTATION METHODS

4.1 MODELING APPROACH

There are three acceptable methods for estimating the peak runoff: the Rational Method, TR-55 and HEC-HMS. These three methods are described below. Tr-55 and HEC-HMS can also be used to estimate runoff volume for storage facility sizing. See Section 3 for design criteria.

Other methods for estimating peak runoff and runoff volume must first be approved by the City Engineer. Table 4-1 indicates the applicable total drainage area for each modelling approach.

Table 4-1
Drainage Models and Applicable Total Drainage Area

Drainage Model	Maximum Drainage Area
Rational Method	< 200 Acres
TR-55	< 2000 Acres for Urban Areas
HEC-HMS	Any

4.2 DRAINAGE BASIN DELINEATION

For the purposes of estimating storm water runoff, major drainage patterns should be identified based on topography and the location of major natural drainage channels. Within major drainage basins, subbasins should be delineated for storm water runoff analysis using available local information including, but not limited to:

1. Topography
2. Aerial photography
3. Locations of storm water collection, conveyance, and detention facilities
4. Land use and zoning maps
5. Hydrologic soil maps

4.3 PROJECTED FUTURE LAND USE CONDITIONS

Impacts that proposed development will have on downstream drainage storm drain facilities shall be evaluated. New development will nearly always increase storm water runoff volume and peak flow. In analyzing the effect of future development, four factors should be evaluated:

1. Increase in percent of impervious area

2. Decrease in subbasin time of concentration due to local storm drain improvements

3. Decrease in runoff routing time due to trunkline and main channel improvements

4. Concentration of runoff to discharge points where the undeveloped condition was predominantly shallow sheet flow

Projected land use for a given area can be obtained from City zoning and planning maps.

4.4 RATIONAL METHOD

4.4.1 RUNOFF COEFFICIENT

Table 4-2 shall be used to estimate the runoff coefficient.

Table 4-2
Rational Method Runoff Coefficients

Type of Drainage Area	Runoff Coefficient, C*
Business:	
Downtown areas	0.70 – 0.95
Neighborhood areas	0.50 – 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 – 0.75
Suburban	0.25 – 0.40
Apartment dwelling areas	0.50 – 0.70
Industrial:	
Light areas	0.50 – 0.80
Heavy areas	0.60 – 0.90
Parks, cemeteries	0.10 - 0.25
Playgrounds	0.20 – 0.40
Railroad yard areas	0.20 – 0.40
Unimproved areas	0.10 – 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2 – 7%	0.10 – 0.15
Sandy soil, steep, 7%	0.15 – 0.20
Heavy soil, flat, 2%	0.13 – 0.17
Heavy soil, average, 2 – 7%	0.18 – 0.22
Heavy soil, steep, 7%	0.25 – 0.65

Table 4-2
Rational Method Runoff Coefficients
(continued)

Type of Drainage Area	Runoff Coefficient, C*
Streets:	
Asphaltic	0.70 – 0.95
Concrete	0.80 – 0.95
Brick	0.70 – 0.85
Drives and walks	0.75 – 0.85
Roofs	0.75 – 0.95

*Higher values are usually appropriate for steeply sloped areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.

4.4.2 TIME OF CONCENTRATION

Time of concentration shall be calculated using the method found in SCS Technical Release 55 (SCS, 1986). Appendix C contains a sample worksheet from that publication, which can be used to calculate the time of concentration. The minimum allowable time of concentration to be used in runoff calculations shall be 10 minutes.

4.4.3 RAINFALL INTENSITY

The rainfall intensity shall be selected from the intensify-duration-frequency curve in Appendix A (see Section 3.1.2). The duration is assumed to equal the time of concentration. The design storm frequency can be obtained from Section 3.1.1.

4.5 TR-55

- The 24-hour SCS Type II storm distribution shall be used (see Appendix B) if the TR-55 method is used.
- The storm depths shall be selected from the depth-duration-frequency curve in Appendix A (see Section 3.1.2)
- Table 2-2a-d in TR-55 shall be used to estimate the runoff Curve Number. Table 2-2a-d and associated information is located in Appendix C.

Worksheet 3: Time of Concentration, and Worksheet 4: Graphical Peak Discharge Method, are included in Appendix C.

4.6 HEC-HMS

There are four main input categories in HEC-HMS which are: design storm, loss method, transform method and routing method. The design storms shall be obtained using the procedure described below. For the loss, transform and routing methods, there are multiple options within HEC-RAS than can be used. Below is a description of the preferred method. Other methods may be allowed, but must first be approved by the City Engineer.

4.6.1 DESIGN STORM

The design storm shall be developed in accordance with Section 3.1.

4.6.2 LOSS METHOD

The SCS Curve Number loss method shall be used. The primary input parameter for this method is the Curve Number. As described below, for developed areas, the percent impervious is also entered. The initial abstraction is typically left blank. The program will calculate the initial abstraction based on the Curve Number using the equation documented in TR-55.

Curve Number

Table 2-2a-d in TR-55 shall be used to estimate the pervious runoff Curve Number (CN). Table 2-2a-d and associated information is located in Appendix C. The categories most often used to estimate the pervious CN are highlighted.

Soil Classification

In order to estimate the CN, the hydrologic soil group classification for the drainage basin must be determined. The hydrologic soil group shall be obtained from the NRCS SSURGO dataset. SSURGO data can be obtained from the Soil Data Mart (http://soildatamart.nrcs.usda.gov/). A figure showing the hydrologic soil groups for Alpine City is contained in Appendix D.

Modelling Impervious Areas

The directly connected impervious area (DCIA) should be entered for developed areas. The DCIA should be measured from aerials for existing developments, or should be obtained from the design plans for a proposed development. Typical values of average percent impervious areas based on land use are included in Table 2-2 of TR-55.

4.6.3 TRANSFORM METHOD

The SCS Unit Hydrograph transform method shall be used. This method requires the input of a single variable: lag time.

Lag Time for Natural Watersheds

The Corps of Engineers version of Snyder's equation shall be used to calculate the lag time for natural watersheds (USBR, 1989) as shown below:

$$\text{Lag Time} = C_t \left(\frac{LL_{ca}}{S^{0.5}}\right)^{0.33}$$

Where:

C_t = Constant between 1.3 and 2.2. 1.6 is typical for the Alpine City area
L = Length, in miles, of the longest watercourse
Lca = Length, in miles, along L to the centroid of the drainage basin
S = Overall drainage basin slope, in feet/mile.

Lag Time of Urban Areas

The lag time for small urban areas is assumed to be equal the time of concentration. Appendix C contains a sample worksheet from TR-55 that can be used to calculate the time of concentration.

4.6.4 ROUTING METHOD

The Muskingum-Cunge method shall be used for routing. The method requires the follow parameters are inputted:

Length – Total length of the reach element.

Slope – Average slope for the entire reach.

Invert – Optional. Typically not used.

Cross Section Shape – Multiple cross sections are available to select from. Depending on the cross section chosen, additional information is required (i.e. diameter, side slope).

Manning's "n" – Average value for the entire reach. Typical values for Manning's "n" used for storm drain conveyance facilities area shown in Table 4-3.

Table 4-3
Values of Manning's Coefficient (n) for Channels and Pipes

Conduit Material	Manning's n*
Plastic pipe	0.011 – 0.015
Steel/cast iron pipe	0.012 – 0.015
Concrete pipe	0.013 – 0.015
Corrugated metal pipe	0.012 – 0.026

Table 4-3
Values of Manning's Coefficient (n) for Channels and Pipes
(continued)

Conduit Material	Manning's n*
Concrete-lined channel	0.013 – 0.020
Excavated or Dredge Channels	
Earth channel – straight and uniform	0.020 – 0.030
Earth channel – winding, fairly uniform	0.025 – 0.040
Rock	0.030 – 0.045
Unmaintained	0.050 – 0.140
Natural Channel	
Fairly regular section	0.030 – 0.070
Irregular section with pools	0.040 – 0.100

* Lower values are usually for well-constructed and maintained (smother) pipes and channels.

4.7 OTHER MODELS

Other computer programs can be used to model the rainfall-runoff process that use similar hydrologic modeling methods, but care should be taken to make sure modeling methods are used correctly. The City Engineer must approve all computer programs and methods, that are not described above, before they are used.

4.8 CALIBRATION

Peak runoff records are typically not available for local drainage studies. An effort should, however, be made to ensure that rainfall runoff analysis results for local drainage studies are consistent and compatible with the City's Storm Drain Master Plan and other pertinent local drainage studies.

It should be noted that the term "calibration" in this context refers to the process of adjusting parameters to achieve results consistent with available reference information, rather than adjusting for actual stream flow observations from the study area. Multiple hydrologic methods should be evaluated and compared to identify reasonable runoff computation results. These methods may include the Rational Formula, the SCS Curve Number Method, the SCS Pervious CN Method, and the Constant and Initial Loss Method. Regional regression equations may also be used to evaluate results depending on the basin size.

Calibration for Natural Watersheds

Results from hydrologic models should be compared to:

- Actual flow records for modeled drainage channels

- Streamflow records from hydrologically similar drainages in the vicinity of the study
- Regional streamflow data (in the event that streamflow records for the local area are not available).

Calibration for Urban Areas

For small urban (developed) areas, the USGS published regression equations than can be used to "calibrate" hydrologic models (see Peak-flow Characteristics of Small Urban Drainages Along the Wasatch Front, Utah).

The range of basin characteristics used to develop the regression equations are shown in Table 4-4.

Table 4-4
Range of Basin Characteristics Used
To Develop Regression Equations for Small Urban Drainages

Basin Characteristic	Unit	Range in Values
Drainage Area (DA)	mi^2	0.085 – 0.87
Basin Slope (BS)	%	0.3 – 15
Effective Impervious Area (EIA)	%	22 – 57

The equations shown in Table 4-5 are only applicable to drainage basins that meet the range of values shown above.

Table 4-5
Regression Equations for Peak Flows
For Small Urban Drainages

Recurrence Interval (Years)	Equations	Average Standard Error of Estimate (%)
10	$Q_{10} = 0.575\ DA^{0.285}\ BS^{0.410}\ EIA^{1.29}$	32
25	$Q_{25} = 66.1\ DA^{0.093}\ BS^{0.243}$	33
100	$Q_{100} = 120\ DA^{0.158}\ BS^{0.194}$	29

The unit peak runoff varies depending on slope and the drainage basin percent impervious. In general, the 10-year event for small urban drainages should be between 0.3 cfs/acre and 1.0 cfs/acre. Modification to input parameters should be considered if simulated runoff results are not within this range.

SECTION 5
EROSION CONTROL

5.1 UPDES PERMIT

All new construction that disturbs one acre of land or more or more shall obtain a UPDES Storm Water General Permit for Construction Activities (Permit #UTR300000) or an alternate individual permit before construction begins. The permit requires the operator, typically the contractor, to control and eliminate storm water pollution sources through the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The permit also requires inspection of the BMP controls either:

- At least once every 7 calendar days, or
- At least once every 14 days and within 24 hours of the end of a storm event of 0.5 inches or greater.

5.2 STORM WATER POLLUTION PREVENTION PLAN

The Storm Water Pollution Prevention Plan (SWPPP) shall be prepared before the contractor can obtain the UPDES permit.

Section 3.5 of the UPDES permit describes in detail what shall be included in the SWPPP. The plan shall include, among other things:

1. Possible sources of storm water pollutants
2. Selection of Best Management Practices (BMPs) to reduce or eliminate pollutant impacts.

A SWPPP template that addresses all of the information required in the SWPPP can be obtained from the State of Utah Division of Water Quality web site:
http://www.waterquality.utah.gov/UPDES/stormwatercon.htm.

5.3 PERMITTING PROCESS

1. The Operator prepares a SWPPP in accordance with the UPDES Permit.
2. The Operator Submits SWPPP to City for review.
3. Once the City has reviewed the SWPPP, the operator applies for the UPDES Permit by completing the Notice of Intent (NOI) form. The form can be completed online at: https://secure.utah.gov/stormwater/main.html
4. Construction may commence only after:

i. The SWPPP has been reviewed by the City
ii. The NOI has been submitted
iii. The Operator has attended a pre-construction meeting with designated City personnel to review and discuss the SWPPP, and
iv. All other applicable permits have been obtained from the City.

5. Once construction has been completed and the site stabilized, the contractor shall complete the Notice of Termination (NOT) form and submit to the Division of Water Quality.

REFERENCES

Farmer, E.E., and J.E. Fletcher, February 1972, Rainfall Intensity-Duration-Frequency Relations for the Wasatch Mountains of Northern Utah, Water Resources Research, Vol.8, No. 1.

Federal Highway Administration, August 2001, Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22, Second Edition.

National Oceanic and Atmospheric Administration, 2006, NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, Volume I, Version 4, Semiarid Southwest.

Thomas, B.E., H.W. Hjalmarson and S.D. Waltemeyer, 1994, Methods for Estimating the Magnitude and Frequency of Floods in the Southwestern United States, U.S. Geological Survey, Open File Report 93-419.

U.S. Army Corps of Engineers, December 1979, Project Cloudburst, Salt Lake County, Utah, Internal File Report.

U.S. Department of Agriculture, Soil Conservation Service, June 1986, Urban Hydrology for Small Watersheds, Technical Release 55.

U.S. Department of the Interior, Bureau of Reclamation, 1989, Flood Hydrology Manual.

U.S. Department of the Interior, Geological Survey, March 1982. Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B.

WRC Engineering, Inc., October 1990. Hydrologic Criteria and Drainage Design Manual, Clark County Regional Flood Control District, Las Vegas, Nevada.

APPENDIX A

NOAA ATLAS 14 INFORMATION

APPENDIX A

Below is the depth-duration-frequency and intensity-duration-frequency data for Alpine City.

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Utah 40.474 N 111.756 W 5209 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Thu Jul 23 2009

Precipitation Frequency Estimates (inches)

AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day
2	0.16	0.24	0.30	0.41	0.50	0.63	0.74	1.01	1.33	1.58	1.99	2.45	3.02
5	0.24	0.36	0.44	0.60	0.74	0.88	1.00	1.32	1.73	2.05	2.59	3.22	3.95
10	0.30	0.45	0.56	0.76	0.94	1.09	1.21	1.55	2.02	2.37	3.00	3.75	4.59
25	0.39	0.60	0.74	1.00	1.23	1.41	1.53	1.88	2.42	2.78	3.52	4.45	5.43
50	0.48	0.73	0.91	1.22	1.51	1.71	1.80	2.14	2.74	3.09	3.93	4.99	6.08
100	0.58	0.88	1.09	1.47	1.82	2.05	2.14	2.44	3.08	3.40	4.34	5.55	6.74
200	0.70	1.06	1.32	1.77	2.20	2.45	2.53	2.78	3.45	3.72	4.75	6.13	7.42
500	0.89	1.35	1.68	2.26	2.80	3.11	3.18	3.41	4.01	4.15	5.32	6.92	8.35
1000	1.07	1.62	2.01	2.71	3.35	3.71	3.78	3.98	4.48	4.48	5.75	7.55	9.08

* These precipitation frequency estimates are based on an annual maxima series. **AEP** is the Annual Exceedance Probability.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Precipitation Intensity Estimates (in/hr)

AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day
2	1.91	1.46	1.20	0.81	0.50	0.31	0.25	0.17	0.11	0.07	0.04	0.03	0.02
5	2.82	2.15	1.78	1.20	0.74	0.44	0.33	0.22	0.14	0.09	0.05	0.03	0.02
10	3.57	2.72	2.25	1.51	0.94	0.55	0.40	0.26	0.17	0.10	0.06	0.04	0.03
25	4.71	3.58	2.96	1.99	1.23	0.71	0.51	0.31	0.20	0.12	0.07	0.05	0.03
50	5.76	4.38	3.62	2.44	1.51	0.85	0.60	0.36	0.23	0.13	0.08	0.05	0.04
100	6.97	5.30	4.38	2.95	1.82	1.02	0.71	0.41	0.26	0.14	0.09	0.06	0.04
200	8.38	6.38	5.27	3.55	2.20	1.23	0.84	0.46	0.29	0.16	0.10	0.06	0.04
500	10.69	8.13	6.72	4.52	2.80	1.55	1.06	0.57	0.33	0.17	0.11	0.07	0.05
1000	12.80	9.74	8.05	5.42	3.35	1.86	1.26	0.66	0.37	0.19	0.12	0.08	0.05

* These precipitation frequency estimates are based on an annual maxima series. **AEP** is the Annual Exceedance Probability.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

APPENDIX B

STORM DISTRIBUTIONS

APPENDIX B
STORM DISTRIBUTIONS

Below are the 10-year storm distributions for the 3-, 6-, and 24-hour storm durations. The total precipitation was obtained from the data shown in Appendix A. In order to apply these storm durations for other storm frequencies, multiply the incremental precipitation values by the ratio of the new storm frequency total depth to the 10-year total depth. The Farmer-Fletcher 3-hour modified storm distribution is the one exception to this rule. Below is an explanation of how that storm distribution was developed.

Salt Lake County developed the modified version of the Farmer-Fletcher distribution by nesting the one-hour (quartile 1) Farmer-Fletcher storm distribution, within the three hour period. The difference between the three-hour and the one-hour rainfall depths is divided equally and is distributed over the first 30 minutes of the storm and from hour 1.5 to 3.0 (see Table B-1).

Table B-1
Farmer-Fletcher Modified 3-Hour
Storm Distribution

Time (min)	Precipitation (Inches)
0	0.000
5	0.011
10	0.011
15	0.011
20	0.011
25	0.011
30	0.011
35	0.268*
40	0.212*
45	0.148*
50	0.094*
55	0.056*
60	0.043*
65	0.032*
70	0.024*
75	0.019*
80	0.017*
85	0.015*
90	0.012*

Time (min)	Precipitation (Inches)
95	0.011
100	0.011
105	0.011
110	0.011
115	0.011
120	0.011
125	0.011
130	0.011
135	0.011
140	0.011
145	0.011
150	0.011
155	0.011
160	0.011
165	0.011
170	0.011
175	0.011
180	0.011
Total:	1.21

* Nested 1-hour storm distribution

Table B-2
NOAA Atlas 14
General Precipitation Area
6-Hour Storm Distribution

Time (min)	Precipitation (Inches)
0	0.000
15	0.065
30	0.057
45	0.053
60	0.051
75	0.073
90	0.101
105	0.085
120	0.071
135	0.085
150	0.078
165	0.078
180	0.074
195	0.073
210	0.067
225	0.060
240	0.056
255	0.064
270	0.064
285	0.065
300	0.059
315	0.047
330	0.043
345	0.042
360	0.040
Total:	1.55

Table B-3
SCS Type II 24-Hour
Storm Distribution

Time (hours)	Precipitation (Inches)
0.0	0.000
0.5	0.013
1.0	0.013
1.5	0.013
2.0	0.014
2.5	0.014
3.0	0.015
3.5	0.016
4.0	0.016
4.5	0.017
5.0	0.018
5.5	0.019
6.0	0.020
6.5	0.021
7.0	0.023
7.5	0.025
8.0	0.027
8.5	0.030
9.0	0.033
9.5	0.037
10.0	0.043
10.5	0.055
11.0	0.073
11.5	0.114
12.0	0.900

Time (hours)	Precipitation (Inches)
12.5	0.170
13.0	0.088
13.5	0.063
14.0	0.049
14.5	0.043
15.0	0.037
15.5	0.033
16.0	0.030
16.5	0.027
17.0	0.025
17.5	0.023
18.0	0.022
18.5	0.020
19.0	0.019
19.5	0.018
20.0	0.017
20.5	0.016
21.0	0.015
21.5	0.015
22.0	0.014
22.5	0.014
23.0	0.013
23.5	0.013
24.0	0.013
Total:	2.37

APPENDIX C

TR-55 INFORMATION

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

Antecedent runoff condition

The index of runoff potential before a storm event is the antecedent runoff condition (ARC). ARC is an attempt to account for the variation in CN at a site from storm to storm. CN for the average ARC at a site is the median value as taken from sample rainfall and runoff data. The CN's in table 2-2 are for the average ARC, which is used primarily for design applications. See NEH-4 (SCS 1985) and Rallison and Miller (1981) for more detailed discussion of storm-to-storm variation and a demonstration of upper and lower enveloping curves.

Urban impervious area modifications

Several factors, such as the percentage of impervious area and the means of conveying runoff from impervious areas to the drainage system, should be considered in computing CN for urban areas (Rawls et al., 1981). For example, do the impervious areas connect directly to the drainage system, or do they outlet onto lawns or other pervious areas where infiltration can occur?

Connected impervious areas — An impervious area is considered connected if runoff from it flows directly into the drainage system. It is also considered connected if runoff from it occurs as concentrated shallow flow that runs over a pervious area and then into the drainage system.

Urban CN's (table 2-2a) were developed for typical land use relationships based on specific assumed percentages of impervious area. These CN vales were developed on the assumptions that (a) pervious urban areas are equivalent to pasture in good hydrologic condition and (b) impervious areas have a CN of 98 and are directly connected to the drainage system. Some assumed percentages of impervious area are shown in table 2-2a

If all of the impervious area is directly connected to the drainage system, but the impervious area percentages or the pervious land use assumptions in table 2-2a are not applicable, use figure 2-3 to compute a composite CN. For example, table 2-2a gives a CN of 70 for a 1/2-acre lot in HSG B, with assumed impervious area of 25 percent. However, if the lot has 20 percent impervious area and a pervious area CN of 61, the composite CN obtained from figure 2-3 is 68. The CN difference between 70 and 68 reflects the difference in percent impervious area.

Unconnected impervious areas — Runoff from these areas is spread over a pervious area as sheet flow. To determine CN when all or part of the impervious area is not directly connected to the drainage system, (1) use figure 2-4 if total impervious area is less than 30 percent or (2) use figure 2-3 if the total impervious area is equal to or greater than 30 percent, because the absorptive capacity of the remaining pervious areas will not significantly affect runoff.

When impervious area is less than 30 percent, obtain the composite CN by entering the right half of figure 2-4 with the percentage of total impervious area and the ratio of total unconnected impervious area to total impervious area. Then move left to the appropriate pervious CN and read down to find the composite CN. For example, for a 1/2-acre lot with 20 percent total impervious area (75 percent of which is unconnected) and pervious CN of 61, the composite CN from figure 2-4 is 66. If all of the impervious area is connected, the resulting CN (from figure 2-3) would be 68.

TR 55 Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project: _____ Designed By: _____ Date: _____

Location: _____ Checked By: _____ Date: _____

Check one: Present Developed

Check one: T_c T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (Applicable to T_c only) Segment ID

1. Surface description (Table 3-1) .....
2. Manning's roughness coeff., n (Table 3-1) .....
3. Flow length, L (total L ≤ 100 ft) ..... ft
4. Two-year 24-hour rainfall, P_2 ..... in
5. Land slope, s ..... ft/ft
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t ..... hr

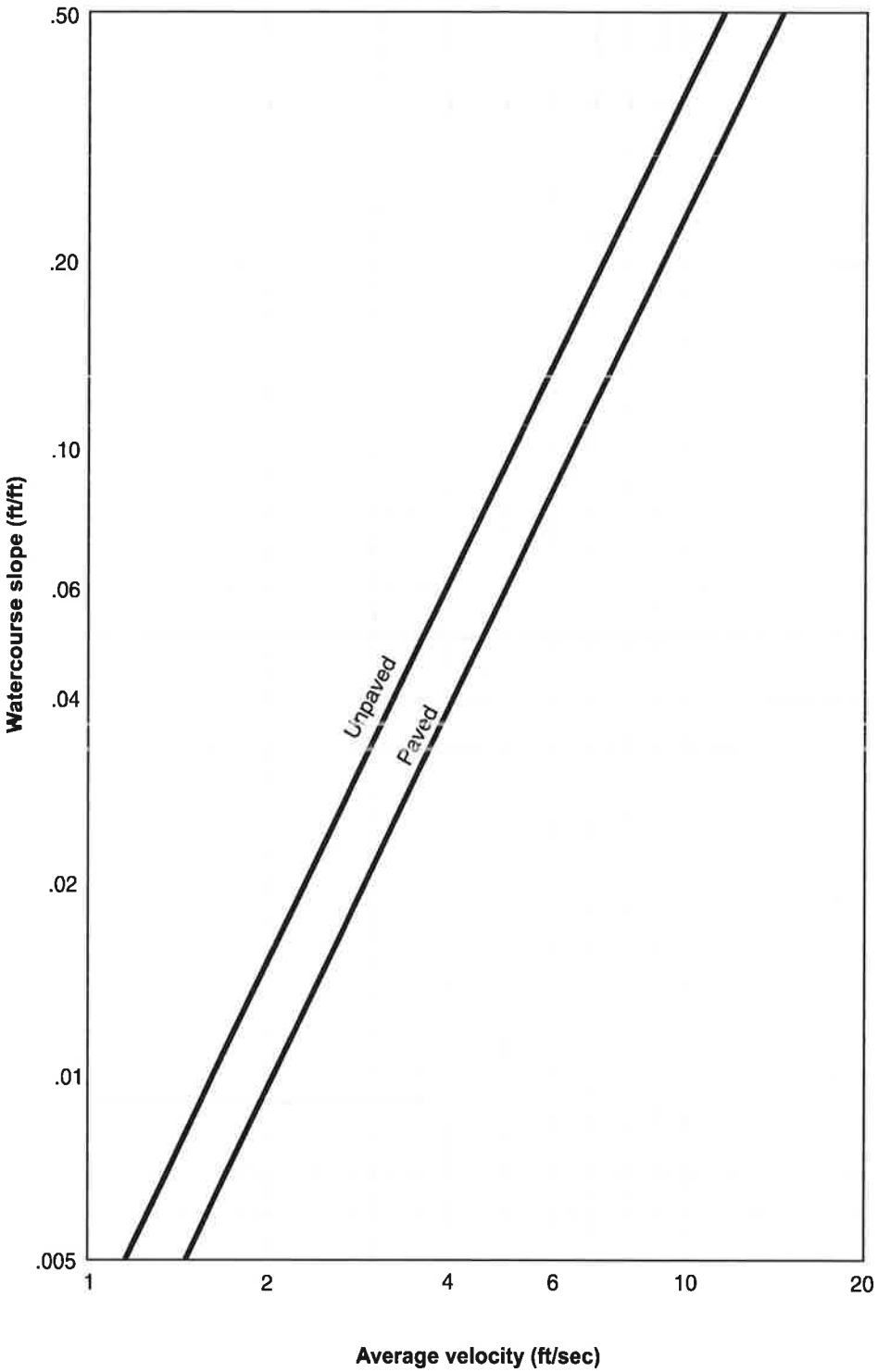
Shallow Concetrated Flow Segment ID

7. Surface description (paved or unpaved) .....
8. Flow length, L ..... ft
9. Watercourse slope, s ..... ft/ft
10. Average velocity, V (Figure 3-1) ..... ft/s
11. $T_t = \frac{L}{3600\ V}$ Compute T_t ..... hr

Channel Flow Segment ID

12. Cross sectional flow area, a ..... ft^2
13. Wetted perimeter, P_w ..... ft
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r ..... ft
15. Channel Slope, s ..... ft/ft
16. Manning's Roughness Coeff., n .....
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ..... ft/s
18. Flow length, L ..... ft
19. $T_t = \frac{L}{3600\ V}$ Compute T_t ..... hr
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19 ..... hr

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

Table 3-1 Roughness coefficients (Manning's n) for sheet flow

Surface description	n [1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The n values are a composite of information compiled by Engman (1986).

2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

3 When selecting n , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \qquad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bankfull elevation.

Tr 55 Worksheet 4: Graphical Peak Discharge Method

Project: _____ Designed By: _____ Date: _____

Location: _____ Checked By: _____ Date: _____

Check one: ____ Present ____ Developed

1. Data:

   Drainage area ..... A_m = _____ mi^2 (acres/640)

   Runoff curve number .... CN = _____ (From Worksheet 2)

   Time of concentration ..... T_c = _____ hr (From Worksheet 3)

   Rainfall distribution type ..... = _____ (II, III, DMVIII)

   Pond and swamp areas spread throughout watershed ..... = _____ percent of A_m (_____ acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency.....	yr			
3. Rainfall, P (24-hour).....	in			
4. Initial abstraction, I_a..... (Use CN with Table 4-1.)	in			
5. Compute I_a/P.....				
6. Unit peak discharge, q_u..... (Use T_c and I_a/P with exhibit 4- 10)	csm/in			
7. Runoff, Q ..... (From Worksheet 2)	in			
8. Pond and swamp adjustment factor, F_p..... (Use percent pond and swamp area with Table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	in			
9. Peak discharge, q_p..... (Where $q_p = q_u A_m Q F_p$)	cfs			

APPENDIX D

SOIL MAP

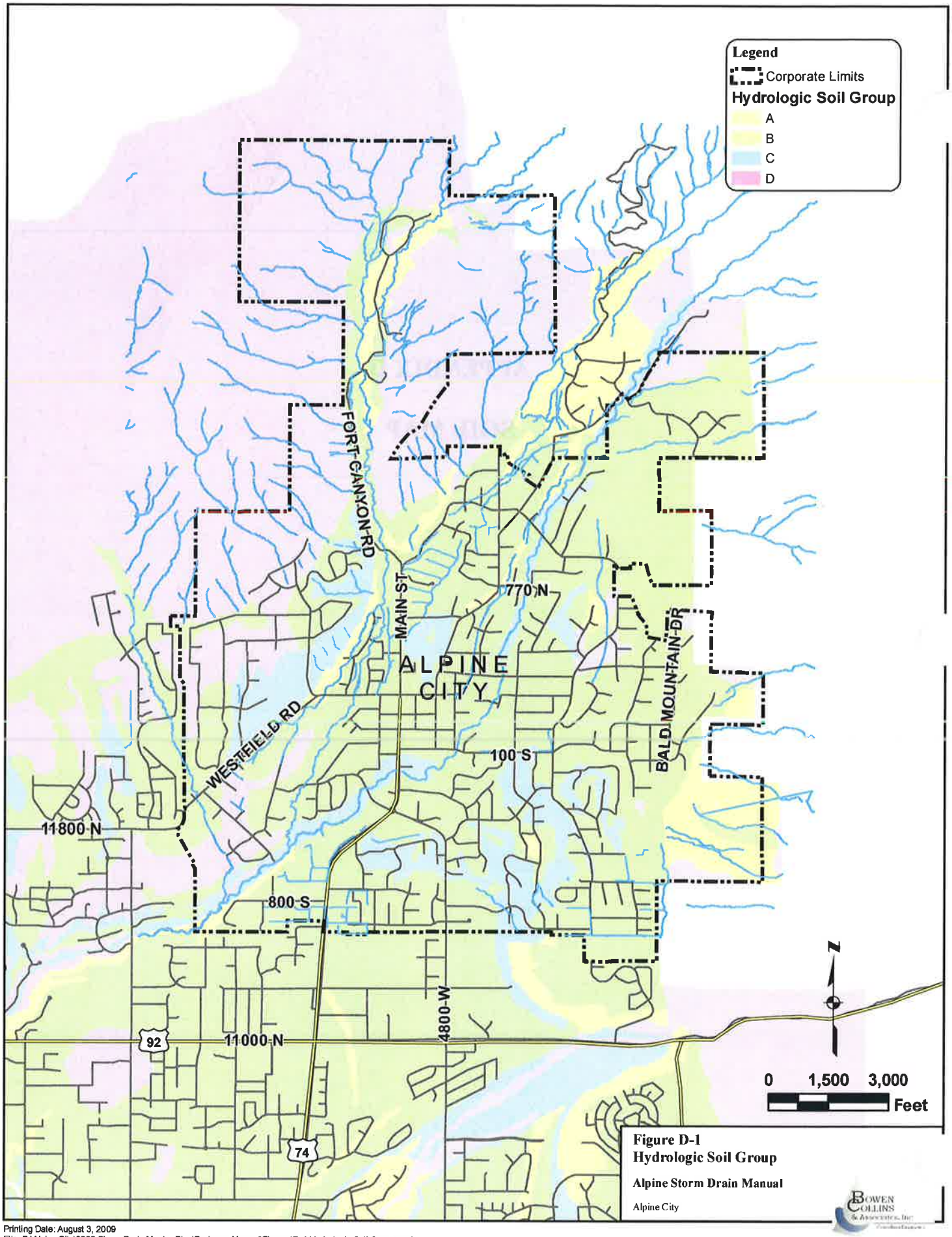


Figure D-1
Hydrologic Soil Group

Alpine Storm Drain Manual

Alpine City

Printing Date: August 3, 2009
File: P:\Alpine City\2009 Storm Drain Master Plan\Drainage Manual\Figures\D-1 Hydrologic Soil Group.mxd

BOWEN COLLINS & Associates, Inc.
Consulting Engineers

TECHNICAL MEMORANDUM

DATE: February 8, 2010

TO: Shane Sorensen, P.E.
City Engineer
Alpine City
20 North Main Street
Alpine, Utah 84004

FROM: Craig Bagley, P.E., Matt Stayner, P.E.
Bowen, Collins & Associates
154 East 14000 South
Draper, Utah 84020

SUBJECT: 2010 Alpine City Storm Drain Master Plan Amendment

INTRODUCTION

Alpine City (City) retained Bowen Collins & Associates (BC&A) to complete an amendment to the 2002 Alpine City Storm Drain Master Plan. This amendment includes:

- New hydrologic and hydraulic evaluations of drainage subbasins B, G, H and W. These subbasins are referred to in this Technical Memorandum as the study area.
- Analysis of and recommended improvements for Hog Hollow Wash
- Development of the Alpine City Storm Water Drainage Design Manual.

The City chose to update the Storm Drain Master Plan for the study area based on current and potential future development pressure. The City chose to study Hog Hollow due to complaints of flooding from residents who live adjacent to the drainage. The primary objective of this amendment is to identify improvements that will resolve existing and future drainage problems in the study area and Hog Hollow Wash.

HYDROLOGIC ANALYSIS

A hydrologic computer model of the study area was developed for the purpose of estimating storm water runoff volumes and peak discharges generated by a design cloudburst event. The model development process is outlined in the following general steps, with detailed information on each step provided later in this technical memorandum:

1. Delineate drainage basin and subbasin boundaries in the study area based on topography, parcel maps, aerial photography, and existing storm drainage facility information.

2. Estimate hydrologic modeling parameters for each subbasin in the study area based on soil type, land use, slope, and other storm water conveyance characteristics.

3. Develop a design precipitation event (or events) using local rainfall data.

4. Combine subbasin, channel routing, and storage elements in an integrated hydrologic model for the study area.

Drainage Basin Delineation

Aerial photography, topographic mapping, field observations and existing storm drainage facility inventory were used to delineate subbasins in the study area. The 2002 Alpine City Storm Drain Master Plan terminated subbasins at City boundaries. The revised subbasins for this updated analysis were delineated to include the drainage area, not just the portion in the City boundary. The updated subbasin boundaries are shown in Figure 1.

Hydrologic Modeling Parameters

Loss Method. The SCS Curve Number method was used in the hydrologic model to calculate infiltration losses. This method requires the input of a composite Curve Number and the percent impervious for each subbasin. Table 2-2 in TR-55 was used to select appropriate curve numbers. The hydrologic soil type was obtain from the NRCS SSURGO dataset, as shown in Appendix D of the Alpine City Storm Water Drainage Design Manual. The land use was obtained from the Alpine City Land Use Map.

For residential areas, the grass coverage was assumed to be 50% to 75%. The percent impervious for residential areas was estimated based on lot size, as shown in Table 1. Percent impervious estimates for other land use types were obtained from Table 2-2 in TR-55 (see Appendix C of the Alpine City Storm Water Drainage Design Manual for a copy of Table 2-2).

Table 1
Average Imperviousness Based on Lot Size

Residential Lot Size	Directly Connected Imperviousness
1/4 acre	30%
1/2 acre	20%
1 acre	15%

For areas that will remain undeveloped, it appears that the ground cover is generally oak and aspen with 30% - 70% ground cover.

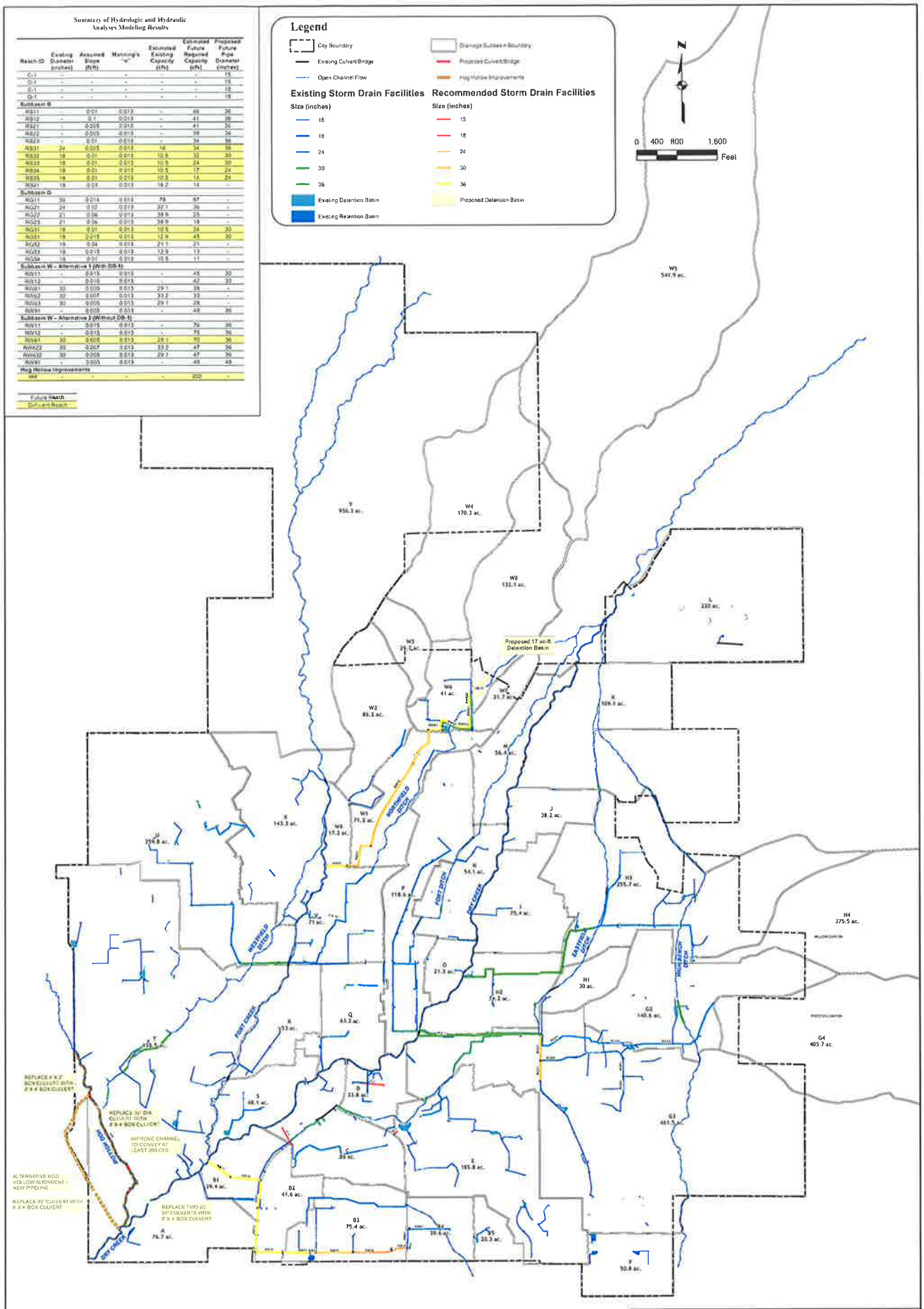


Figure 1
Recommended Storm Drain Improvements
2010 Alpine Storm
Drain Master Plan Update
Alpine City

Bowen Collins & Associates, Inc.

Transform Method. The SCS Unit Hydrograph was used in the hydrologic model to convert rainfall to runoff. This method requires the lag time as an input parameter. For urban areas, Worksheet 3 in TR-55 (also included in Appendix C of the Alpine City Storm Water Drainage Design Manual) was used to estimate the time of concentration. The time of concentration was assumed to be equal to the lag time for the urban areas in this study.

For undeveloped drainage basins, lag times were estimated based on approximate collection channel lengths and slopes using the USACE version of Snyder's equation for lag time (USBR, 1989).

$$\text{Lag Time} = 1.8\ \left(\frac{LL_{ca}}{S^{0.5}}\right)^{0.33}$$

where:

L = the longest water course in a given basin from the drainage boundary to the point of concentration (in miles)

L_{ca} = the length along L from a point perpendicular to the basin centroid to the point of concentration (in miles)

S = the overall slope of L (in feet per mile).

Routing Method. The Muskingum-Cunge routing method was in the hydrologic model to compute the affects of routing in the computer model. The input parameters for this routing method require the reach geometry and Manning's n. These values were selected as describe in the Storm Water Drainage Design Manual.

Design Storm Parameters

The design storm parameters utilized in this study amendment were obtained from the Storm Water Drainage Design Manual and are briefly described below.

Design Storm Frequency. Storm water runoff from a storm with a 10%, or 10-year, return frequency was used to analyze minor storm drain facilities in the study area. All of the storm drain pipes in the study area were considered to be minor facilities.

Storm water runoff from a storm with a 1%, or 100-year, return frequency was used to analyze major storm drain facilities. The detention basin in Subbasin W8 and the Hog Hollow channel and culverts were considered to be major facilities.

Design Storm Depth. Precipitation depth-duration-frequency data from NOAA Atlas 14 (2006) were used in developing the design storm depths (see Appendix A of the Storm Water Drainage Design Manual). The design storm precipitation depths used in the study are presented in Table 2.

Table 2
Design Storm Depth, Duration, Frequency Data
(from NOAA Atlas 14)

Depth Frequency Estimates (inches)		
ARI* (Years)	**3 Hour**	**24 Hour**
10	1.21**	2.37
100	2.14	3.40**

* **ARI** is the Average Recurrence Interval.

** Values used in hydrologic analysis

Design Storm Distribution and Duration. The 3-hour Modified Farmer-Fletcher precipitation distribution was used to estimate the peak runoff that would need to be conveyed in the storm drain pipes. The 24-hour, median quartile 3, general storm from NOAA Atlas 14 was used to estimate the required volume of the proposed detention basin. This 24-hour storm distribution was also used in the Dry Creek Dam Hydrology Report (2007). That distribution is reasonable for this area, and was used in this analysis in order to obtain results that were similar to those from the Dry Creek Dam Hydrology Report.

The precipitation distributions for the 10-year, 3-hour and the 100-year, 24-hour design storms are located in Appendix B of the Alpine City Storm Water Drainage Design Manual.

Hydrologic Modeling Methods and Assumptions

The hydrologic analysis of the study area was performed using the HEC-HMS software package, version 3.1.3, developed by the U.S. Army Corps of Engineers (USACE). HEC-HMS uses the HEC-1 Flood Hydrograph Package algorithms in a Windows environment, with additional pre- and post-data processing. A complete description of HEC-HMS modeling methods and capabilities is presented in the USACE HEC-HMS User's Manual. The model input parameters were assembled using multiple data sources, including subbasin delineations, soil surveys, land use maps, recent aerial photography, and model input data used in similar hydrologic studies within or in the vicinity of the study area.

The following standard assumptions were made in completing the hydrologic analyses of the study area:

1. Design Storm return frequency is equal to associated runoff return frequency.

2. Design storm rainfall has a uniform spatial distribution over the watershed.

3. Normal (SCS Type II) antecedent soil moisture conditions exist at the beginning of the design storm.

4. The hydrologic computer model accurately simulates watershed response to precipitation.

5. All storm water runoff generated by the model is conveyed through downstream model elements (the hydrologic model does not account for storm drain inlet or conveyance deficiencies).

Hog Hollow Analysis

A hydrologic analysis of Hog Hollow was not performed as part of this study amendment as it was recently studied in the 2007 Highland City Storm Drain Master Plan (SDMP). In the Highland SDMP analysis, the post-developed 100-year discharges from Draper (Suncrest Development) and Highland are 171 cfs and 24 cfs, respectively. The total 100-year discharge on Hog Hollow at the Highland/Alpine City boundary was estimated to be approximately 200 cfs.

In this analysis two options were considered to safely convey the 100-year discharge from Westfield Road to Dry Creek. The first option is to improve the channel and culverts to convey the entire 100-year discharge. This would require deepening the channel and laying the channel banks back. It is likely the banks would need to be have riprap placed on them. Also, the culverts would need to be replaced with structures that could convey the 100-year discharge, an 8-foot by 4-foot box culvert, for example. The cost estimate below is based on this option.

The second option is to construct a pipeline in Westfield road and down the private drive to Dry Creek (see Figure 1 for alignment). The existing channel and culverts on Dry Creek can convey approximately 50 cfs without flooding in the overbanks. The pipeline would therefore need to be sized to convey the remaining flow (approximately 150 cfs).

CRITERIA FOR DRAINAGE FACILITIES ANALYSIS

The following major tasks were completed to identify drainage system deficiencies:

- Estimated peak discharge rates and runoff volumes from design storm simulations were computed for the study area.

- Estimated hydraulic capacities for storm drains, minor irrigation channels, and culverts in the study area based on storm drain inventory information collected as part of this study.

- Used the results of the hydrologic and hydraulic analyses to identify deficiencies in storm drain lines and storm water detention basins in the study area.

- Recommended improvements to resolve storm drain system deficiencies under projected future development conditions in the study area.

The following criteria were used as the basis of identifying drainage system deficiencies in the study area as well as the design of recommended improvements:

- Storm drain pipelines serving urban areas should have capacity to collect and convey storm water runoff generated from a 10-year, 3-hour design storm.
- Open channels that collect storm water runoff only from urban areas should have capacity to convey runoff generated from a 10-year, 3-hour design storm.
- Hog Hollow and all other natural drainage channels that convey runoff from mountain watersheds should have capacity to convey runoff generated from a 100-year, 24-hour design storm.

The evaluation of drainage system facilities was performed only for projected full build-out development conditions. Pipes in the study area that were identified as being deficient are highlighted in yellow on the table in Figure 1. Future proposed pipes are highlighted in blue on the same table. Recommended storm drain facilities are identified in Figure 1 and are summarized below.

RECOMMENDED DRAINAGE SYSTEM IMPROVEMENT PROJECTS

Information obtained by coorinating with City officials, field reconnaissance, and performing hydrologic and hydraulic analyses of projected full build-out conditions was used to identify drainage system improvements that are needed to safely collect and convey runoff from designated design storms in the study area and Hog Hollow Wash. An updated list of recommended drainage system improvements for the entire City has been developed for use in budgeting and planning is presented in the table on Figure 1. The recommended improvements for the study area aw sell as the recommended improvements from the previous study that have not yet been constructed are shown on Figure 1.

Conceptual cost estimates for the recommended improvements are included in Table 3. Unit costs used in developing the conceptual construction costs are presented in Table A-1 in the Appendix. The unit costs for construction were developed in 2010 dollars using information from a variety of sources including recent bids for similar projects, local contractors, and construction estimating guides.

It should be noted that two alternatives sets of storm drain improvements for Subbasin W are presented in Figure 1. Alternative 1 includes a detention basin in Subbasin W8. The detention basin was sized to limit the downstream discharge to an amount that can be conveyed in the existing downstream 30-inch diameter pipes (RW62 and RW 63). This option may be cost prohibitive if the City must pay for land acquisition.

In Alternative 2, there is no detention pond to attenuate the peak discharge for the design storm. New 36-inch diameter pipes (RW622 and RW632) parallel to the existing 30-inch diameter pipes would need to be constructed. In this Alternative, the pipes downstream of Subbasin W8 are sized to convey the peak discharge from the 100-year design storm.

LIMITATIONS OF MASTER PLAN DATA

This technical memorandum presents information that is intended to be used to plan for the funding and design of needed storm drain facilities in Alpine City. The design discharges associated with the recommended structural improvements are associated with projected full buildout conditions. More detailed analyses and studies should be completed during the design phase of the recommended storm drain projects. Some of the needed projects could be phased to match available funding streams. For example, a detention or retention facility could initially be constructed with a volume smaller than what is recommended if a significant portion of the storm drain collection system in developed parts of the City will not be constructed for some time. In addition, the actual locations of some of the drainage corridors, pipelines, and regional detention/retention facilities may be changed to better fit conditions not known when this plan was developed.

Table 3
Updated Estimated Cost Summary of Capital Improvements

			Percentage of Cost Attributable to:[1]		Cost Attributable to:	
Project Identifier	Location	Total Estimated Cost	Existing Development	Future Development	Existing Development	Future Development
C-1	Alpine Hwy / Bateman Ln.	$ 22,860	100%	0%	$ 22,860	$ -
D-1	Red Pine Dr.	$ 42,422	0%	100%	$ -	$ 42,422
E-1	Canyon Crest Rd. near Ridge Dr.	$ 15,675	70%	30%	$ 10,973	$ 4,703
Q-1	100 W. / 120 S.	$ 7,139	100%	0%	$ 7,139	$ -
Subbasin B						
RB-11	West of Alpine Highway	$ 109,310	0%	100%	$ -	$ 109,310
RB-12	West of Alpine Highway to Alpine Highway	$ 135,311	0%	100%	$ -	$ 135,311
RB-21	Alpine Highway	$ 139,874	0%	100%	$ -	$ 139,874
RB-22	Alpine Highway	$ 242,447	0%	100%	$ -	$ 242,447
RB-23	Between Alpine Highway and Allegheny Way	$ 122,641	0%	100%	$ -	$ 122,641
RB-31	Allegheny Way	$ 134,379	80%	20%	$ 107,503	$ 26,876
RB-32	Allegheny Way	$ 27,452	80%	20%	$ 21,962	$ 5,490
RB-33	Allegheny Way	$ 144,572	80%	20%	$ 115,657	$ 28,914
RB-34	Allegheny Way	$ 142,763	80%	20%	$ 114,210	$ 28,553
RB-35	Allegheny Way	$ 76,748	80%	20%	$ 61,398	$ 15,350
Subbasin G						
RG-31	800 East	$ 80,123	100%	0%	$ 80,123	$ -
RG-51	800 East	$ 193,529	100%	0%	$ 193,529	$ -

Table 3 (Continued)
Updated Estimated Cost Summary of Capital Improvements

Project Identifier	Location	Total Estimated Cost	Percentage of Cost Attributable to:[1]		Cost Attributable to:	
			Existing Development	Future Development	Existing Development	Future Development
Subbasin W - Alternative 1 (With DB-1)						
RW-11	Pioneer Rd. to Eastview Ln.	$ 175,554	5%	95%	$ 8,778	$ 166,776
RW-12	Pioneer Rd. to Eastview Ln.	$ 499,716	5%	95%	$ 24,986	$ 474,730
RW-61	East View Ln. to Detention Basin	$ 55,485	5%	95%	$ 2,774	$ 52,711
RW-91	West of Main Street	$ 98,388	5%	95%	$ 4,919	$ 93,469
DB-W	East of Elkridge Lane	$ 1,991,588	0%	100%	$ -	$ 1,991,588
Subbasin W - Alternative 2 (Without DB-1)						
RW-11	Pioneer Rd. to Eastview Ln.	$ 236,864	5%	95%	$ 11,843	$ 225,021
RW-12	Pioneer Rd. to Eastview Ln.	$ 777,391	5%	95%	$ 38,870	$ 738,521
RW-61	East View Ln. to Detention Basin	$ 93,251	5%	95%	$ 4,663	$ 88,589
RW-622	Heritage Hills Road	$ 172,368	0%	100%	$ -	$ 172,368
RW-632	Elk Ridge Lane	$ 175,811	0%	100%	$ -	$ 175,811
RW-91	West of Main Street	$ 123,066	5%	95%	$ 6,153	$ 116,913
Hog Hollow Improvements						
HH	Hog Hollow - from Alpine City Boundary to Dry Creek	$ 1,572,075	50%	50%	$ 786,038	$ 786,038
Miscellaneous						
Misc. A	Annual Storm Drain Master Plan Update ($2,500 for 25 Years to 2030)	$ 83,575	20%	80%	$ 16,715	$ 66,860
Misc. B	5 Year Storm Drain Master Plan Update ($20,000 every 5 Years to 2030)	$ 160,464	20%	80%	$ 32,093	$ 128,371
	Total Cost Estimate with Subbasin W - Alternative 1	**$ 6,274,086**			**$ 1,611,656**	**$ 4,662,430**
	Total Cost Estimate with Subbasin W - Alternative 2	**$ 5,032,107**			**$ 1,631,728**	**$ 3,400,379**

(1) Percentage of estimated cost attributable to existing and future development based on a comparison of existing and future development needed design capacity (i.e. peak volumes for detention basins and peak flows for culverts, open channels, and storm drain pipe.

REFERENCES

Farmer, E.E., and J.E. Fletcher, February 1972, Rainfall Intensity-Duration-Frequency Relations for the Wasatch Mountains of Northern Utah, Water Resources Research, Vol.8, No. 1.

Hansen, Allen and Luce, Inc., September 2007, Highland City Storm Drain Master Plan.

National Oceanic and Atmospheric Administration, 2006, NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, Volume I, Version 4, Semiarid Southwest.

Psomas, March 2007, Dry Creek Dam Hydrology Report, prepared for the North Utah County Water Conservancy District

U.S. Department of Agriculture, Soil Conservation Service, June 1986, Urban Hydrology for Small Watersheds, Technical Release 55.

U.S. Department of Agriculture, Soil Conservation Service, 2000, Soil Survey of Juab Area, Utah.

U.S. Department of the Interior, Bureau of Reclamation, 1989, Flood Hydrology Manual.

APPENDIX A

Table A-1
Estimated Cost of Capital Improvements
Alpine City Storm Drainage Master Plan Update

Project Identifier	Pipe Length (ft)	Diameter (in)	Catch Basin / Inlet Box (EA)	Junction Box / Manhole (EA)	Outlet Works (EA)	Saw Cut (LF)	Class "A" Road Repair (SF)	ENG., Legal, Admin. (15%) Contingencies (25%)	Estimated Project Cost
Subbasin B									
RB-11	546	36"		1	1			X	$ 109,310
RB-12	619	36"	2	1		35	210	X	$ 135,311
RB-21	553	36"	2	1		553	3318	X	$ 139,874
RB-22	887	36"	6	3		887	5322	X	$ 242,447
RB-23	556	36"	2	1		25	150	X	$ 122,641
RB-31	562	36"		1		562	3372	X	$ 134,379
RB-32	121	30"		1		121	726	X	$ 27,452
RB-33	734	30"		2		734	4404	X	$ 144,572
RB-34	782	24"		2		782	4692	X	$ 142,763
RB-35	314	24"	2	3		314	1884	X	$ 76,748
								Subbasin Total	**$ 1,275,494**
Subbasin G									
RG-31	410	30"		1		410	2460	X	$ 80,123
RG-51	973	30"		3		973	5838	X	$ 193,529
								Subbasin Total	**$ 273,652**
Subbasin W - Alternative 1 (With DB-W)									
RW-11	839	30"	6	2		518	3108	X	$ 175,554
RW-12	2,661	30"	14	7		410	2460	X	$ 499,716
RW-61	335	30"		1		10	60	X	$ 55,485
RW-91	424	36"	2	1	1	20	120	X	$ 98,388
DB-W 17 ac-ft Detention Basin									
Excavation and Hauling				27,450	Cubic Yards				$ 356,850
Landscaping (non-irrigated native)				218,000	Square Feet				$ 65,400
Inlet Apron				12,000	LS				$ 12,000
Outlet Structure				16,000	LS				$ 16,000
Emergency Spillway				5,000	LS				$ 5,000
Riprap				20,000	LS				$ 20,000
Land acquisition				5	acre				$ 1,000,000
Eng, Legal, Admin, Conting (35%)									$ 516,338
								Detention Basin Sub-Total	**$ 1,991,588**
								Subbasin Total	**$ 2,722,343**

Table A-1 (Continued)
Estimated Cost of Capital Improvements
Alpine City Storm Drainage Master Plan Update

Subbasin W - Option 2 (Without DB-W)										
RW-11	839	36"	6	2		518	3108	X	$	236,864
RW-12	2,661	36"	14	7		410	2460	X	$	777,391
RW-61	335	36"		1		10	60	X	$	93,251
RW622	704	36"		2		704	4224	X	$	172,368
RW632	719	36"		2		719	4314	X	$	175,811
RW-91	424	48"	2	1	1	20	120	X	$	123,066
								Subbasin Total	**$**	**1,578,751**
Hog Hollow Improvments										
Open Channel										
Excavation				14500	Cubic Yards				$	188,500
Riprap				9,000	Cubic Yards				$	675,000
Landscaping				102,000	Square Feet				$	51,000
Settling Basin				1	Lump Sum				$	20,000
Culverts	250	4' X 8'							$	200,000
Permanent Easement Acq			3	acres					$	30,000
Eng, Legal, Admin, Conting (35%)									$	407,575
								Subbasin Total	**$**	**1,572,075**

Note:

For Class "A" Road Repair - Trench width of 4' for 18" or less pipe and 6' for 24" or larger pipe.

Table A-2
Conceptual Cost Estimate Unit Cost Summary
Alpine City Storm Drainage Master Plan Update

Description	Unit	Unit Cost
Detention Basins		
Property Acquisition	Acre	$200,000
Excavation and Hauling	Cubic Yard	$13
Landscaping (Non-irrigated Native)	Square Foot	$0.30
Landscaping (Irrigated Turfgrass)	Square Foot	$2.60
Inlet Apron	Lump Sum	$12,000
Outlet Structure	Lump Sum	$16,000
Emergency Spillway	Lump Sum	$5,000
Riprap	Lump Sum	$20,000
Storm Drain Pipelines		
Permanent Easement Acquisition	Acre	$10,000
18-inch RCP (1)	Linear Foot	$100
24-inch RCP (1)	Linear Foot	$125
30-inch RCP (1)	Linear Foot	$135
30-inch RCP (2)	Linear Foot	$110
36-inch RCP (1)	Linear Foot	$170
36-inch RCP (2)	Linear Foot	$145
42-inch RCP (1)	Linear Foot	$195
48-inch RCP (1)	Linear Foot	$240
48-inch RCP (2)	Linear Foot	$215
Manhole (1)	Each	$4,000
Catch Basin (1)	Each	$2,800
36-inch Concrete End Section	Each	$1,800
48-inch Concrete End Section	Each	$2,000
Bore and Jack Steel Casing (for 18- to 42-inch RCP)	Linear Foot/ Inch Dia.	$16
Bore and Jack Steel Casing (for 48- to 72-inch RCP)	Linear Foot/ Inch Dia.	$17
Traffic Control	Linear Foot	$16
Storm Drain Culvert Road Crossings for Creeks and Washes		
Pipe Culvert	See RCP Storm Drain Costs Above	
4' X 8' Box Culvert (2-5 feet of cover)	Linear Foot	$800
Headwalls	Lump Sum	$4,800
Riprap	Lump Sum	$64,000
Traffic Control	Lump Sum	$5,300
Channel Construction		
Excavation and Hauling	Cubic Yard	$13
Riprap	Cubic Yard	$75
Landscaping (Non-irrigated Native)	Square Foot	$0.30
Other		
Contingency	25 Percent of Construction Cost	
Engineering, Legal, and Administration	15 Percent of Construction Cost w/ Contingency	

(1) - Includes trenching, installation, backfill, and asphalt surface restoration.
(2) - Includes trenching, installation, and backfill w/out asphalt surface restoration

SWPPP REIVEW CHECKLIST

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

SWPPP COMPLIANCE INSPECTION FORM

Project Name:	Address:	Date:
Owner:	Contractor (Gen/Sub)	Start time:
Site Contact:	Phone:	Stop time:
Other Site Contacts:		
Other Site Contacts:		
UPDES Permit #: Expiration:	Weather: Sunny Cloudy Raining Snowing Other:	
Date of last rain event: Duration:	Approx. Rainfall (in):	
Inspected By (Print):	Local Jurisdiction or County:	
Other Inspectors:		
Other Inspectors:		
Total Project Area:	Total Disturbed Area:	
Project Type: (circle) *Subdivision* *Commercial* *Industrial* *Linear (Road/Pipe/Power)* *Land Disturbance*		
Reason for Inspection: Scheduled Complaint/Tip Random	Receiving Waters:	
Inspection Code (circle): SW sampling / SW non-sampling	Inspector Code (circle): (S) State / (L) Local	Type Code (circle): 1 - Municipal 2 - Industrial 3 - State

SWPPP, EROSION, SEDIMENT AND HOUSEKEEPING BMP's INFORMATION	YES	NO	N/A
1. Is the SWPPP on site and accessible, or is the SWPPP location posted in an obvious place and reasonably accessible (in a short time)?			
2. Are erosion control, sediment control, buffer controls and good housekeeping BMP's installed on the site as shown in the SWPPP?			
3. Has the SWPPP been updated to reflect the current site conditions (modifications dated & initialed on site map, new BMPs on site map, discontinued BMPs crossed off site map, new BMP details & spec's in SWPPP, SWPPP amendment Log, etc.)?			
4. Are on-site inspections being performed and recorded by a qualified person on a weekly or biweekly basis, reporting items required by permit? (Inspector name &qualifications, weather, problems/repairs, corrective action, new BMPs, removed BMPs, discharges, etc.)			
5. Have all corrective action items from previous inspections been addressed and documented within the time frame allotted ?			
6. Are SW flows entering and leaving the construction site controlled, managed, or diverted around the site? (e.g. buffer zones perimeter controls, berms, silt fence, up gradient boundary diversion, down gradient boundary sediment control, etc.)			
7. Is there evidence of sediment discharge such as mud flows or soil deposits from the construction site in downstream locations?			
8. Is there evidence of vehicles tracking soil off the construction site?			
9. Is there soil, construction material, landscaping items, or other debris piled on impervious surfaces (roads, drives) that could be washed with SW to a storm drain or water body?			
10. Is there a need to repair, maintain, or improve erosion control BMPs (temporary stabilization, erosion blankets, mulch, vegetated strips, rip rap, surface roughening, pipe slope drain, dust control, etc)?			
11. Is there a need to repair, maintain, or improve sediment control BMPs (silt fence, check dams, fiber rolls, sediment trap/basin, inlet protection, waddles, straw bails, curb cut-back, etc?			
12. Is there a need to repair, maintain, or improve good housekeeping controls (clean track out pad, sweeping, construction materials management, litter/trash control, port-o-potties staked down, fueling areas, concrete wash out area, proper curb ramps, spill prevention, etc)?			
13. Are there disturbed areas that have not had construction activities for 14 to 21 days without stabilization? (except snow or frozen ground)?			
14. Are there places where BMPs are needed and should be installed or not needed and should be removed?			

COMMENTS AND CORRECTIVE ACTIONS FOR SWPPP COMPLIANCE

Identify the problem and its location. If appropriate, describe (in general terms) what needs to be completed. However, only if qualified (e.g., you are a designer) should you be mandating specific BMPs to install. Include the date when corrections are made.

Inspector, please check all applicable SEV codes on the bottom of the next page.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Operator:	(Print Name)	(Title)	(Signature)	(Date)
Inspector:				

(Attach additional sheets of narrative, pictures and checklists, as necessary)

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Additional Comments and Corrective Action For SWPPP Compliance

SWPPP PRE-SITE REVIEW INFORMATION	YES	NO	N/
1. Has a pre-construction review of the SWPPP been conducted by the appropriate municipal agency?			
2. Are contact names, positions, responsibilities, and telephone numbers of the Storm Water Team and all other site Operators listed in the SWPPP?			
3. Does the SWPPP include a site map showing storm drains, slopes/surface drainage patterns, stream buffer zones, SW discharge points, construction boundaries, limits of disturbance, surface waters (name of receiving water), structural controls, and does it define/explain non-structural controls?			
4. Does the SWPPP have an estimate of the area to be disturbed, a sequence of construction activities, the SW runoff coefficient for after completion, a description of the soil types, controls for discharges from (asphalt/concrete) batch plants if any, show wetland areas, and have a description of the nature of the construction activity?			
5. Does the SWPPP and site map show erosion and sediment controls placement & details (e.g. erosion blankets, mulch, slope drains, check dams, sediment basins, grass-lined channels, fiber rolls, sediment traps, silt fence, inlet protection, curb cut-back, dust control, etc?)			
6. Does the SWPPP and site map show and describe good housekeeping controls (e.g. track out pad, street sweeping, material storage, construction waste containment and removal, sanitary waste, concrete washout pits, etc)			
7. Are post-construction elements included in the SWPPP? (i.e. grass swales, detention basins, vegetated filter strips, infiltration, depression storage, landscaping/xeriscaping, discontinuous concrete or hard surface SW conveyance, etc.)			
8. Is this project in a sensitive watershed (within forest service boundaries or has a TMDL)?			X
9. Is the SWPPP signed by a responsible corporate officer with the certification statement (see permit appendix G.16.)?			
10. Are the NOI and a copy of the CGP or Common Plan permit in the SWPPP?			

EPA Form 3560-3 SEV Codes and Descriptions

DOR11		Discharge without a permit	BR19B		Failure to properly operate and maintain BMP's
DOR18		Failure to apply for a Notice of Termination	BR19A		Failure to properly install/implement BMP's
BOR12		Failure to conduct inspections	EOR16		Failure to submit required report (non-DMR)
BOC17		Failure to develop any or adequate SWPPP/SWMP	AOR22		Narrative effluent violation
BOC18		Failure to implement SWPPP/SWMP	DOR12		Failure to submit required permit information
BOR41		Failure to maintain records	AOR12		Numeric effluent violation
COR11		Failure to monitor	BOR42		Violation of a milestone in an order

Name of Development_____

Developer_____Phone:_____

Responsible Contact_____Phone:_____

Submittal Date _____ Reviewed Date _____ Reviewed by _____

References are given from both the Small MS4 General UPDES Permit (section 4.2) and the Construction General Permit (section 3.5).

I- SWPPP Document (4.2.4.3.1)

Site Description

- ☐ Nature of activity or project – 3.5.1.a

  _____
- ☐ Intended sequence of major soil disturbing activities – 3.5.1.b

  _____
- ☐ Total area of site, area to be disturbed – 3.5.1.c _____
- ☐ Runoff coefficient – 3.5.1.d
  - Pre-construction _____
  - Post-construction_____
- ☐ General location map – 3.5.1.e
  - Existing drainage patterns and slopes
  - Final drainage patterns and slopes
  - Construction boundaries
  - Existing vegetation description
  - Areas of soil disturbance
  - Areas of no soil disturbance
  - BMP locations
  - Off-site areas used for construction support (may be non-applicable)
  - Final stabilization treatment
  - Discharge locations
- ☐ Description and location of discharges associated with off-site facilities (portable asphalt or concrete plants, stockpile areas, etc...) – 3.5.1.f

  _____

  _____
- ☐ Name and location of receiving waters – 3.5.1.g _____
- ☐ Area and boundary of any associated wetlands (may be non-applicable) – 3.5.1.g
- ☐ Copy of the current General Permit for Construction Activities

Erosion and Sediment Controls - 3.5.2.a.1

- ☐ Control measures for each major soil disturbing activity
  - Activity_____
  - Control Measure to be used_____
  - Timing_____
  - Installation details
  - Anticipated maintenance requirements

Stabilization Practices – 3.5.2.a.2

- ☐ Site specific stabilization
  - Interim stabilization practices – including timing
  - Permanent stabilization practices – including timing

Structural Controls - 3.5.2.a.3

- ☐ Flow control
  - Description of flow diversion BMPs

Name of Development_____

- Description of flow storage BMPs
- If site is 10 acres are more – Sediment Basin required
  - Basin sized for 3,600 cf/acre or 10-yr 24 hour storm

Post-Construction BMPs – 3.5.2.b

- ☐ Description of how pollutants are controlled after construction. (ie. permanent detention or retention basins, flow attenuation swales, infiltration, combination of BMPs, etc.)
- ☐ Technical basis for selecting post-construction BMPs
- ☐ Velocity dissipation devices at discharge points (as necessary)

Other Controls – 3.5.2.c

- ☐ Waste Disposal – location and practices to control
- ☐ Off-Site Tracking – off-site tracking and dust control
- ☐ Septic, Waste and Sanitary Sewer Disposal – location and practices to control
- ☐ Vehicle/Equip. maintenance areas and controls.
- ☐ Exposure to construction materials – inventory, storage practices, locations, spill response, and practices to control
- ☐ Off-site support area controls (if applicable)

Maintenance – 3.5.3

- ☐ Maintenance requirements and schedules
- ☐ Maintenance Agreements

Non-Storm Water Discharges – 3.5.5

- ☐ Identify non-storm water discharges that may be associated with project (water used to clean or flush improvements, etc...)
- ☐ Describe measures to be taken to implement pollution prevention for non-storm water discharges

Inspections – 3.5.4

- ☐ Inspection requirements (at least once every 7 days).
- ☐ Qualifications of the inspector
- ☐ Linear project inspection requirements (0.25 miles above and below each access point)
- ☐ Inspection report forms
  - Inspection date
  - Name, title and qualifications of inspector
  - Weather information since last inspection
  - Current weather information
  - Locations of pollutant discharges
  - Locations of BMPs needing maintenance
  - Locations of BMPs that aren't working
  - Locations where additional BMPs are needed
  - Any corrective actions that may be required, including changes that

Name of Development_____

need to be made to the SWPPP – with implementation dates

- ☐ Requirements to keep records as part of SWPPP for at least 5 years

II- Water Quality Review (4.2.4.3.2)

- ☐ Urban Pollutants of Concern
  - o Sediments
  - o Nutrients (Phosphorus, Nitrogen...)
  - o Metals
  - o Hydrocarbons/oils
  - o Pesticides
  - o Chlorides
  - o Trash and Debris
  - o Bacteria
  - o Organics matter
  - o Others_____
- ☐ Consider options to include water quality aspects to this project.
- ☐ Identify any highly impacted areas.
- ☐ Identify and limit directly connected impervious areas (DCIA) on this project.
- ☐ Identify measures to minimize runoff.

III- Low Impact Development Design (4.2.4.3.3)

- ☐ Identify any low-impact development concepts and ideas that might work for this project. Consider the following LID Techniques:
  - o Bio-Retention Areas
  - o Green Roof
  - o Permeable Pavements
  - o Rain Water Collection
  - o Riparian Buffers
  - o Green Street System
  - o Non Structural

IV- Sensitive Areas (4.2.4.3.4)(3.5.2.d)

List any of the following within the proximity:

- ☐ Impaired water bodies
- ☐ High Quality Waters
- ☐ TMDL
- ☐ Wetlands
- ☐ Wildlife issues (Threatened & Endangered Species)
- ☐ Historic
- ☐ Priority Construction sites (7.36)
- ☐ Other_____

Any variance of Permit_____

Comments: _____

_____

_____

_____

This document and attachments must be maintained by the MS4 for a period of five years or until construction is completed, whichever is longer. (4.2.4.3)

CONSTRUCTION BMP FACT SHEETS

BMP: BMP Inspection and Maintenance

BMPIM

Applications

- ☐ Manufacturing
- ☒ Material Handling
- ☒ Vehicle Maintenance
- ☐ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

Description:

Inspect and maintain all structural BMP's (both existing and new) on a routine basis to remove pollutants from entering storm drain inlets. This includes the establishment of a schedule for inspections and maintenance.

Approach:

Regular maintenance of all structural BMP's is necessary to ensure their proper functionality.

- Annual inspections.
- Prioritize maintenance to clean, maintain, and repair or replace structures in areas beginning with the highest pollutant loading.
- Clean structural BMP's in high pollutant areas just before the wet season to remove sediments and debris accumulated during the summer and fall.
- Keep accurate logs of what structures were maintained and when they were maintained.
- Record the amount of waste collected.

Limitations:

- Availability of trained staff

Targeted Pollutants

- ■ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substances
- ■ Oil & Grease
- ■ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

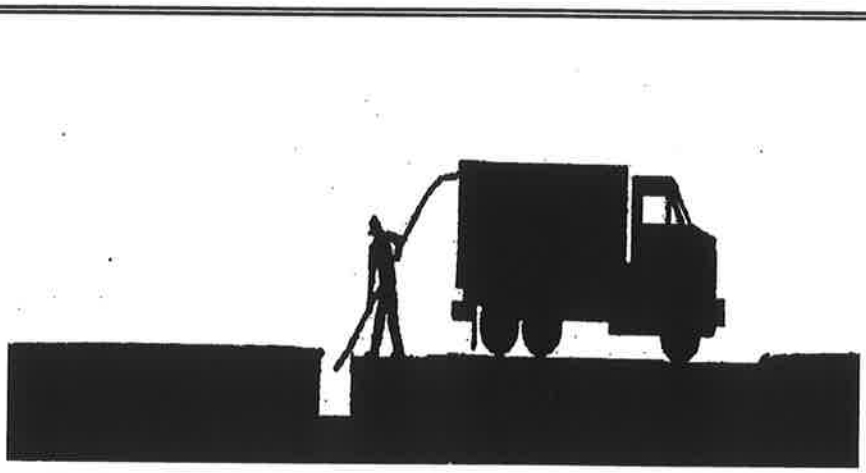
Implementation Requirements

- ■ Capital Costs
- ■ O&M Costs
- ☒ Maintenance
- ☒ Staffing
- ☐ Training
- ☐ Administrative

■ High ☒ Medium ☐ Low

BMP: Catch Basin Cleaning

CBC



DESCRIPTION:

Maintain catch basin and stormwater inlets on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, and restore the catch basins' sediment trapping capacity. A catch basin is distinguished from a stormwater inlet by having at its base a sediment sump designed to catch and retain sediments below the overflow point. This information sheet focuses on the cleaning of accumulated sediments from catch basins.

APPROACH:

Regular maintenance of catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants. In general, the key to effective catch basins are:

- At least annual inspections.
- Prioritize maintenance to clean catch basins and inlets in areas with the highest pollutant loading.
- Clean catch basins in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.

LIMITATIONS:

There are no major limitations to this best management practice.

MAINTENANCE:

Regular maintenance of public and private catch basins and inlets is necessary to ensure their proper functioning. Clogged catch basins are not only useless but may act as a source of sediments and pollutants. In general, the keys to effective catch basins are:

- Annual/monthly inspection of public and private facilities to ensure structural integrity, a clean sump, and a stenciling of catch basins and inlets.
- Keep logs of the number of catch basins cleaned.
- Record the amount of waste collected.

PROGRAM ELEMENTS

- ☐ New Development
- ☐ Residential
- ☐ Commercial Activities
- ☐ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ■ Heavy Metals
- ☐ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☒ Oil & Grease
- ■ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

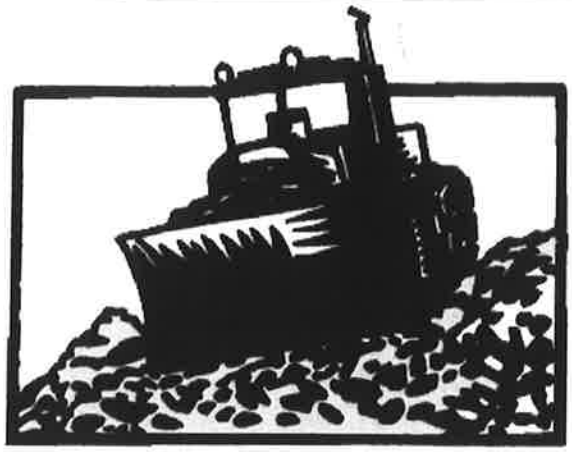
- ☒ Capital Costs
- ■ O&M Costs
- ☐ Regulatory
- ☒ Training
- ■ Staffing
- ☒ Administrative

■ High ☒ Medium ☐ Low

J-U-B Engineers, Inc

BMP: Contaminated or Erodible Surface Areas

CESA



Description:

Prevent or reduce the discharge of pollutants to storm water from contaminated or erodible surface areas by leaving as much vegetation on-site as possible, minimizing soil exposure time, stabilizing exposed soils, and preventing storm water runon and runoff.

Application:

This BMP addresses soils which are not so contaminated as to exceed criteria but the soil is eroding and carrying pollutants off in the storm water.

Installation/Application Criteria:

Contaminated or erodible surface areas can be controlled by:

- Preservation of natural vegetation
- Re-vegetation
- Chemical stabilization
- Removal of contaminated soils
- Geosynthetics.

Limitations:

Disadvantages of preserving natural vegetation or re-vegetating include:

- Requires substantial planning to preserve and maintain the existing vegetation.
- May not be cost-effective with high land costs.
- Lack of rainfall and/or poor soils may limit the success of re-vegetated areas.

Disadvantages of chemical stabilization include:

- Creation of impervious surfaces.
- May cause harmful effects on water quality.
- Is usually more expensive than vegetative cover.

Maintenance:

Maintenance should be minimal, except possibly if irrigation of vegetation is necessary.

Objectives

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

Targeted Pollutants

- ■ Sediment
- ■ Nutrients
- ■ Toxic Materials
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

Implementation Requirements

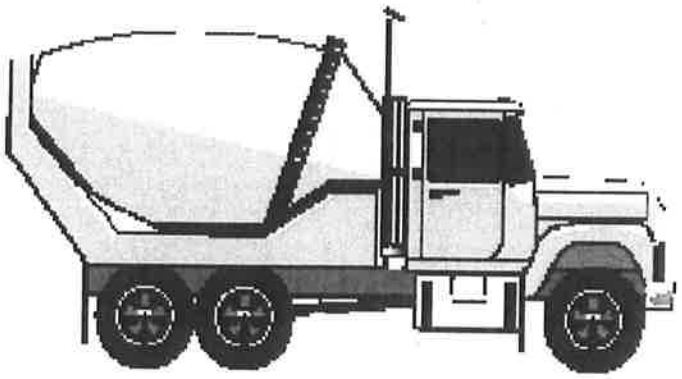
- ☒ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc

BMP: Concrete Waste Management

CWM



Description:

Prevent or reduce the discharge of pollutants to storm water from concrete waste by conducting washout off-site, performing on-site washout in a designated area, and training employees and subcontractors.

Applications:

This technique is applicable to all types of sites.

Installation/Application Criteria:

- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete or cement on-site.
- Perform washout of concrete trucks off-site or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped on-site, except in designated areas.
- When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water within a bermed or level area. (See Earth Berm Barrier information sheet.)
- Train employees and subcontractors in proper concrete waste management.

Limitations:

- Off-site washout of concrete wastes may not always be possible.

Maintenance:

- Inspect subcontractors to ensure that concrete wastes are being properly managed.
- If using a temporary pit, dispose hardened concrete on a regular basis.

Objectives

- ☐ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☒ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

Implementation Requirements

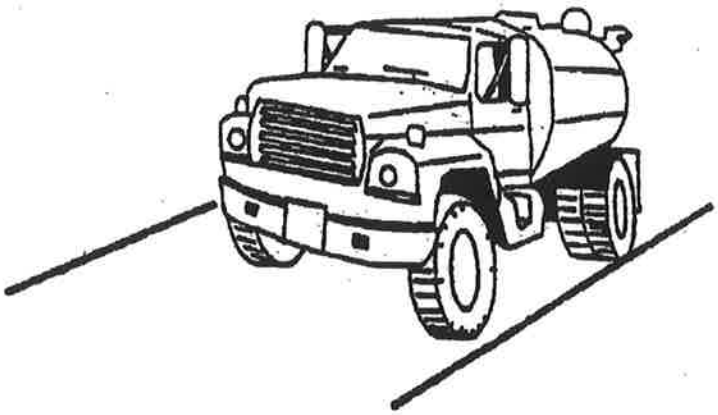
- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Dust Controls

DC



DESCRIPTION:
Dust control measures are used to stabilize soil from wind erosion, and reduce dust by construction activities.

APPLICATION:
Dust control is useful in any process area, loading and unloading area, material handling areas, and transfer areas where dust is generated. Street sweeping is limited to areas that are paved.

INSTALLATION/APPLICATION CRITERIA:
- Two kinds of street sweepers are common: brush and vacuum. Vacuum sweepers are more efficient and work best when the area is dry.
- Mechanical equipment should be operated according to the manufacturers' recommendations and should be inspected regularly.
- Water may be sprayed on the ground surface to moisten dry soils, making it less susceptible to wind erosion.

LIMITATIONS:
- Street sweeping is labor and equipment intensive and may not be effective for all pollutants.
- Water sprayed from water trucks must be done at a rate such that the water is absorbed in the soil; if excessive amounts of water are used, it may run off, carrying soil with it.

MAINTENANCE:
If excess water results from water spraying, dust-contaminated waters should not be allowed to run off site. Areas may need to be resprayed to keep dust from spreading.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☒ Minimize Disturbed Areas
- ☒ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

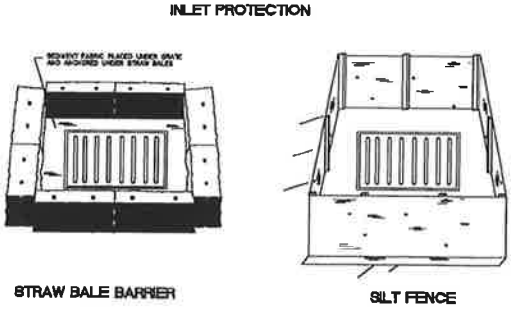
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Inlet Protection - Silt Fence or Straw Bale

IPS



SEE INDIVIDUAL BMP INFORMATION SHEETS FOR INSTRUCTIONS FOR CONSTRUCTION OF STRAW BALE BARRIER AND SILT FENCE.

DESCRIPTION:

Sediment barrier erected around storm drain inlet.

APPLICATION:

Construct at storm drainage inlets located downgradient of areas to be disturbed by construction (for inlets in paved areas see other information sheets for inlet protection).

INSTALLATION/APPLICATION CRITERIA:

- Provide upgradient sediment controls, such as silt fence during construction of inlet.
- When construction of inlet is complete, erect straw bale barrier or silt fence surrounding perimeter of inlet. Follow instructions and guidelines on individual BMP information sheets for straw bale barrier and silt fence construction.

LIMITATIONS:

- Recommended maximum contributing drainage area of one acre.
- Limited to inlets located in open unpaved areas.
- Requires shallow slopes adjacent to inlet.

MAINTENANCE:

- Inspect inlet protection following storm event and at a minimum of once monthly.
- Remove accumulated sediment when it reaches 4-inches in depth.
- Repair or realign barrier/fence as needed.
- Look for bypassing or undercutting and recompact soil around barrier/fence as required.

OBJECTIVES

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ■ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Parking Lot Sweeping/Vacuuming

PLSV

DESCRIPTION:
Reduce the discharges of pollutants to stormwater from parking lot surfaces by conducting parking lot cleaning on a regular basis.

APPROACH:
- Restrict parking prior to and during sweeping.
- Establish frequency of sweeping based on anticipated need and observations of debris or sediment accumulation
- Increase sweeping frequency just before the rainy season.
- Lots that generate greater amounts of debris or sediment must be swept more frequently. These include lots associated with or adjacent to recreational, commercial, or industrial areas, or other areas of high vehicle or pedestrian traffic.
- Manually remove debris from corners or other areas of the parking lot that equipment cannot reach
- Keep accurate operation logs to track programs.
- Equipment selection can be key for this particular BMP. There are two types used, the mechanical broom sweepers (more effective at picking up large debris and cleaning wet streets), and the vacuum sweepers (more effective at removing fine particles and associated heavy metals). It may be useful to have the ability to use both kinds.

LIMITATIONS:
- Conventional sweepers are not able to remove oil and grease.
- Mechanical sweepers are not effective at removing finer sediments.
- Effectiveness may also be limited by parking lot conditions, presence of parked vehicles, presence of construction projects, climatic conditions and condition of curbs.

MAINTENANCE:
- Acquisition and maintenance of equipment is generally handled by the company hired to perform the sweeping/vacuuming.

PROGRAM ELEMENTS

- ☐ New Development
- ☐ Residential
- ☒ Commercial Activities
- ☒ Industrial Activities
- ☒ Municipal Facilities
- ☒ Illegal Discharges

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ☒ Toxic Materials
- ■ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

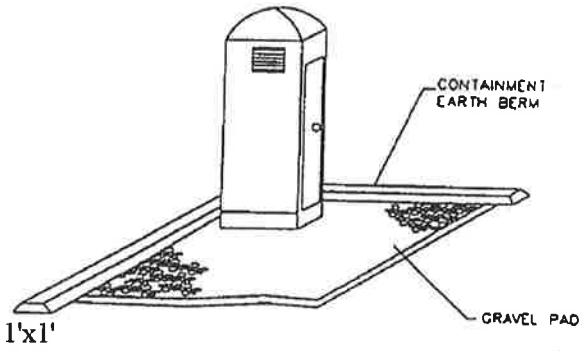
- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Regulatory
- ☐ Training
- ☐ Staffing
- ☒ Administrative

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc

BMP: Portable Toilets

PT



DESCRIPTION:
Temporary on-site sanitary facilities for construction personnel.

APPLICATION:
All sites with no permanent sanitary facilities or where permanent facility is too far from activities.

INSTALLATION/APPLICATION CRITERIA:
- Locate portable toilets in convenient locations throughout the site.
- Prepare level, gravel surface and provide clear access to the toilets for servicing and for on-site personnel.
- Construct earth berm perimeter (See Earth Berm Barrier Information Sheet), control for spill/protection leak.

LIMITATIONS:
No limitations.

MAINTENANCE:
- Portable toilets should be maintained in good working order by licensed service with daily observation for leak detection.
- Regular waste collection should be arranged with licensed service.
- All waste should be deposited in sanitary sewer system for treatment with appropriate agency approval.

OBJECTIVES

- ☒ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ■ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

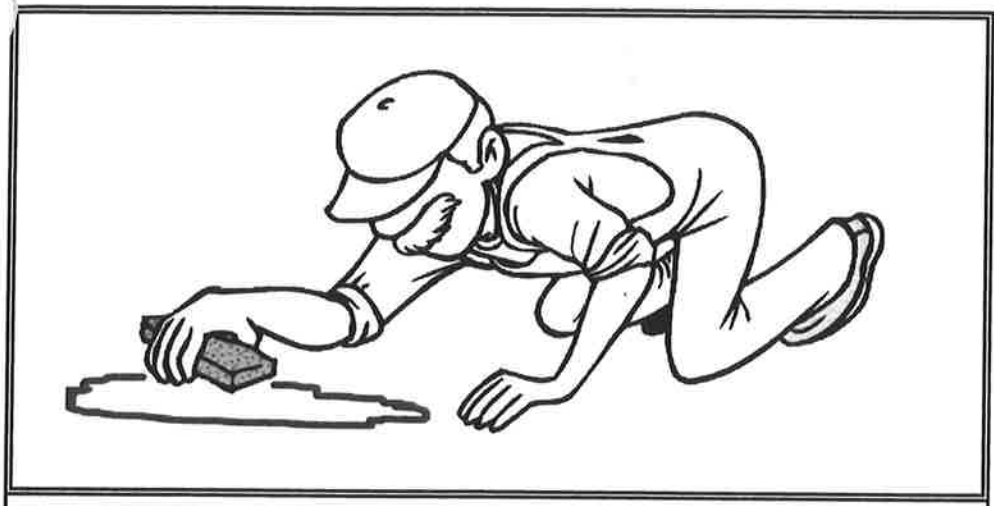
- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc

BMP: Spill Clean-Up

SCU



DESCRIPTION:
Practices to clean-up leakage/spillage of on-site materials that may be harmful to receiving waters.

APPLICATION:
All sites

GENERAL:
- Store controlled materials within a storage area.
- Educate personnel on prevention and clean-up techniques.
- Designate an Emergency Coordinator responsible for employing preventative practices and for providing spill response.
- Maintain a supply of clean-up equipment on-site and post a list of local response agencies with phone numbers.

METHODS:
- Clean-up spills/leaks immediately and remediate cause.
- Use as little water as possible. NEVER HOSE DOWN OR BURY SPILL CONTAMINATED MATERIAL.
- Use rags or absorbent material for clean-up. Excavate contaminated soils. Dispose of clean-up material and soil as hazardous waste.
- Document all spills with date, location, substance, volume, actions taken and other pertinent data.
- Contact local Fire Department and State Division of Environmental Response and Remediation (Phone #801-536-4100) for any spill of reportable quantity.

OBJECTIVES

- ☒ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ■ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ■ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc

BMP: Storm Drain Flushing

SDF

DESCRIPTION:

A storm drain is "flushed" with water to suspend and remove deposited materials. Flushing is particularly beneficial for storm drain pipes with grades too flat to be self-cleansing. Flushing helps ensure pipes convey design flow and remove pollutants from the storm drain system.

APPROACH:

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Whenever possible, flushed effluent should be collected, decanted, evaporated, and disposed of in a landfill.

LIMITATIONS:

- Most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity).
- Water source must be available.
- May have difficulty finding downstream area to collect sediments.
- Requires liquid/sediment disposal.

PROGRAM ELEMENTS

- ☐ New Development
- ☐ Residential
- ☐ Commercial Activities
- ☐ Industrial Activities
- ☒ Municipal Facilities
- ☐ Illegal Discharges

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ■ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☐ Toxic Materials
- ☒ Oxygen Demanding Substances
- ☐ Oil & Grease
- ☐ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

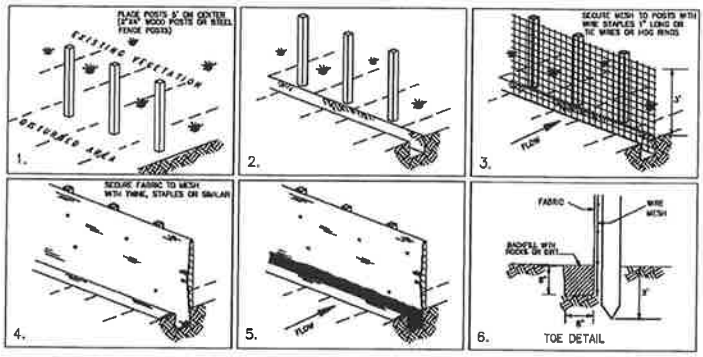
- ☒ Capital Costs
- ■ O&M Costs
- ☐ Regulatory
- ☒ Training
- ■ Staffing
- ☐ Administrative

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc

BMP: Silt Fence

SF



Description:

A temporary sediment barrier consisting of entrenched filter fabric stretched across and secured to supporting posts.

Application:

- Perimeter control: place barrier at downgradient limits of disturbance
- Sediment barrier: place barrier at toe of slope or soil stockpile
- Protection of existing waterways: place barrier near top of stream bank
- Inlet protection: place fence surrounding catchbasins

Installation/Application Criteria:

- Place posts 6 feet apart on center along contour (or use preassembled unit) and drive 2 feet minimum into ground. Excavate an anchor trench immediately upgradient of posts.
- Secure wire mesh (14 gage min. With 6 inch openings) to upslope side of posts. Attach with heavy duty 1 inch long wire staples, tie wires or hog rings.
- Cut fabric to required width, unroll along length of barrier and drape over barrier. Secure fabric to mesh with twine, staples, or similar, with trailing edge extending into anchor trench.
- Backfill trench over filter fabric to anchor.

Limitations:

- Recommended maximum drainage area of 0.5 acre per 100 feet of fence
- Recommended maximum upgradient slope length of 150 feet
- Recommended maximum uphill grade of 2:1 (50%)
- Recommended maximum flow rate of 0.5 cfs
- Ponding should not be allowed behind fence

Maintenance:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff bypassing ends of barriers or undercutting barriers.
- Repair or replace damaged areas of the barrier and remove accumulated sediment.
- Reanchor fence as necessary to prevent shortcutting.
- Remove accumulated sediment when it reaches ½ the height of the fence.

Objectives

- ☐ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☒ Protect Slopes/Channels
- ☒ Control Site Perimeter
- ☒ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

Targeted Pollutants

- ■ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

Implementation Requirements

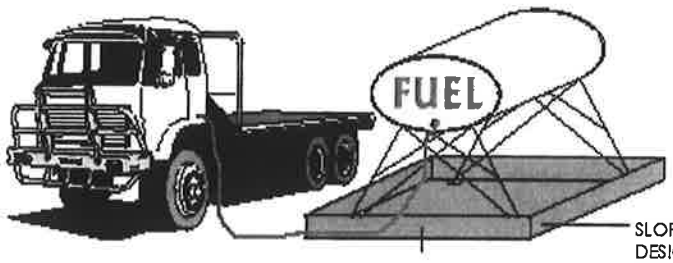
- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Vehicle And Equipment Fueling

VEF



SLOPED OR OTHERWISE DESIGNED FOR EASY REMOVAL OF LEAKED FUEL

DESCRIPTION:

Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

INSTALLATION/APPLICATION:

- Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute storm water. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.
- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of storm water and the runoff of spills. Discourage"topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks. Place a stockpile of spill cleanup materials where it will be readily accessible. Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Carry out all Federal and State requirements regarding stationary above ground storage tanks.(40 CF Sub. J) Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time. Train employees and subcontractors in proper fueling and cleanup procedures.

LIMITATIONS:

Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance.

MAINTENANCE:

- Keep ample supplies of spill cleanup materials on-site.
- Inspect fueling areas and storage tanks on a regular schedule.

OBJECTIVES

- ☒ Housekeeping Practices
- ☐ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

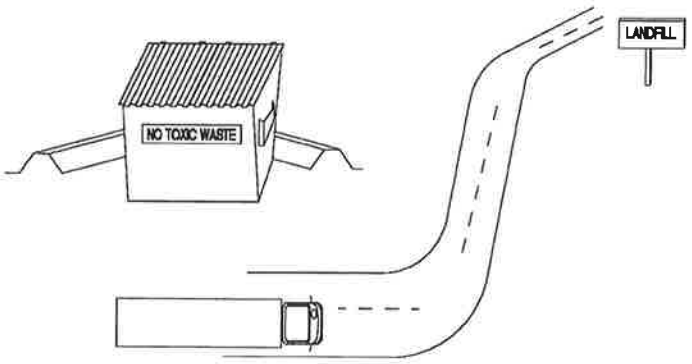
- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Waste Disposal

WD



DESCRIPTION:
Controlled storage and disposal of solid waste generated by construction activities.

APPLICATION:
All construction sites.

INSTALLATION:
- Designate one or several waste collection areas with easy access for construction vehicles and personnel. Ensure no waterways or storm drainage inlets are located near the waste collection areas.
- Construct compacted earthen berm (See Earth Berm Barrier BMP Fact Sheet), or similar perimeter containment around collection area for impoundment in the case of spills and to trap any windblown trash.
- Use water tight containers with covers to remain closed when not in use. Provide separate containers for different waste types where appropriate and label clearly.
- Ensure all on site personnel are aware of and utilize designated waste collection area properly and for intended use only (e.g. all toxic, hazardous, or recyclable materials shall be properly disposed of separately from general construction waste).
- Arrange for periodic pickup, transfer and disposal of collected waste at an authorized disposal location. Include regular Porto-potty service in waste management activities.

LIMITATIONS:
- On-site personnel are responsible for correct disposal of waste.

MAINTENANCE:
- Discuss waste management procedures at progress meetings.
- Collect site trash daily and deposit in covered containers at designated collection areas.
- Check containers for leakage or inadequate covers and replace as needed.
- Randomly check disposed materials for any unauthorized waste (e.g. toxic materials).
- During daily site inspections check that waste is not being incorrectly disposed of on-site (e.g. burial, burning, surface discharge, discharge to storm drain).

OBJECTIVES

- ☒ Housekeeping Practices
- ☒ Contain Waste
- ☐ Minimize Disturbed Areas
- ☐ Stabilize Disturbed Areas
- ☐ Protect Slopes/Channels
- ☐ Control Site Perimeter
- ☐ Control Internal Erosion

LINDON

Adapted from Salt Lake County BMP Fact Sheet

TARGETED POLLUTANTS

- ☐ Sediment
- ☐ Nutrients
- ■ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ■ Other Waste

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ■ O&M Costs
- ☒ Maintenance
- ■ Training

■ High ☒ Medium ☐ Low

J·U·B Engineers, Inc.

BMP: Contractor Certification &Inspector Training

CCIT

Municipalities can establish training programs to educate contractors about erosion and sediment control practices

Construction reviewers periodically inspect construction sites to ensure that contractors have installed and maintained their erosion and sediment controls properly (Source: University of Connecticut Cooperative Extension System, 2000)

APPLICATIONS

- ☐ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☒ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☐ Housekeeping Practices

DESCRIPTION:

One of the most important factors determining whether or not erosion and sediment controls will be properly installed and maintained on a construction site is the knowledge and experience of the contractor. Many communities require certification for key on-site employees who are responsible for implementing the ESC plan. Several states have contractor certification programs. The State of Delaware requires that at least one person on any construction project be formally certified. The Delaware program requires certification for any foreman or superintendent who is in charge of onsite clearing and land-disturbing activities for sediment and runoff control associated with a construction project.

APPROACH:

- Training and certification will help to ensure that the plans are properly implemented and that best management practices are properly installed and maintained.
- Inspector training programs are appropriate for municipalities with limited funding and resources for ESC program implementation.
- Contractor certification can be accomplished through municipally sponsored training courses, or more informally, municipalities can hold mandatory pre-construction or pre-wintering meetings and conduct regular and final inspection visits to transfer information to contractors (Brown and Caraco, 1997).
- To implement an inspector training program, the governing agency would need to establish a certification course with periodic recertification, review reports submitted by private inspectors, conduct spot checks for accuracy, and institute fines or other penalties for noncompliance.
- Curb systems should be maintained through curb repair (patching and replacement).
- To minimize the amount of spilled material tracked outside of the area by personnel, grade within the curbing to direct the spilled materials to a down-slope side of the curbing, thus keeping the spilled materials away from personnel and equipment. Grading will also facilitate clean-up.

LIMITATIONS:

- Contractor certification and inspector training programs require a substantial amount of effort on the part of the municipality or regulatory agency.
- They need to develop curricula for training courses, dedicate staff to teach courses, and maintain a report review and site inspection staff to ensure that both contractors and inspectors are fulfilling their obligations and complying with the ESC program.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ☐ Heavy Metals
- ■ Toxic Materials
- ☐ Oxygen Demanding Substances
- ■ Oil & Grease
- ■ Floatable Materials
- ☐ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ■ Capital Costs
- ■ O&M Costs
- ☒ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

BMP: Classroom Education On Storm Water

CESW

Students learn about storm water pollution (Source: City of Sacramento Storm Water Management Program, no date)

APPLICATIONS

- ☐ Manufacturing
- ☒ Material Handling
- ☐ Vehicle Maintenance
- ☐ Construction
- ☐ Commercial Activities
- ☐ Roadways
- ☒ Waste Containment
- ☒ Housekeeping Practices

DESCRIPTION:

Classroom education is an integral part of any storm water pollution outreach program. Providing storm water education through schools exposes the message not only to students but to their parents as well. Topics can include Water conservation, proper lawn and garden care, and proper disposal of hazardous household wastes.

APPROACH:

- Building a strong relationship with the school district is the most important step in getting storm water education into the schools.
- When developing an outreach message for children, choose the age ranges to target. Many additional classroom materials are available for use free of cost. educational materials available for downloading from the Internet at www.csu.org/water/watereducation/watereducation.html.
- Should make students aware of the potential impacts of hazardous household materials on water quality and inform residents of ways to properly store, handle, and dispose of the chemicals
- Water usage in the home can easily be reduced by 15 to 20 percent—without major discomfort—by implementing a program to conserve water in the home.
- Lawn and garden activities can result in contamination of storm water through pesticide, soil, and fertilizer runoff. Proper landscape management, however, can effectively reduce water use and contaminant runoff and enhance the aesthetics of a property.

LIMITATIONS:

- One of the limitations of classroom education is being able to incorporate storm water issues into the school curricula. With so many subjects to teach, environmental issues might be viewed as less important.

MAINTENANCE:

- Programs and educational materials can be re-used, but they must be presented on a continual basis.

TARGETED POLLUTANTS

- ■ Sediment
- ■ Nutrients
- ■ Heavy Metals
- ■ Toxic Materials
- ■ Oxygen Demanding Substances
- ■ Oil & Grease
- ■ Floatable Materials
- ■ Bacteria & Viruses

- ■ High Impact
- ☒ Medium Impact
- ☐ Low or Unknown Impact

IMPLEMENTATION REQUIREMENTS

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

■ High ☒ Medium ☐ Low

SPECIAL ENVIRONMENTAL CONSIDERATIONS

Special Environmental Considerations

Discharges to Water Quality Impaired Waters

Impaired waters near Alpine City are as follows:

Discharging into Utah Lake via Dry Creek and its tributaries.
N 40°26'33" ; W 111°47'32" Dry Creek exit point on City property

The 303(d) list of impaired waterbodies is found at:
http://www.waterquality.utah.gov/TMDL/index.htm

Threatened or Endangered Species
(No longer a permit requirement but referenced regardless)

Where applicable, compliance efforts to this law shall be reflected in the SWMP document. (Small MS4 General UPDES Permit 3.2) The following web sites are helpful in determining the status of any species of interest.

http://wildlife.utah.gov/habitat/pdf/endgspec.pdf.

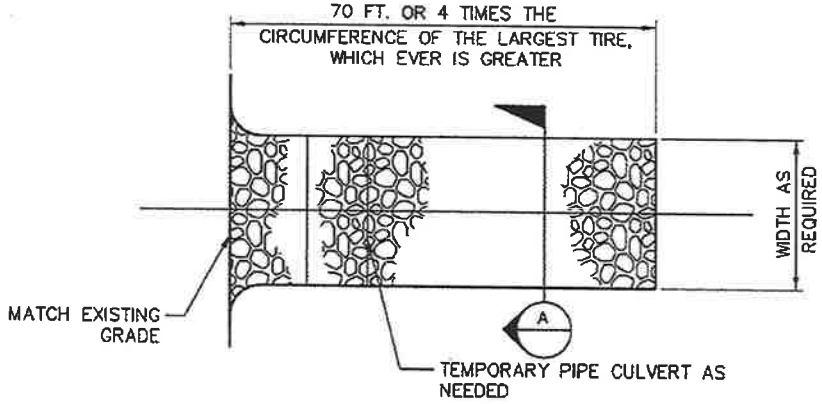
http://www.fws.gov/endangered/

Historic Properties

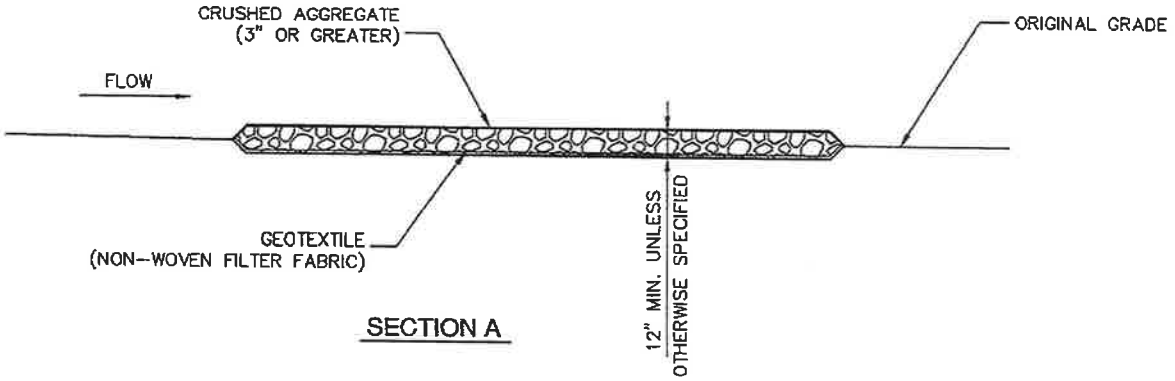
Where applicable, compliance efforts to this law shall be reflected in the SWMP document. (Small MS4 General UPDES Permit 3.2) Web sites include the following, along with possible county and city listings:

http://history.utah.gov/historic_buildings/index.html

STANDARD DETAILS



PLAN VIEW

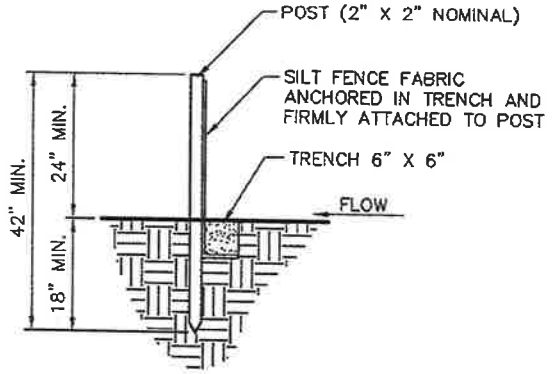


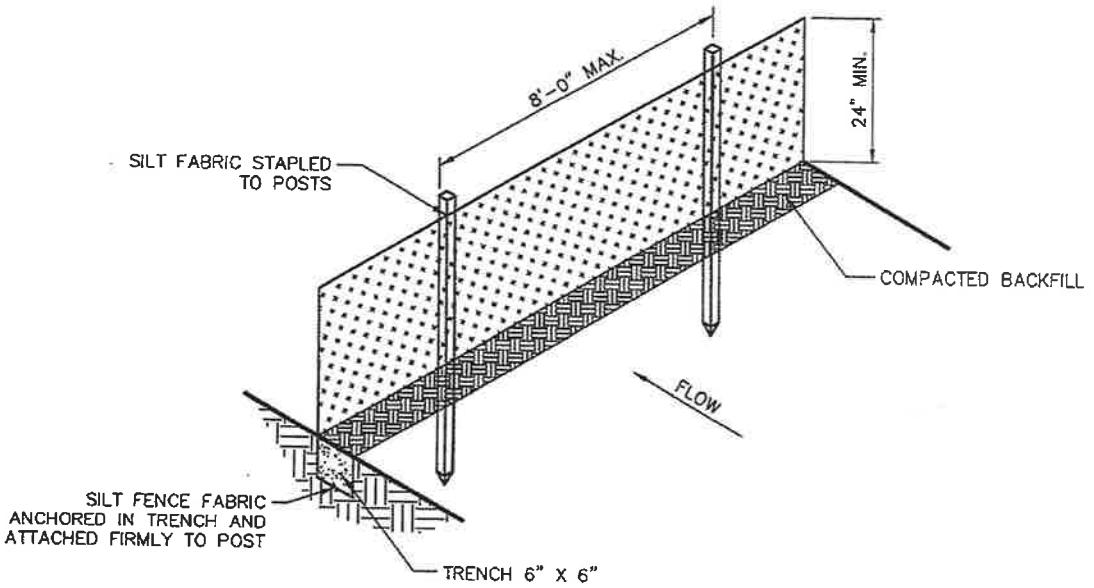
SECTION A

STABILIZED CONSTRUCTION ENTRANCE DETAIL

1

SCALE: N. T. S.

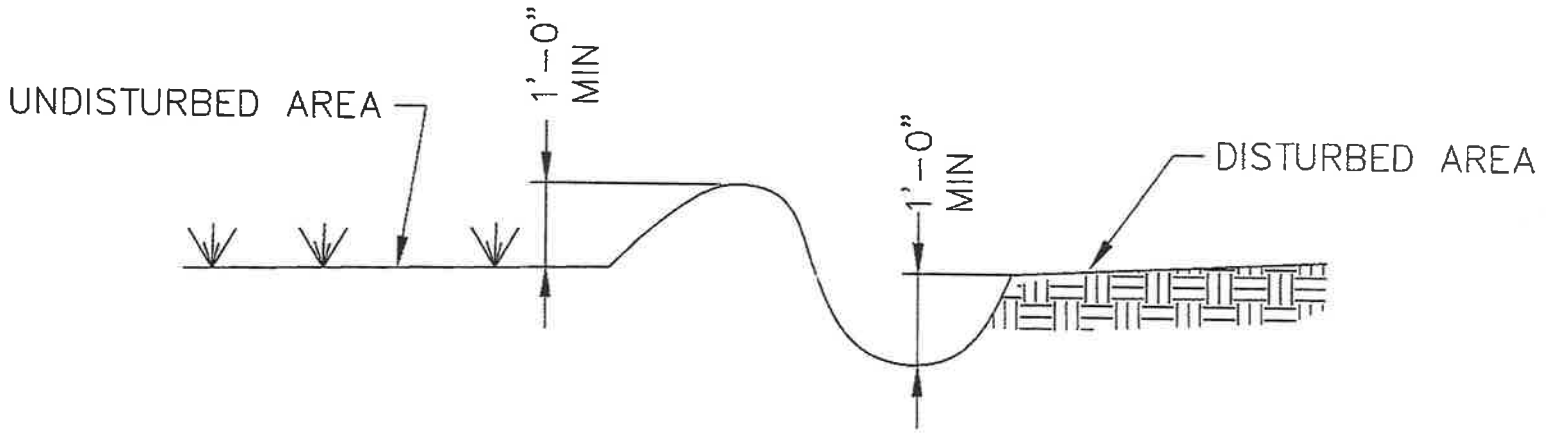




NOTES:
1. MINIMUM FILTER FABRIC HEIGHT SHALL BE 24".
2. POSTS FOR SILT FENCES SHALL BE METAL OR HARD WOOD WITH A MINIMUM LENGTH OF 36". WOOD POSTS SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION OF 2". METAL POSTS SHALL BE "STUDDED TEE" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 LBS/FOOT.
3. DRIVE POSTS VERTICALLY INTO THE GROUND TO A MINIMUM DEPTH OF 18", AND EXCAVATE A TRENCH APPROXIMATELY 6" WIDE AND 6" DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER. NO LESS THAN THE BOTTOM 1 FOOT OF THE FABRIC SHALL BE BURIED INTO THIS TRENCH.
4. THE FILTER FABRIC MATERIALS SHALL BE FASTENED SECURELY TO METAL OR WOOD POSTS USING WIRE TIES, OR TO THE WOOD POSTS WITH ¾" LONG #9 HEAVY DUTY STAPLES.
5. POSTS SHALL BE SPACED A MAXIMUM OF 8 FEET APART.

SILT FENCE DETAIL 2

SCALE: N. T. S.

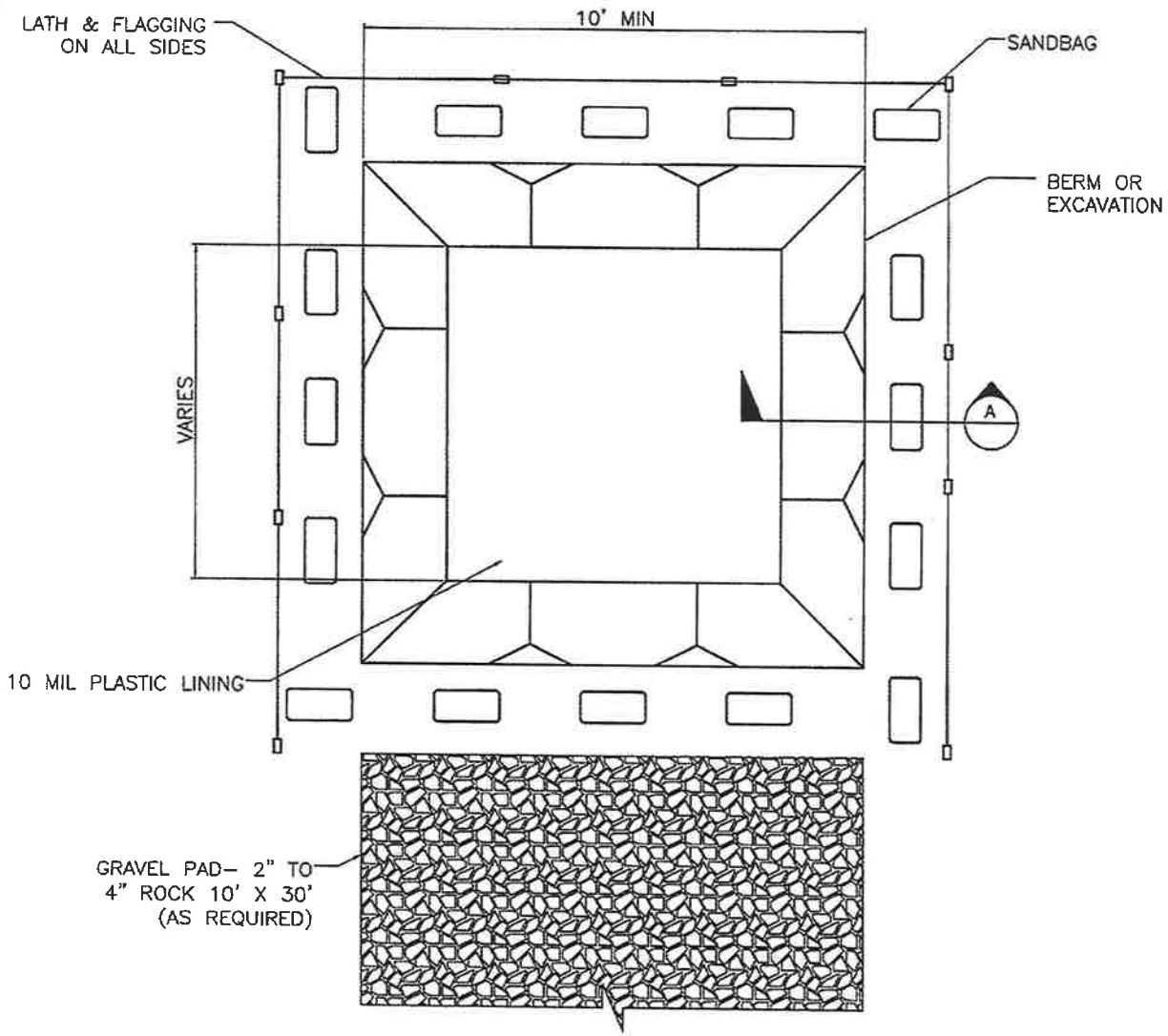


SWALE / BERM DETAIL 3

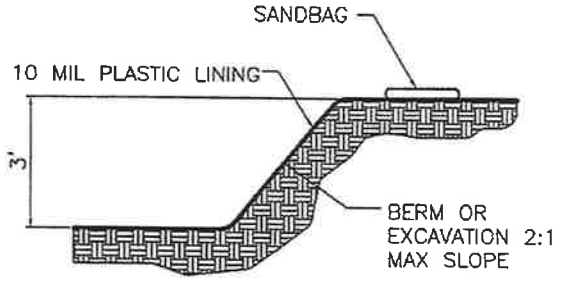
SCALE: N. T. S.

LAST UPDATE: 9/27/2010
PLOT DATE: 9/27/2010
FILE: BERM-SWALE DETAIL

J-U-B ENGINEERS, INC.



PLAN



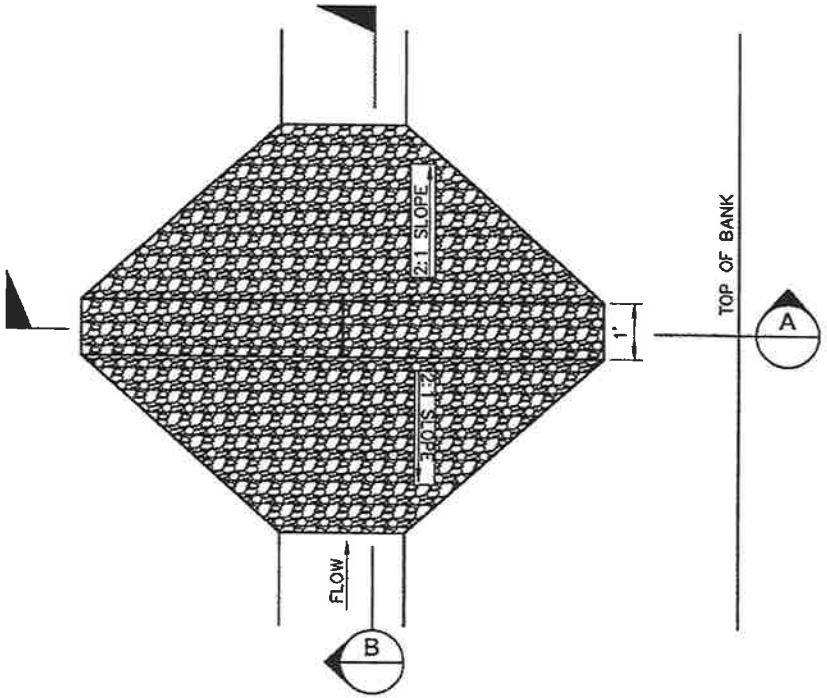
SECTION A

NOTES:
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
3. WASHOUT NEEDS TO BE EMPTIED AND REPAIRED WHEN 75% OF STORAGE CAPACITY IS FILLED.
4. DEVELOPER/CONTRACTOR RESPONSIBLE FOR REMOVAL & PROPER DISPOSAL OF CONCRETE PRIOR TO FILING N.O.T

CONCRETE WASHOUT DETAIL 4
SCALE: N. T. S.

LAST UPDATE: 9/27/2010
PLOT DATE: 9/27/2010
FILE: CONCRETE WASHOUT

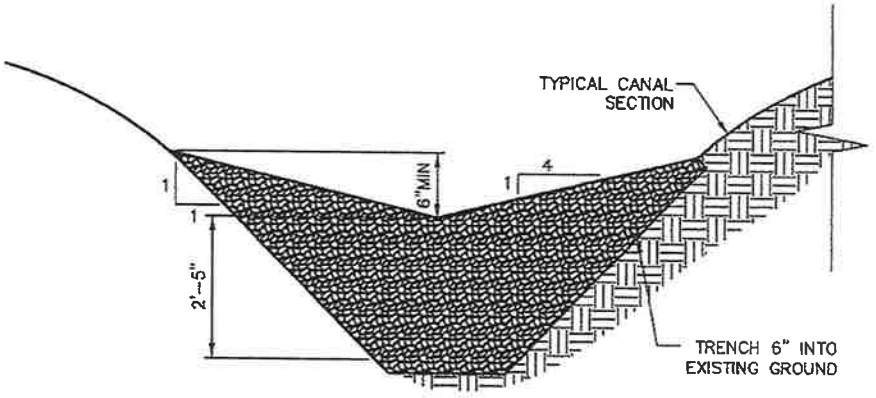
J-U-B ENGINEERS, INC.



PLAN VIEW

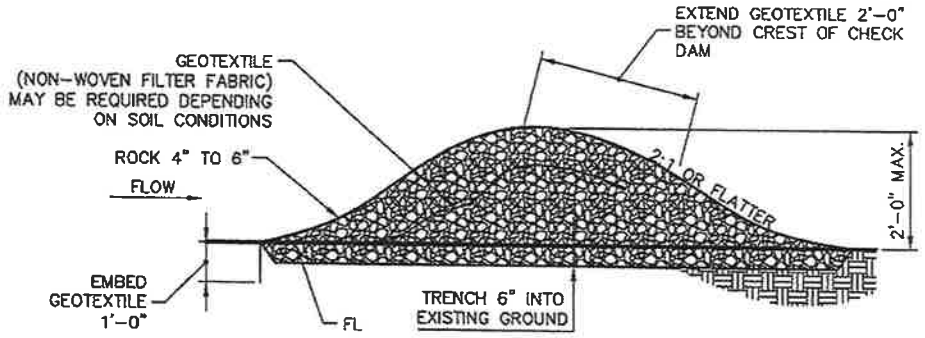
DITCH ROCK CHECK DAM 5

SCALE: N.T.S.



SECTION A

SCALE: N.T.S.

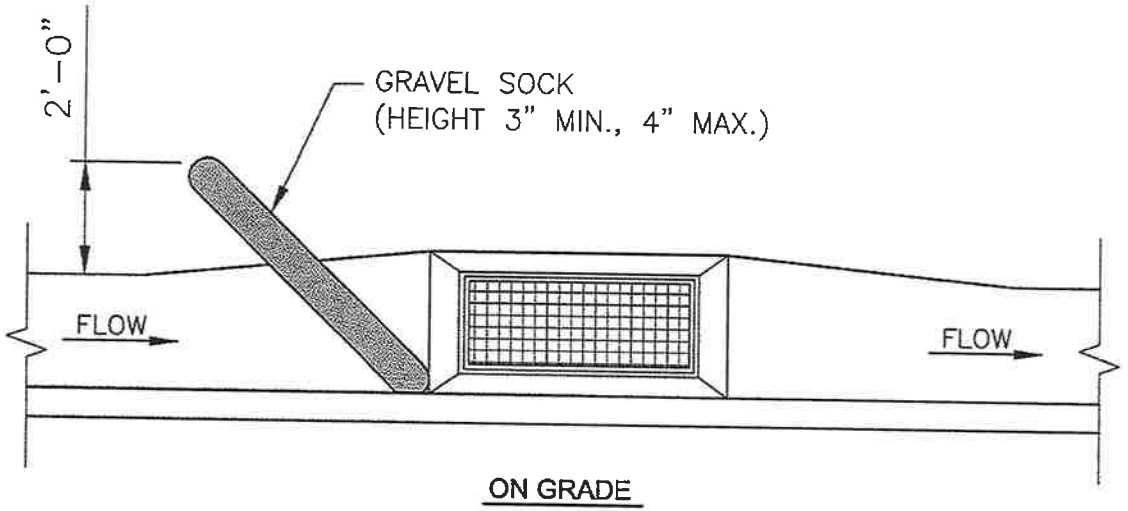


SECTION B

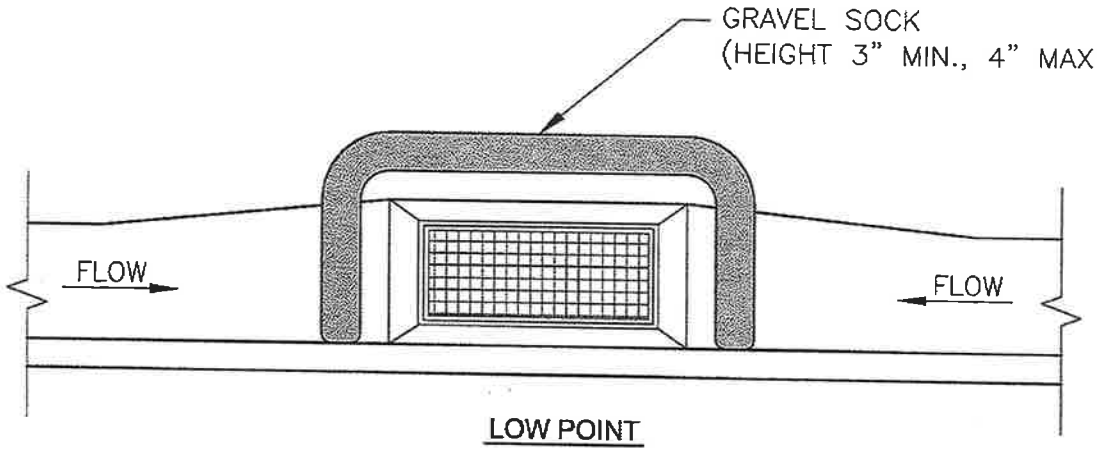
SCALE: N.T.S.

J-U-B ENGINEERS, INC.

LAST UPDATE: 9/27/2010
PLOT DATE: 9/27/2010
FILE: ROCK CHECK DAM - DITCH



ON GRADE



LOW POINT

6 INLET PROTECTION DETAIL
SCALE: N.T.S.

INSPECTION AUTHORITY
(SEE APPENDIX E)

ENFORCEMENT PROCEDURES

SWPPP COMPLIANCE INSPECTION FORM

Project Name:	Address:	Date:
Owner:	Contractor (Gen/Sub):	Start time:
Site Contact:	Phone:	Stop time:
UPDES Permit #: Expiration:	Weather: Sunny Cloudy Raining Snowing Other:	
Date of last rain event:	Duration: Approx. Rainfall (in):	
Inspected By (Print):	Local Jurisdiction or County:	
Reason for Inspection: Scheduled Complaint/Tip Random	Receiving Waters:	
Inspection Code (circle): SW sampling SW non-sampling	Inspector Code (circle): (S) State (L) Local	Type Code (circle): 1 - Municipal 2 - Industrial 3 - State

SWPPP, EROSION, SEDIMENT AND HOUSEKEEPING BMP's INFORMATION	YES	NO	N/A
1. Is the SWPPP on site and accessible, or is the SWPPP location posted in an obvious place and reasonably accessible (in a short time)?			
2. Are erosion control, sediment control, and good housekeeping BMP's installed on the site as shown in the SWPPP?			
3. Has the SWPPP been updated to reflect the current site conditions (modifications dated & initialed on site map, new BMPs on site map, discontinued BMPs crossed off site map, new BMP details & spec's in SWPPP, SWPPP amendment Log, etc.)?			
4. Are on-site inspections being performed and recorded by a qualified person on a weekly or biweekly basis, reporting items required by permit? (Inspector name &qualifications, weather, problems/repairs, corrective action, new BMPs, removed BMPs, discharges, etc.)			
5. Have all corrective action items from previous inspections been addressed and documented within the time frame allotted by the inspector?			
6. Are SW flows entering and leaving the construction site controlled, managed, or diverted around the site? (e.g. perimeter controls, berms, silt fence, upgradient boundary diversion, down gradient boundary sediment control, etc.)			
7. Is there evidence of sediment discharge such as mud flows or soil deposits from the construction site in downstream locations?			
8. Is there evidence of vehicles tracking soil off the construction site?			
9. Is there soil, construction material, landscaping items, or other debris piled on impervious surfaces (roads, drives) that could be washed with SW to a storm drain or water body?			
10. Is there a need to repair, maintain, or improve erosion control BMPs (temporary stabilization, erosion blankets, mulch, vegetated strips, rip rap, surface roughening, pipe slope drain, dust control, etc)?			
11. Is there a need to repair, maintain, or improve sediment control BMPs (silt fence, check dams, fiber rolls, sediment trap/basin, inlet protection, waddles, straw bails, curb cut-back, etc?			
12. Is there a need to repair, maintain, or improve good housekeeping controls (clean track out pad, sweeping, construction materials management, litter/trash control, port-o-potties staked down, fueling areas, concrete wash out area, proper curb ramps, spill prevention, etc)?			
13. Are there disturbed areas that have not had construction activities for 14 to 21 days without stabilization? (except snow or frozen ground)?			
14. Are there places where BMPs are needed and should be installed or not needed and should be removed?			

COMMENTS AND CORRECTIVE ACTIONS FOR SWPPP COMPLIANCE

Identify the problem and its location. If appropriate, describe (in general terms) what needs to be completed. However, only if qualified (e.g., you are a designer) should you be mandating specific BMPs to install. Include the date when corrections are made.

Inspector, please list all applicable SEV codes:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Inspector:

(Print Name) (Title) (Signature) (Date)

Operator:

(Print Name) (Title) (Signature) (Date)

modified 8/12/10

(Attach additional sheets of narrative, pictures and checklists, as necessary)

ADDITIONAL COMMENTS AND CORRECTIVE ACTIONS FOR SWPPP COMPLIANCE

Insert City Logo Here

Site Name:	Date of Evaluation:	Page of
Site Address:		

EPA Form 3560-3 SEV Codes and Descriptions					
DOR11		Discharge without a permit	BR19B		Failure to properly operate and maintain BMP's
OR18		Failure to apply for a Notice of Termination	BR19A		Failure to properly install/implement BMP's
OR12		Failure to conduct inspections	EOR16		Failure to submit required report (non-DMR)
BOC17		Failure to develop any or adequate SWPPP/SWMP	AOR22		Narrative effluent violation
BOC18		Failure to implement SWPPP/SWMP	DOR12		Failure to submit required permit information
BOR41		Failure to maintain records	AOR12		Numeric effluent violation
COR11		Failure to monitor	BOR42		Violation of a milestone in an order

ESCALATING ENFORCMENT

See also Appendix E, Municipal Code 14-411

Step 1 – Verbal Warning

Alpine City uses an online SWPPP Inspection program (UTILISYNC) to track all communications. This report is created for site visits and inspections. Verbal warnings are tracked via a "Failed" SWPPP report and are emailed to both the City and Contractor/Owner.

One (1) to seven (7) days are typically granted to correct verbal warnings

Step 2 – Written Notice

A written notice is also tracked electronically. If a site receives a written notice, it is typically because corrective actions at Step 1 were not corrected in the allowed time frame. Written notices are typically followed up with a "red tag" or "cease and desist" order.

Ten (10) days are allowed by ordinance to correct infractions, if uncorrected by day 10, a Notice of Violation will be issued.

Step 3 – Notice of Violation/Fines

A notice of violation can be given at any time depending on the severity of the infraction. If a notice of violation is given, it will be tracked electronically and noted on the electronic form created. Fines are imposed if a Notice of Violation is given.

N.O.T. PROCEDURES

NOTICE OF TERMINATION PROCESS

The Notice of Termination has been a topic of discussion for some time on the State level. The Notice of Termination formally brings to a close the temporary permit to discharge stormwater from construction sites. This is a permit issued by the State and as such the State of Utah is the entity that grants a termination to that permit. However, the State of Utah does not have the resources or man-power required to ensure that all construction sites meet the requirements necessary to obtain a NOT and are leaning on MS4s state-wide to aid in the process. In this light, please refer to:

UTRH00000

1.7 Notice of Termination or APPENDIX F of SWMP

UTRC00000

8. HOW TO TERMINATE COVERAGE or APPENDIX F of SWMP

Possible Steps for Terminating the Discharge of Water Associated with Construction Activities

When a Construction Site is nearing completion and the permittee is desirous of terminating their permit with the State of Utah for discharging water associated with construction activities the following steps should be taken:

1. The Contractor's SWPPP coordinator for the project should notify the city storm water inspector that they are ready for final inspection.
2. The city storm water inspector visits the site to determine if the site has reached final stabilization as determined by the UPDES Storm Water General Permit for Construction Activities, UTRH00000. The city storm water inspector also checks to see if all temporary BMP have been removed.
3. If there is work still to be completed they are included in the Additional Comments and Corrective Actions for SWPPP Compliance portion of the State's UPDES Storm Water Inspection Evaluation Form for SWPPP Compliance (State's inspection form) and provides a copy for the SWPPP coordinator.
4. When the city storm water inspector is satisfied that all requirements have been met, the city storm water inspector uses the State's inspection form and completes the Notice of Termination (NOT) Inspection section of that form and sends a copy to the State for their records.
5. The city storm water inspector or designated individual then needs to log into the State's database and change the status of the permit for the given permit.
6. Once the State has received confirmation that the site meets all the requirements the NOT is granted.

L.I.D. HANDBOOK

Low-Impact Development Techniques

The permit requires that MS4's consider Low Impact Developments (LID's) for your community referenced in 4.2.5.3.2, 4.2.6.4, and 4.2.4.3.3. The following 7 categories with associated links are intended to assist communities in proper planning and Construction to encourage LID practices.

Bio-Retention areas: designed for site specific conditions to optimize the effectiveness of water filtration and retention. There is no standard. Creativity, ingenuity and dedication are the key to success.

- Aquatic Buffers
- Green Parking Lots
- Bioretention
- Soil Amendments
- Soil Restoration
- Created Wetlands
- Dispersal Trench
- Conveyance Furrow
- Urban Forestry
- Vegetation Restoration
- Biofiltration
- Stormwater Planters

Green Roofs: A bio retention area as well as a form of rain water collection; it also adds a public place and social element.

- Green Roofs
- Biofiltration

Permeable Pavements: allow for water to permeate through the surface, yet still give a hard surface for pedestrian and vehicular traffic.

- Break Up Flow Directions From Paved Surfaces
- Use Alternative Surfaces
- Green Parking Lots

Rain water collection: Utah law allows for re-use on site. For larger buildings such as offices and malls this is an impact that could greatly reduce storm drain usage in the area.

- Water Harvesting and Reuse
- Parking Lot and Street Storage
- Dispersal Trench
- Pop-Up Emitter

Riparian Buffers: Applied along a watershed by restricting development along creeks, streams, washes, ect. This keeps the natural flow of water, mitigates erosion and contamination, as well as provides an interconnected habitat for animals, and recreation opportunities.

- Protect Natural Site Functions
- Preserve Natural Corridors
- Aquatic Buffers

Green Street System: Includes the different aspects of rain gardens and swales along roads into an incorporated system for retention and filtration of storm water.

- Reduced Clearing and Grading
- Functional Grading
- Locate Impervious Surfaces to Drain to Natural Systems
- Minimize Directly Connected Impervious Areas
- Break Up Flow Directions From Paved Surfaces
- Trail and Path Network
- Narrow Roadways
- Reconfigure Driveways
- Alternative Turnarounds
- Green Parking Lots
- Stormwater Planters
- Urban Forestry
- Alternative Street Layouts
- Eliminate Curb and Gutter

Zoning/Alternative Development Configurations and Standards: creative zoning and development standards directed towards minimizing disturbances of the natural habitat and hydrology of the area.

- Site Fingerprinting
- Fit Development to Natural Gradient
- Alternative Development Configurations
- Define Development Envelope
- Identify Sensitive Areas
- Alternative Lot Configuration
- Reconfigure Driveways
- Alternative Turnarounds
- Reduced Sidewalk Application
- Alternative Street Layouts
- Eliminate Curb and Gutter
- Large lot sizes – higher impervious area percentage
- Cluster Zoning – consolidating development – fewer impacted areas
- Development credits – limiting overall development in a community
- Considering conservation easements
- Limit maximum Directly Connected Impervious Areas (DCIA)

References:

www.lid-stormwater.net (Tool created through Cooperative Assistance Agreement under the US EPA Office of Water 104b(3) Program)

http://www.epa.gov/owow/NPS/lid/lid.pdf

http://www.deq.idaho.gov/water/data_reports/storm_water/catalog/sec_3/text.pdf

SWMP Update 2010

Coaching Session 2 Lid Handout

Permit Reference #: 4.2.5.3.2, 4.2.6.4, 4.2.4.3.3

4.2.6.7. The Permittee must develop and implement a process to assess the water quality impacts in the design of all new flood management structural controls that are associated with the Permittee or that discharge to the MS4. This process must include consideration of controls that can be used to minimize the impacts to site water quality and hydrology while still meeting project objectives. A description of this process must be included in the SWMP document

4.2.6.8. Construction Projects. Public construction projects shall comply with the requirements applied to private projects. All construction projects disturbing greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, owned or operated by the Permittee are required to be covered under the General UPDES Permit for Storm Water Discharges Associated with Construction Activities. All public projects approved after the effective date of this Permit shall include construction and post-construction controls selected and implemented pursuant to the requirements in Parts 4.2.4. and 4.2.5.

Ideas for including water quality on all projects

1. Review Storm Drain Master Plan for opportunities to include water quality projects or water quality aspects to Capital Improvement Projects.
2. Update Master Plan to include water quality issues.
3. During conceptual design review meetings – ask the questions –
    a. *Is there opportunity to include water quality aspects to this project?*
    b. *Are there any highly impacted areas?*
    c. *Are there low-impact development concepts and ideas that might work for this project?*
    d. *Can we limit directly connected impervious areas (DCIA) on this project?*
    e. *What could be done to minimize runoff?*
4. Train all employees, contractors and developers on SOP's and BMP's for all projects.
5. Include SWPPP discussion as part of the agenda for preconstruction meetings for all projects.
6. Look for "green money" funding options for water quality aspects of all projects.
7. Follow normal SWPPP review process/checklist review for all projects.

STORM WATER DRAINAGE DESIGN MANUAL AMENDMENT 2016

Prepared by

Alpine City

Alpine City
20 N. Main
Alpine, UT 84004

August 2016

STORM WATER DRAINAGE DESIGN MANUAL AMENDMENT 2016

August 2016

TABLE OF CONTENTS

INTRODUCTION

March 1, 2016 the State of Utah issued an updated Municipal Separate Storm Sewer System (MS4) permit (UTR090000) to municipalities. The permit had multiple updates, two of which that affect the way storm water is handled within MS4's. These will be briefly explained with details to follow. First, Low Impact Development (LID) is now required. LID uses alternative ways of handling storm water to infiltrate water where it falls rather than forcing it downstream. Second, the total volume of rainwater to discharge from a site is now regulated where in the past only the rate of flow was regulated. Municipalities are now required to retain, infiltrate, evapotranspire, or re-use rainwaters up to and including the 90th percentile storm event. This means all storms less than or equal to a size of storm the city receives 90 percent of the time must be retained onsite via LID practices or retention.

AMENDMENTS

LOW IMPACT DEVELOPMENT

Low Impact Development is added after the first paragraph of section 3.2 of the Storm Water Drainage Design Manual (SWDDM) to read as follows:

"Low Impact Development is a required approach for storm water control. State MS4 Permit UTR090000 Section 4.2.5.3.2 reads:

"For new development or redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, the program shall include a process which requires the evaluation of a Low Impact Development (LID) approach which encourages the implementation of BMPs that infiltrate, evapotranspire or harvest and use storm water from the site to protect water quality. Structural controls may include green infrastructure practices such as rainwater harvesting, rain gardens, permeable pavement, and vegetated swales. If an LID approach cannot be utilized, the Permittee must document an explanation of the reasons preventing this approach and the rationale for the chosen alternative controls on a case by case basis for each project."

State MS4 Permit UTR090000 Section 4.2.5.3.4 reads:

"Each Permittee shall develop and define specific hydrologic method or methods for calculating runoff volumes and flow rates to ensure consistent sizing of structural BMPs in their jurisdiction and to facilitate plan review. Within 180 days from the effective date of this Permit, new development or redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale must manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 90th percentile rainfall event. This objective must be accomplished by the use of practices that are designed, constructed, and maintained to infiltrate, evapotranspire and/or harvest and reuse rainwater. The 90th percentile rainfall event is the event whose precipitation total is greater than or equal to the 90 percent of all storm events over a given period of record. If meeting this retention standard is technically infeasible, a rationale shall be provided on a case by case basis for the use of alternative design criteria. The project

must document and quantify that infiltration, evapotranspiration and rainwater harvesting have been used to the maximum extent technically feasible and that full employment of these control are infeasible due to site constraints."

90TH PERCENTILE STORM

1. Historical rain data is available for Alpine City dated to the year 1900. Using this data, the 90th percentile storm event for Alpine City is 0.55 inches which is shown in Appendix E. This is the amount that must be retained onsite. The applicant must provide calculations and details as to how this will be achieved.
2. Only storm volumes greater than the 90th percentile storm can be discharged at the rate described in section 3.3, though it is encouraged LID be maximized on each site. 100-year storage requirements still apply (SWDDM Section 3.1.1).

LID REQUIREMENTS

1. No two developments are the same due to changing site conditions. Every development will be different in how the LID requirement is achieved. Appendix F contains a list of LID details and more explanation. Alpine City is open to review ideas that are not contained in Appendix F, final approval must be obtained from the City Engineer. "

AMENDED SECTION 2.2

Section 2.2, first paragraph, shall be amended to read as follows:

"A Conceptual Drainage Plan and Report is required for *new development or redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale.* The report shall contain the following information."

Item 9 shall be added to Section 2.2 (report requirements) to read as follows:

"*9. General description of how the development will achieve the Low Impact Development and 90th percentile storm event requirements as set forth in section 3.2.*"

Item 12 of Section 2.2 (drawing requirements) shall be amended to read as follows:

"*12.* Other relevant drainage features *including but not limited to indicating all existing and proposed low points on the plan to ensure proper drainage.*"

AMENDED SECTION 2.3

Section 2.3, first paragraph, shall be amended to read as follows:

"A final Drainage Plan and Report is required for *new development or redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale* and shall be prepared by a

professional civil engineer registered in the State of Utah. The report portion of the Drainage Plan and Report shall contain the following:"

Items 20 and 21 shall be added to Section 2.3 (report requirements) to read as follows:

"20. *Description and calculations of how the development achieved the Low Impact Development and 90th percentile storm event requirements as set forth in section 3.2.*

21. If the Final Plat is to be presented in sections, a general drainage plan for the entire area shall be presented with the first section, an appropriate development stages for the drainage system for each section indicated."

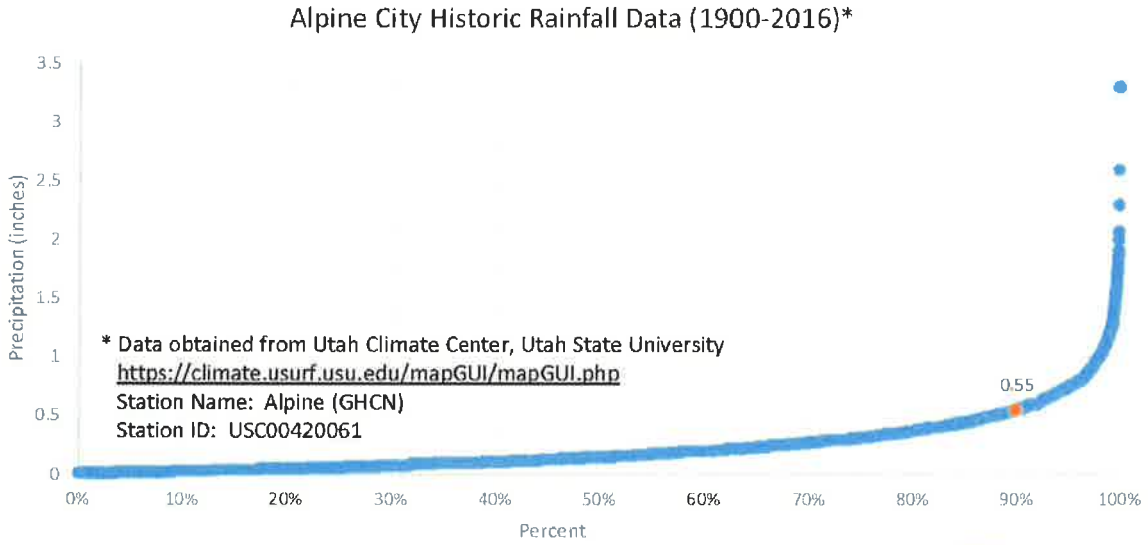
AMENDED SECTION 3.3.4

Section 3.3.4 shall be changed to read as follows:

"4. Landscaping and sprinklers shall be installed upon recommendation of the *City Engineer* and Planning Commission to the City Council."

APPENDIX E – 90th PERCENTILE EVENT DATA

Data to calculate the 90th percentile storm for Alpine City Utah was taken from the Utah Climate Center, Utah State University. Daily values were acquired for the years 1900 to 2016. The data was then sorted by precipitation and all non-rainfall values were eliminated. What was left was the rainfall values, they were sorted by amount and charted as shown below. As shown, the 90th percentile storm for Alpine City is 0.55 inches are rainfall.



The City is (and has been) requiring the 90TH percentile storm, the process of adopting this into ordinance is in motion.

APPENDIX F – LOW IMPACT DEVELOPMENT

Low-Impact Development Techniques

State Permit UTR09000 requires that municipalities consider Low Impact Developments (LID's) for communities referenced in 4.2.5.3.2, 4.2.6.4, and 4.2.4.3.3. The following 7 categories with associated links are intended to assist developers of any sized project in proper planning and construction to encourage LID practiccs.

Bio-Retention areas: designed for site specific conditions to optimize the effectiveness of water filtration and retention. There is no standard. Creativity, ingenuity and dedication are the key to success.

- Aquatic Buffers
- Green Parking Lots
- Bioretention
- Soil Amendments
- Soil Restoration
- Created Wetlands
- Dispersal Trench
- Conveyance Furrow
- Urban Forestry
- Vegetation Restoration
- Biofiltration
- Stormwater Planters

Green Roofs: A bio retention area as well as a form of rain water collection; it also adds a public place and social element.

- Green Roofs
- Biofiltration

Permeable Pavements: allow for water to permeate through the surface, yet still give a hard surface for pedestrian and vehicular traffic.

- Break Up Flow Directions From Paved Surfaces
- Use Alternative Surfaces
- Green Parking Lots

Rain water collection: Utah law allows for re-use on site. For larger buildings such as offices and malls this is an impact that could greatly reduce storm drain usage in the area.

- Water Harvesting and Reuse
- Parking Lot and Street Storage
- Dispersal Trench
- Pop-Up Emitter

Riparian Buffers: Applied along a watershed by restricting development along creeks, streams, washes, etc. This keeps the natural flow of water, mitigates erosion and contamination, as well as provides an interconnected habitat for animals, and recreation opportunities.

- Protect Natural Site Functions
- Preserve Natural Corridors

- Aquatic Buffers

Green Street System: Includes the different aspects of rain gardens and swales along roads into an incorporated system for retention and filtration of storm water.

- Reduced Clearing and Grading
- Functional Grading
- Locate Impervious Surfaces to Drain to Natural Systems
- Minimize Directly Connected Impervious Areas
- Break Up Flow Directions From Paved Surfaces
- Trail and Path Network
- Narrow Roadways
- Reconfigure Driveways
- Alternative Turnarounds
- Green Parking Lots
- Stormwater Planters
- Urban Forestry
- Alternative Street Layouts
- Eliminate Curb and Gutter
- Tree Box Filters

Zoning/Alternative Development Configurations and Standards: creative zoning and development standards directed towards minimizing disturbances of the natural habitat and hydrology of the area.

- Site Fingerprinting
- Fit Development to Natural Gradient
- Alternative Development Configurations
- Define Development Envelope
- Identify Sensitive Areas
- Alternative Lot Configuration
- Reconfigure Driveways
- Alternative Turnarounds
- Reduced Sidewalk Application
- Alternative Street Layouts
- Eliminate Curb and Gutter
- Large lot sizes – higher impervious area percentage
- Cluster Zoning – consolidating development – fewer impacted areas
- Development credits – limiting overall development in a community
- Considering conservation easements
- Limit maximum Directly Connected Impervious Areas (DCIA)

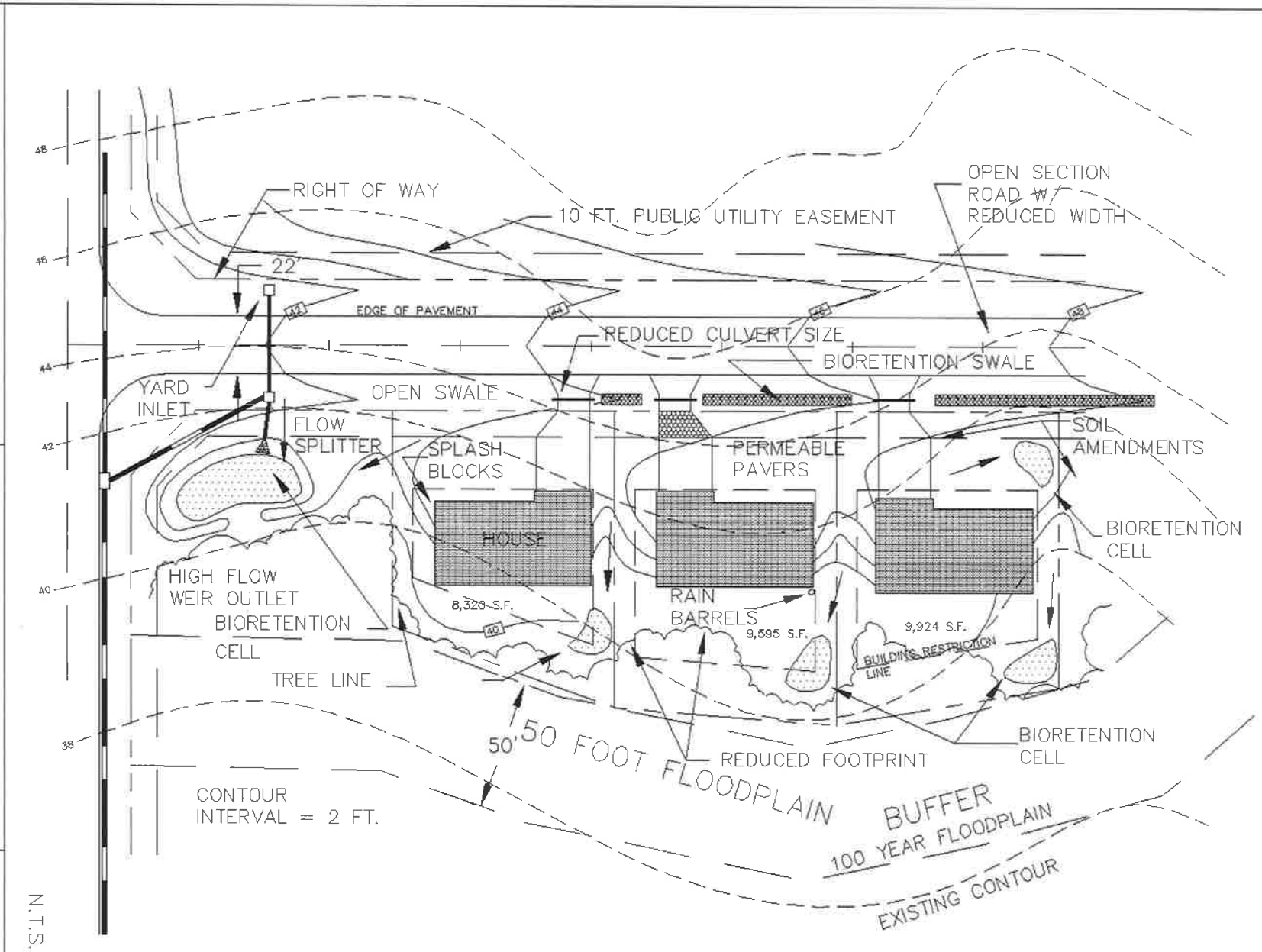
References:
www.lid-stormwater.net
(Tool created through Cooperative Assistance Agreement under the US EPA Office of Water 104b(3) Program)
http://www.epa.gov/owow/NPS/lid/lid.pdf *(Google "epa lid" if links do not work)*
http://www.deq.idaho.gov/water/data_reports/storm_water/catalog/sec_3/text.pdf

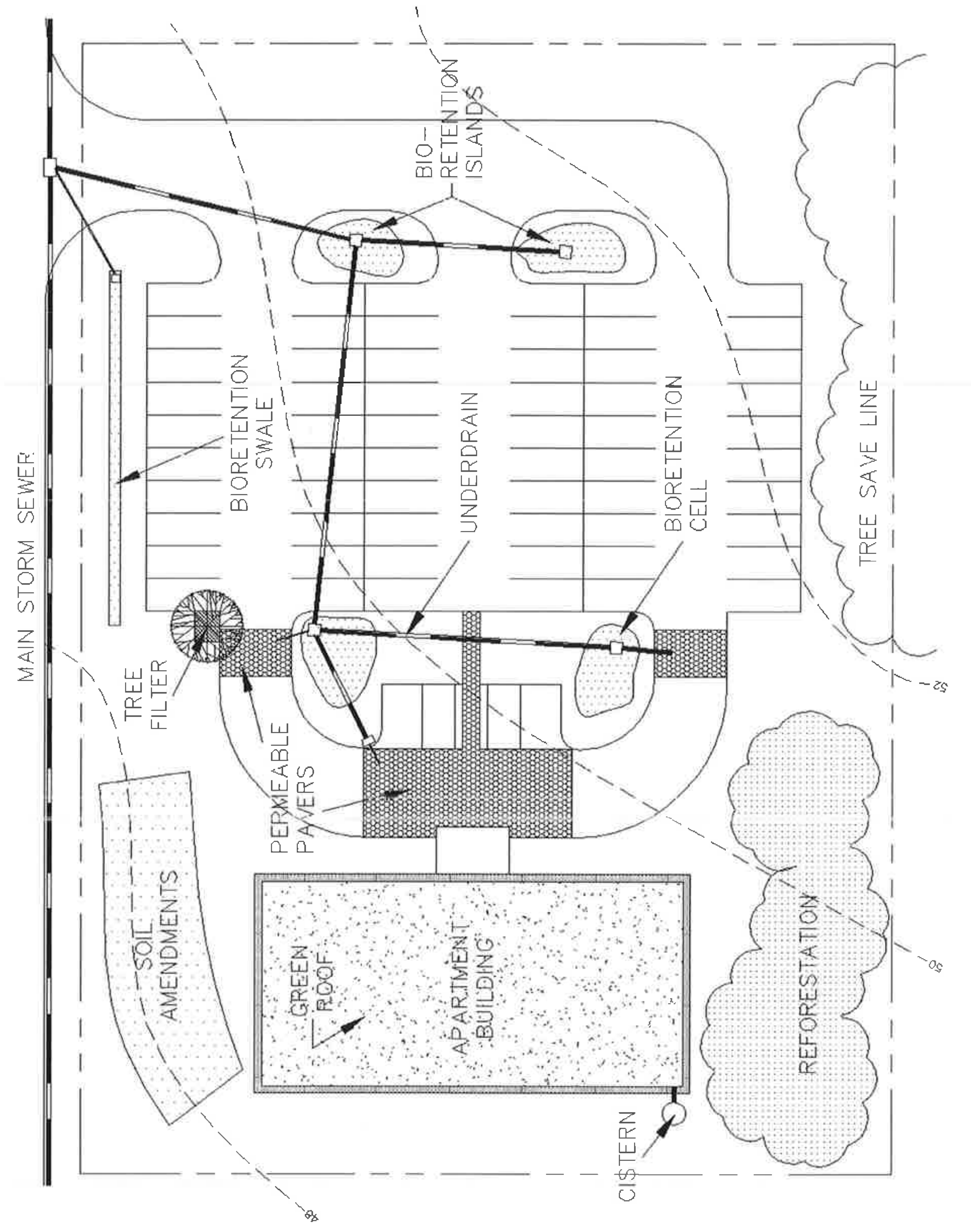
LID STANDARD DETAILS & IDEAS

THE LOW IMPACT
DEVELOPMENT CENTER, INC.
WWW.LOWIMPACTDEVELOPMENT.ORG

LID SINGLE FAMILY EXAMPLE

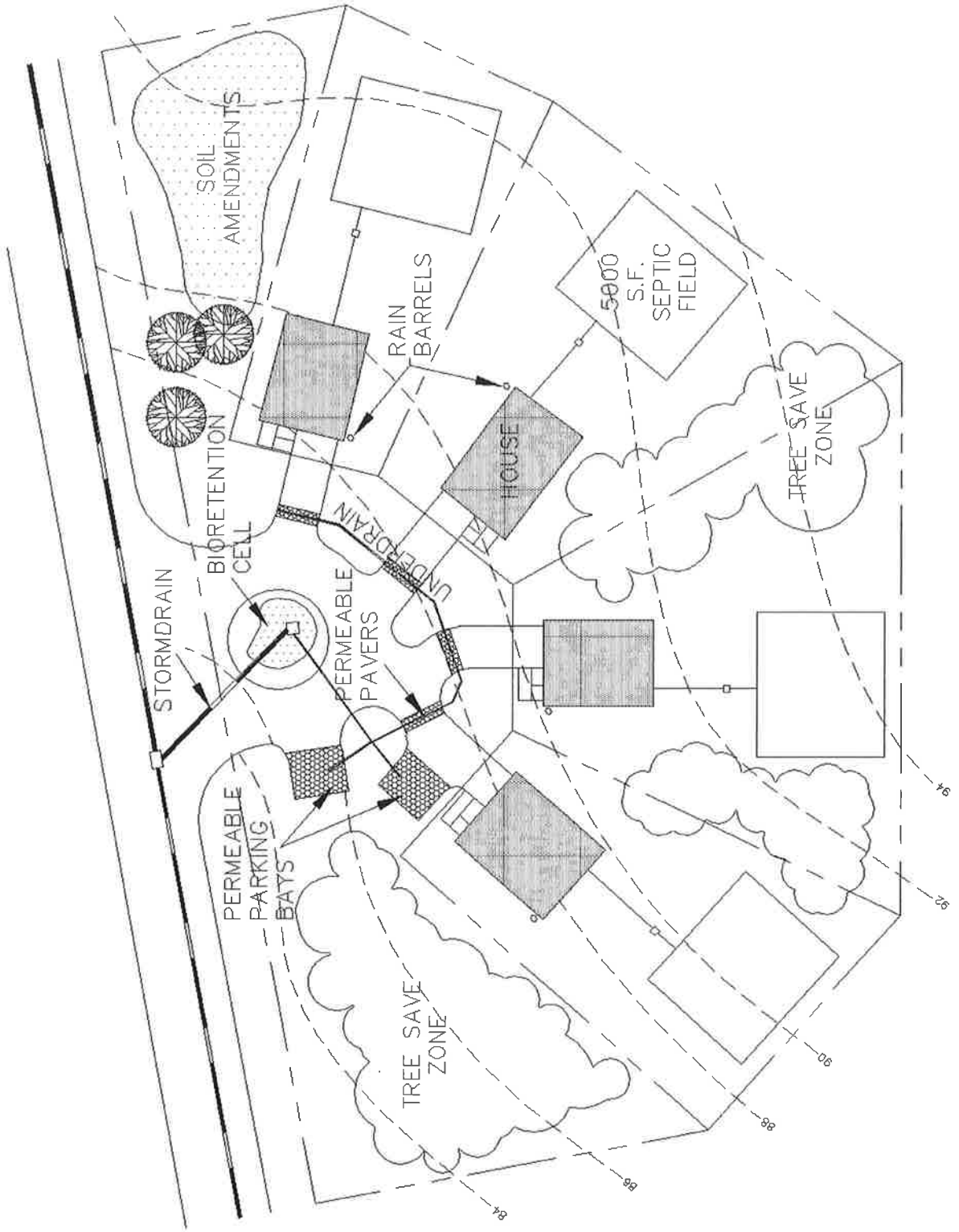
EX. 1.0
NOV 2002





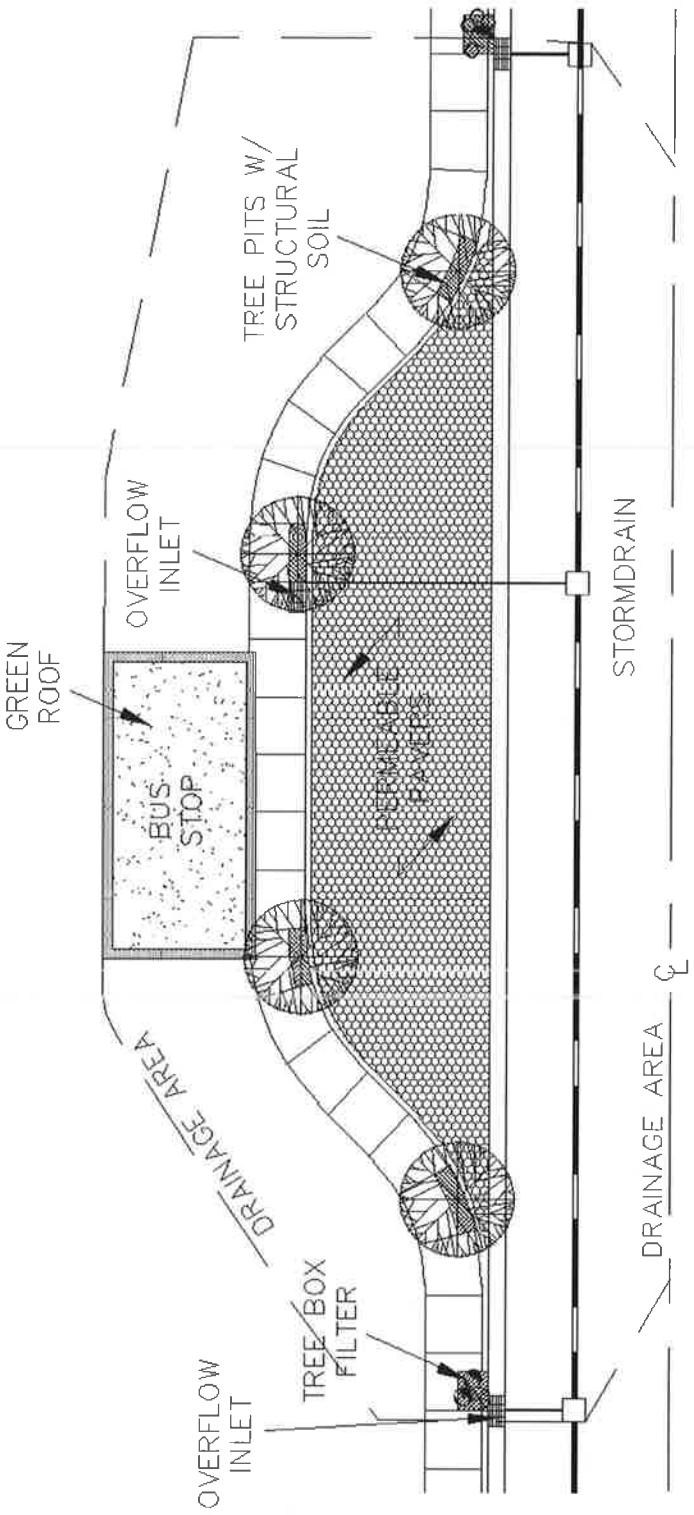
N.T.S.

THE LOW IMPACT DEVELOPMENT CENTER, INC. WWW.LOWIMPACTDEVELOPMENT.ORG	LID SUBURBAN HIGHRISE APARTMENT EXAMPLE	EX. 2.0 NOV 2002



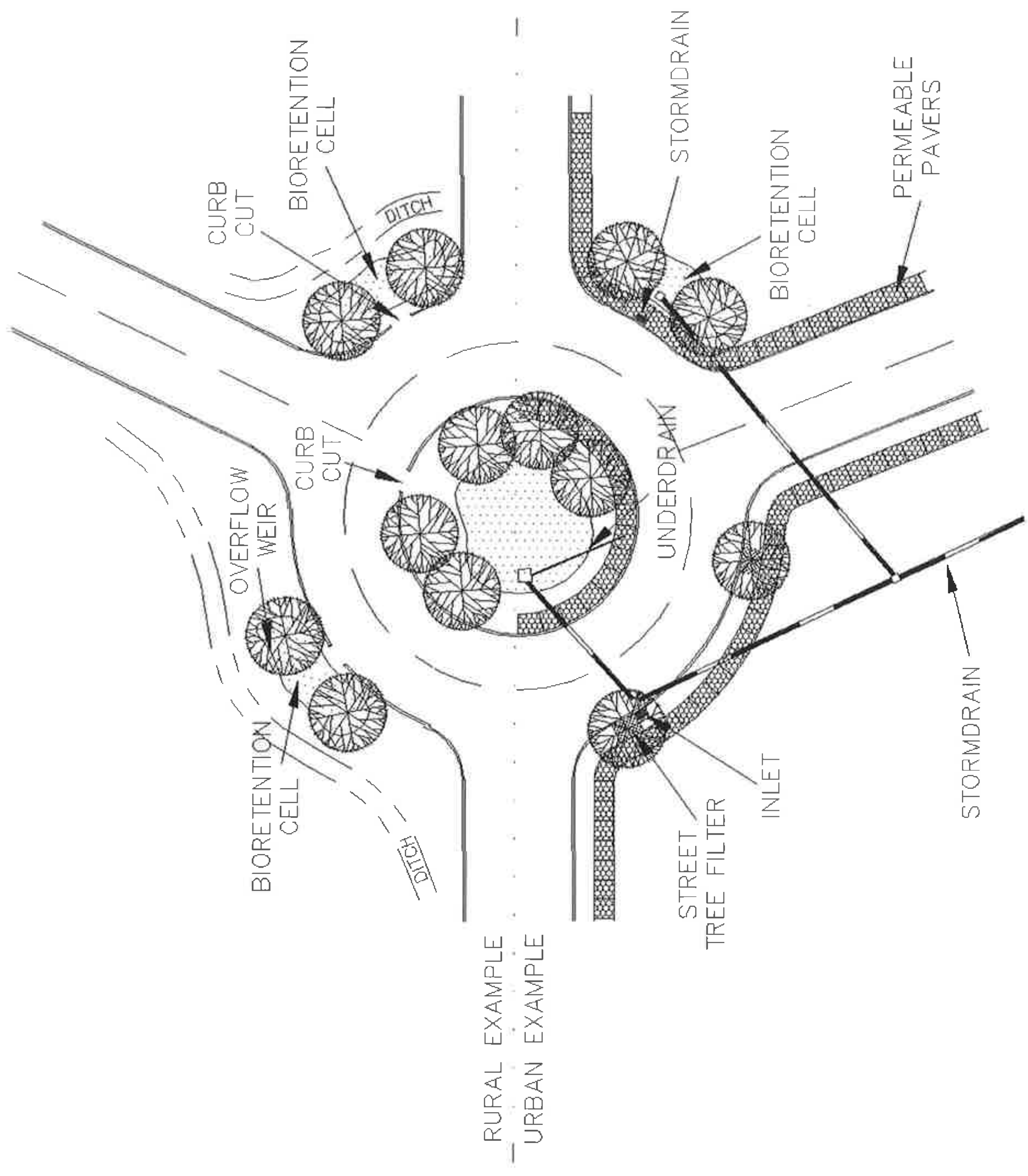
N.T.S.

THE LOW IMPACT DEVELOPMENT CENTER, INC. WWW.LOWIMPACTDEVELOPMENT.ORG	LID SUBDIVISION – ZERO LOT LINE EXAMPLE	EX. 3.0 NOV 2002



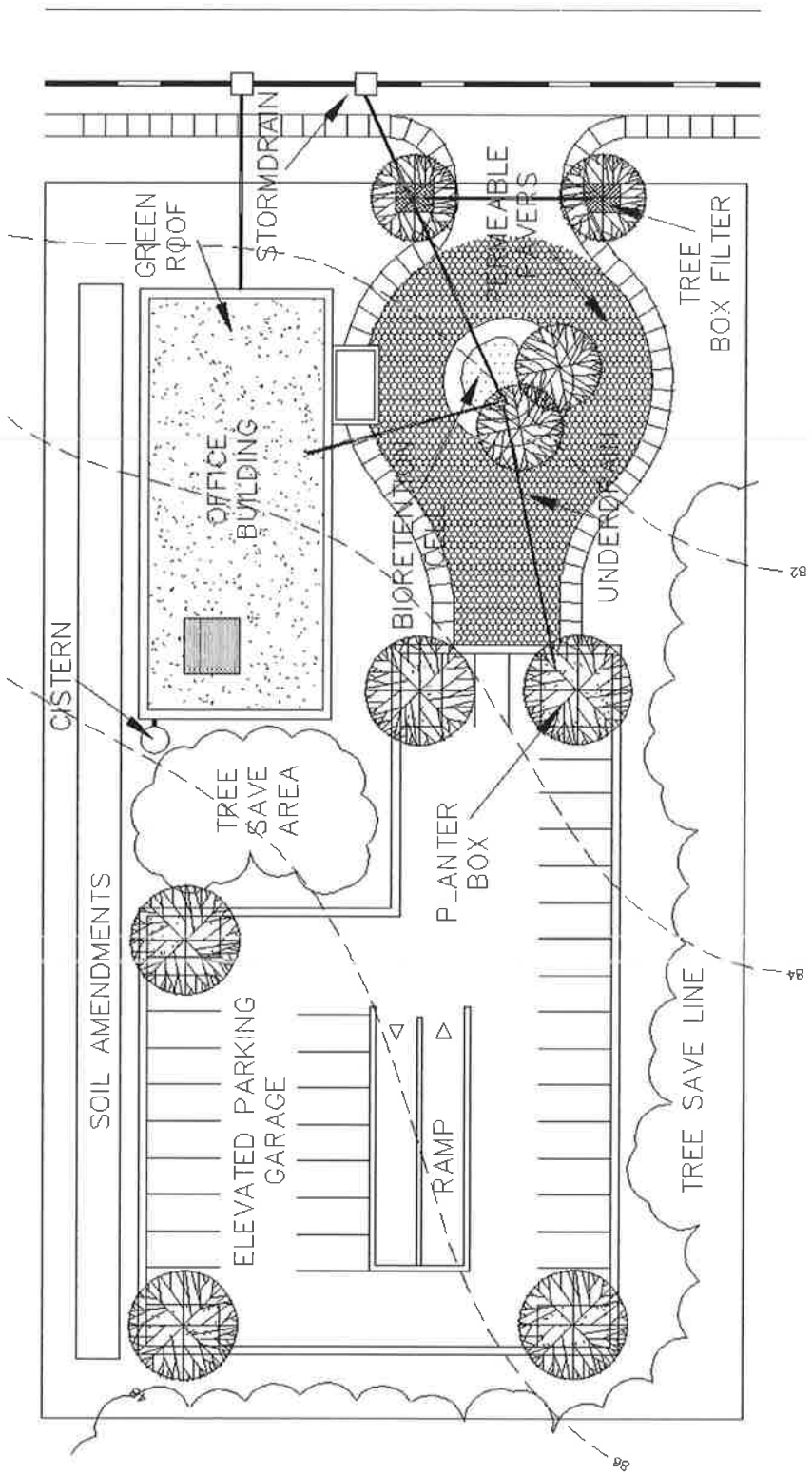
N.T.S.

THE LOW IMPACT DEVELOPMENT CENTER, INC. WWW.LOWIMPACTDEVELOPMENT.ORG	LID URBAN BUS STOP EXAMPLE	EX. 4.0 NOV 2002



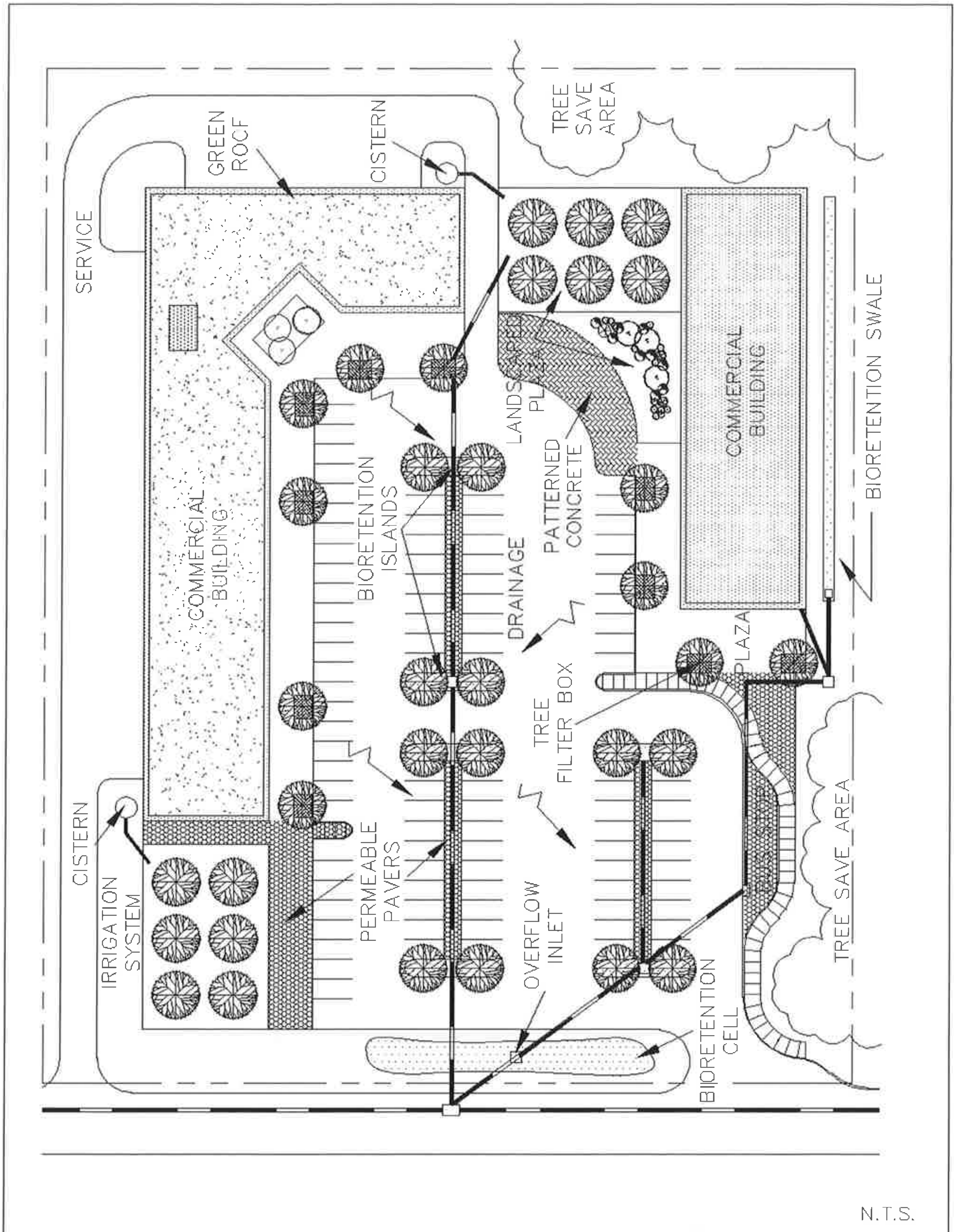
N.T.S.

THE LOW IMPACT DEVELOPMENT CENTER, INC. WWW.LOWIMPACTDEVELOPMENT.ORG	LID TRAFFIC CIRCLE — RURAL & URBAN	EX. 5.0 NOV 2002



N.T.S.

THE LOW IMPACT DEVELOPMENT CENTER, INC. WWW.LOWIMPACTDEVELOPMENT.ORG	LID URBAN OFFICE & PARKING EXAMPLE	EX. 6.0 NOV 2002

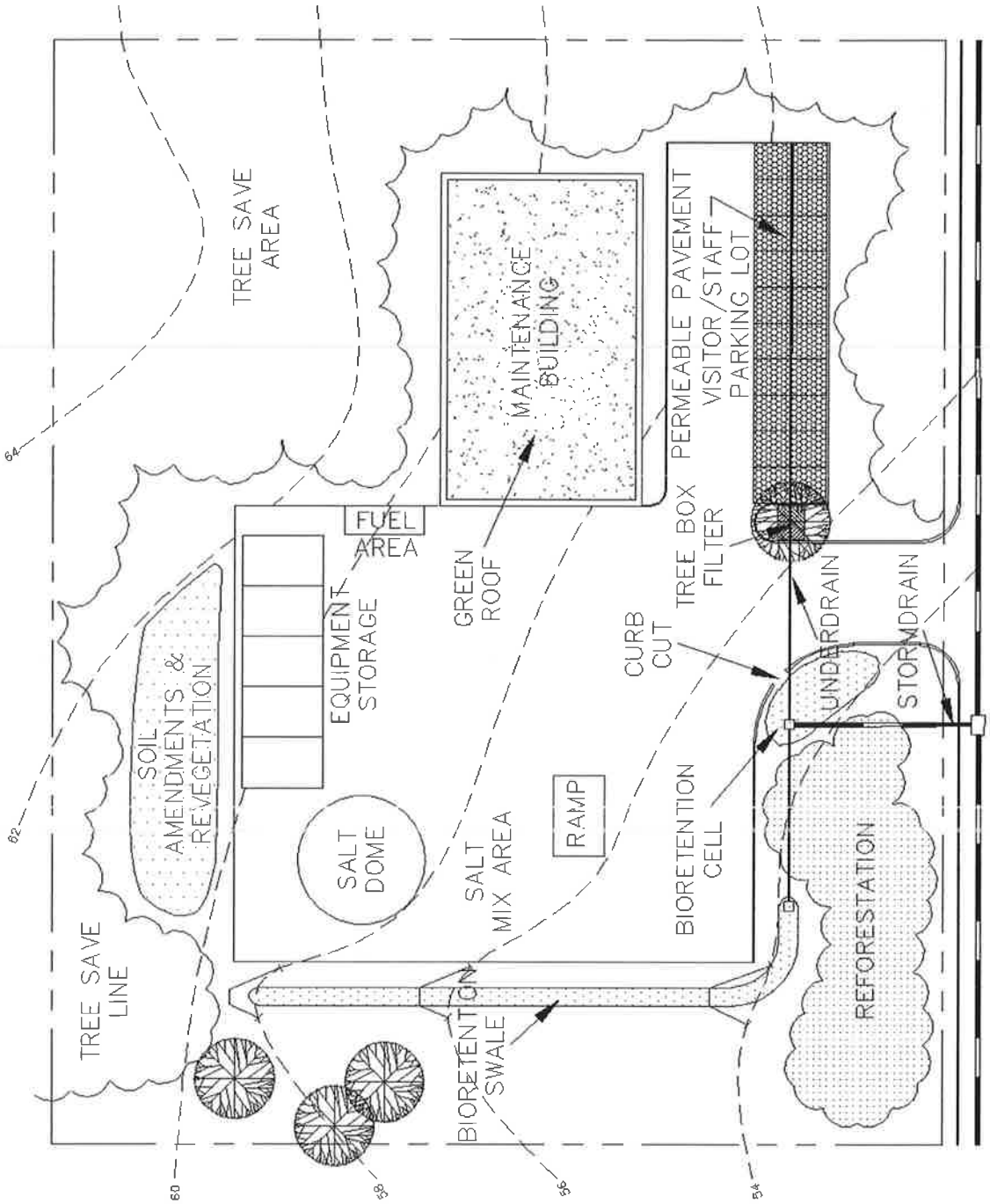


THE LOW IMPACT DEVELOPMENT CENTER, INC.

WWW.LOWIMPACTDEVELOPMENT.ORG

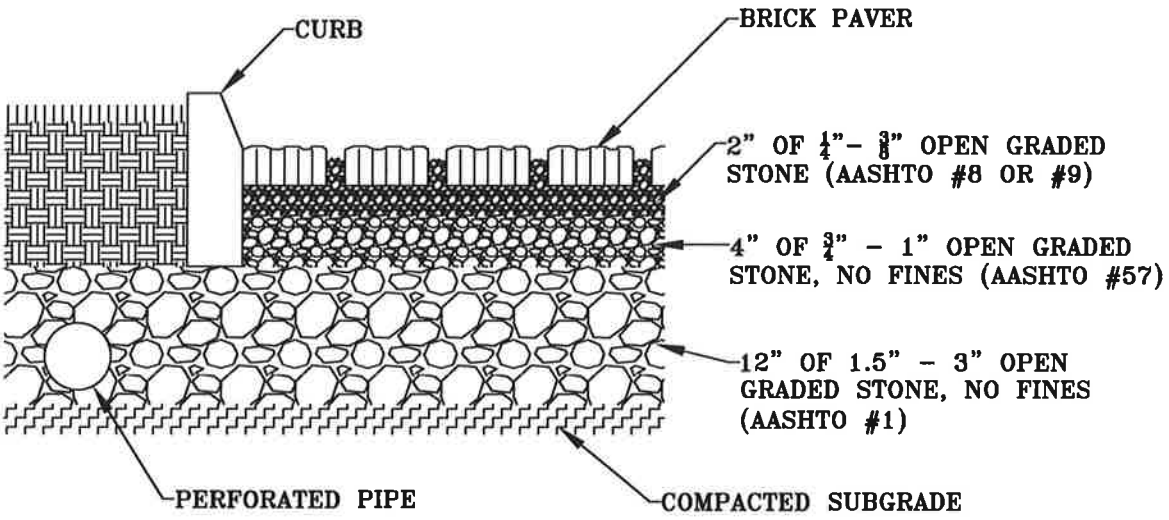
LID COMMERCIAL STRIP PARKING LOT

EX. 7.0
NOV 2002



N.T.S.

THE LOW IMPACT DEVELOPMENT CENTER, INC. WWW.LOWIMPACTDEVELOPMENT.ORG	LID HIGHWAY MAINTENANCE FACILITY	EX. 8.0 NOV 2002



NOTES

1. **TYPICAL DRAWING SHOWN, SUBMITTALS REQUIRED FOR APPROVAL**
2. **STORM WATER CALCULATIONS REQUIRED**

LOW IMPACT DEVELOPMENT
PERMEABLE PAVEMENTS

N.T.S.

REVISION

NO.	DESCRIPTION	BY	APRL	DATE

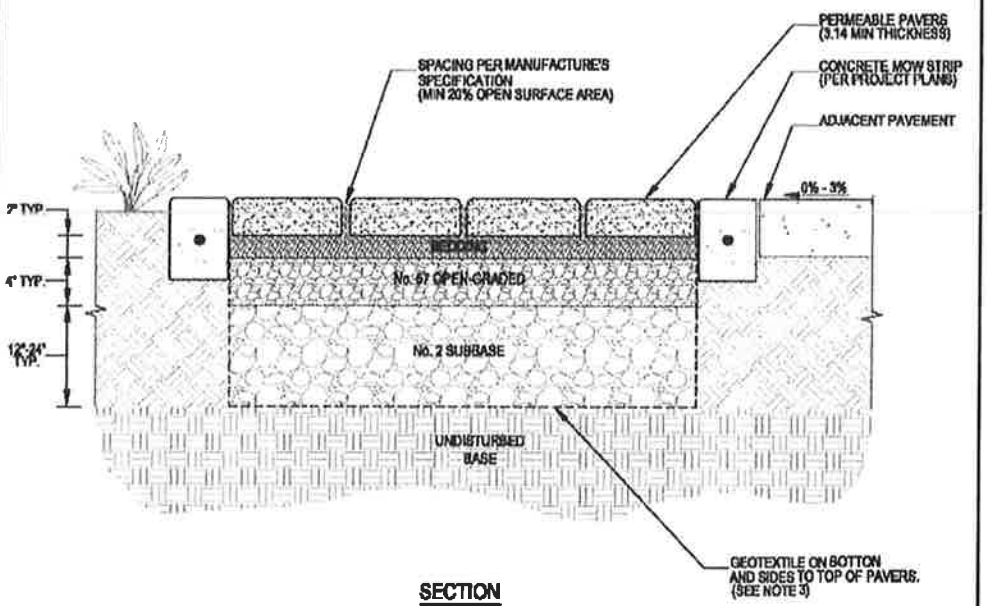
CAD FILE: [redacted]

ALPINE CITY
ESTABLISHED 1850

LID - PERMEABLE PAVEMENTS

ALPINE CITY
20 NORTH MAIN
ALPINE, UT 84004

STANDARD DRAWING NUMBER:	27
PLOT SCALE:	N.T.S.
DRAWN BY:	J.M.
DESIGN BY:	
CHECKED BY:	
ADOPTED DATE:	--



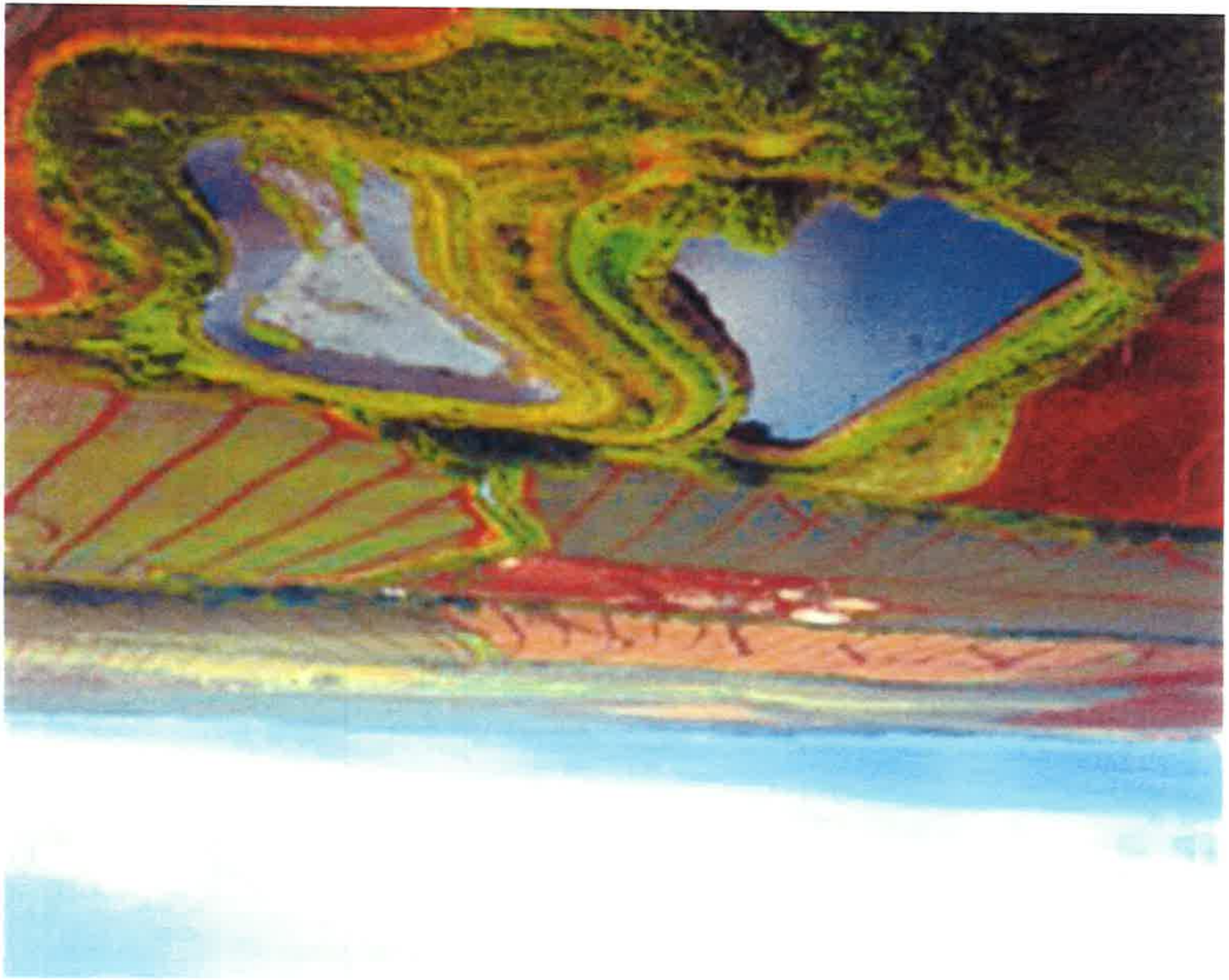
SECTION

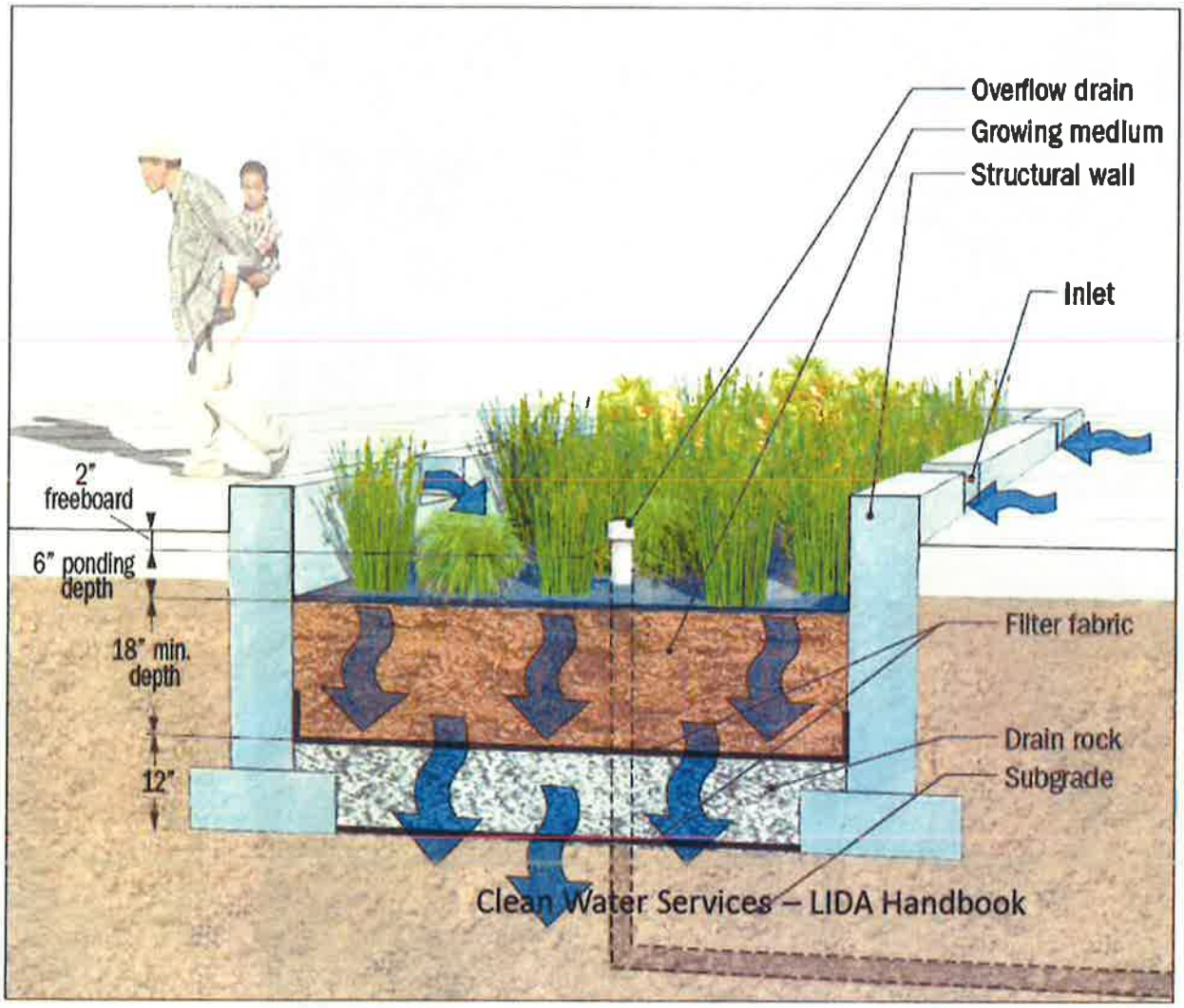
NOT TO SCALE

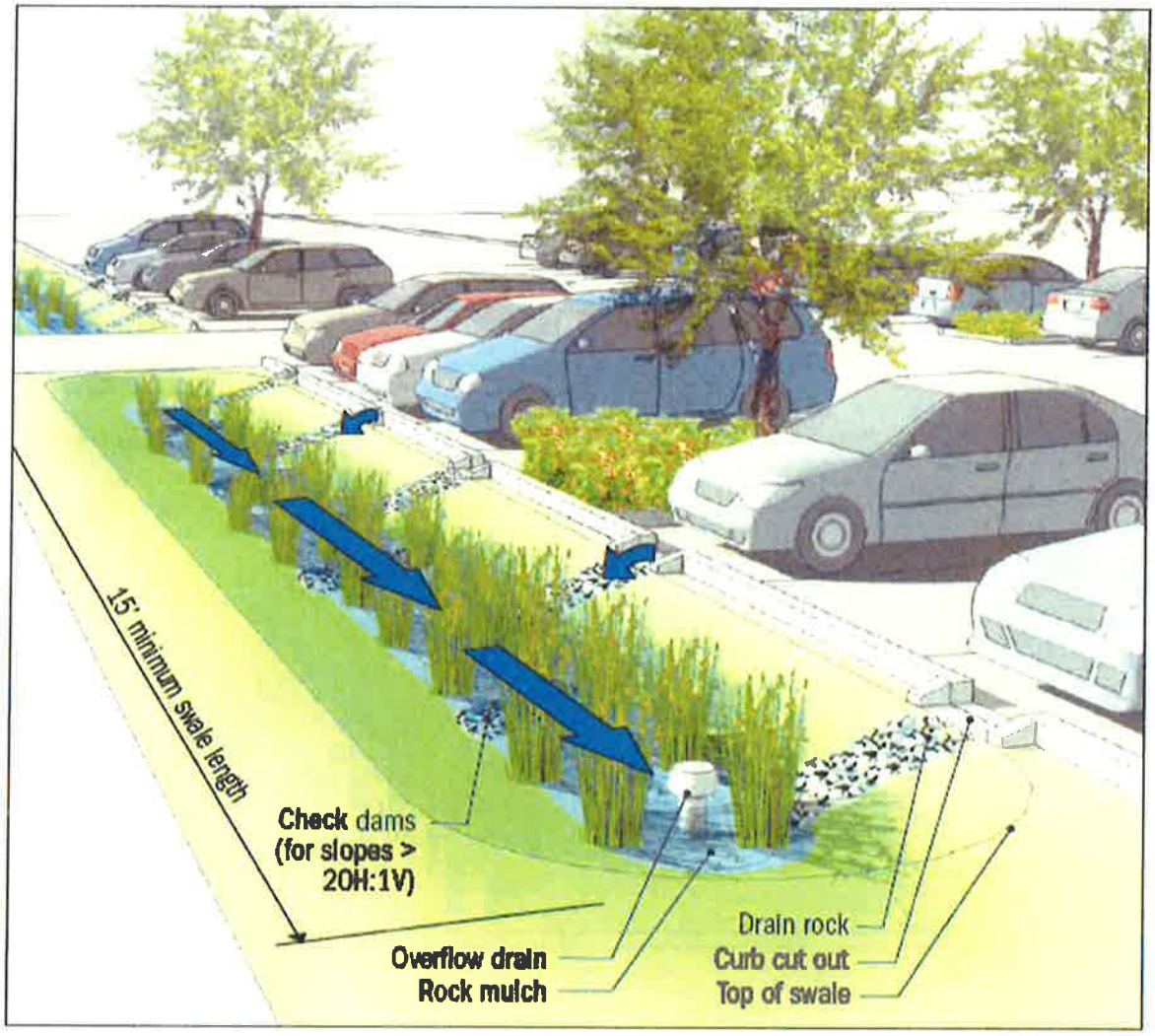
NOTES:

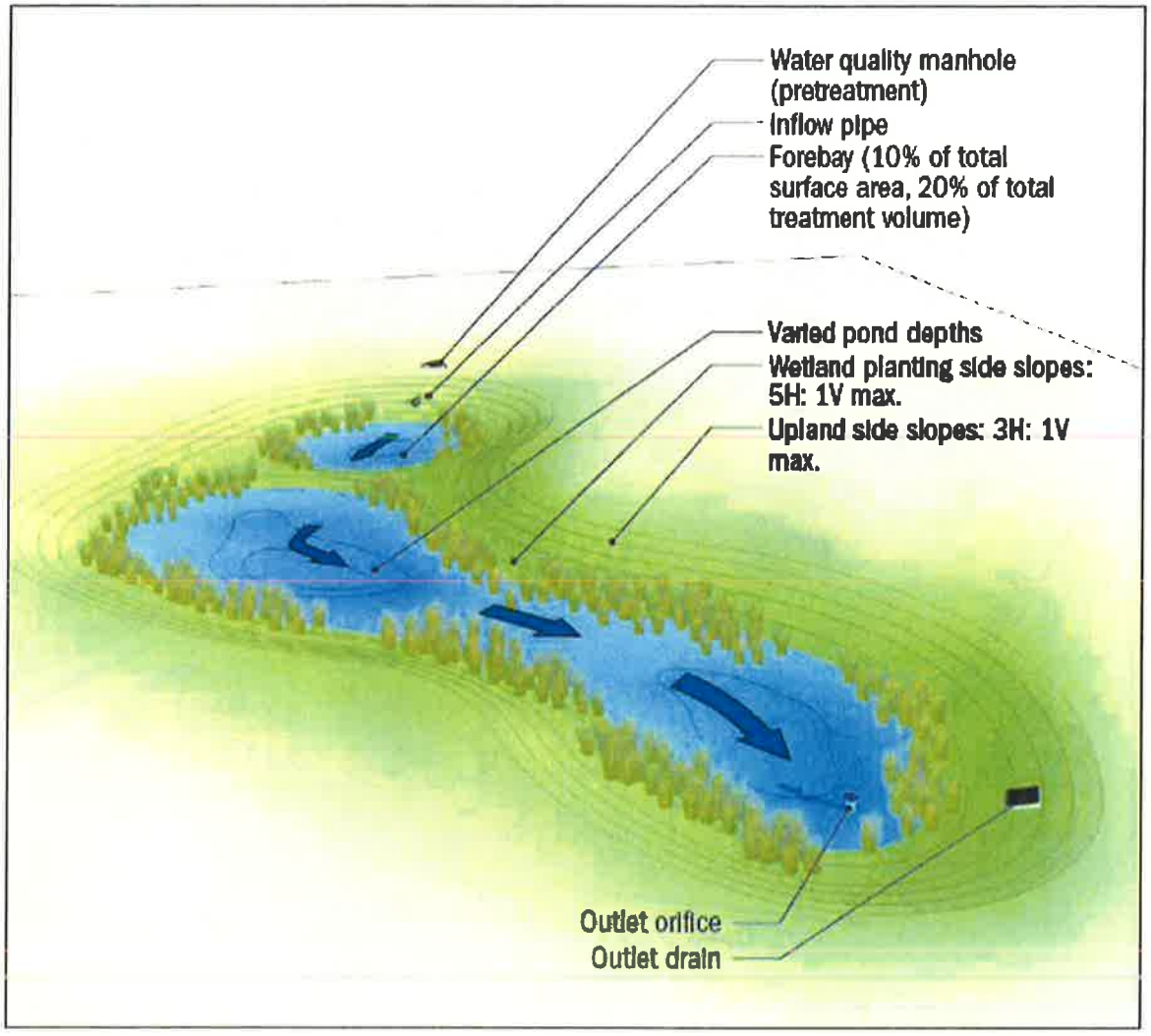
1. SITE SOILS SHALL HAVE ADEQUATE DRAINAGE (AT LEAST 0.5 INCHES PER HOUR).
2. INFILTRATION SHALL NOT CAUSE GEOTECHNICAL HAZARDS RELATED TO EXPANSIVE SOIL MOVEMENT, TUNNEL EROSION, OR SLOPE STABILITY.
3. IF INFILTRATION HARZARDS ARE A CONCERN, AN UNDERDRAIN SHALL BE INSTALLED TO DRAIN WATER INTO STORM DRAIN INLET OR ONSITE BMP. GEOTEXTILE SHALL BE REPLACED WITH IMPERMEABLE LINER AND UNDERDRAIN PREFERRED PIPE.
4. ANY OVERFLOW SHALL BE DISCHARGED PER BUREAU OF ENGINEERING AND BUILDING & SAFETY REQUIREMENTS.
5. SLOPE IS NOT GREATER THAN 3 PERCENT.
6. FLOW DIRECTED TO PERMEABLE PAVEMENT SHALL BE DISPERSED SO AS NOT TO BE CONCENTRATED AT A SMALL AREA OF PAVEMENT.
7. PRE-FABRICATED PRODUCTS HAVE BEEN INSTALLED PER ALL APPROPRIATE MANUFACTURER'S SPECIFICATIONS. IF REQUIRED, SUB-GRADE SOIL SHALL BE COMPACTED IN ACCORDANCE WITH PRODUCT INSTALLATION SPECIFICATION.
8. SEE PERMEABLE PAVERS FACT SHEET FOR MORE INFORMATION.

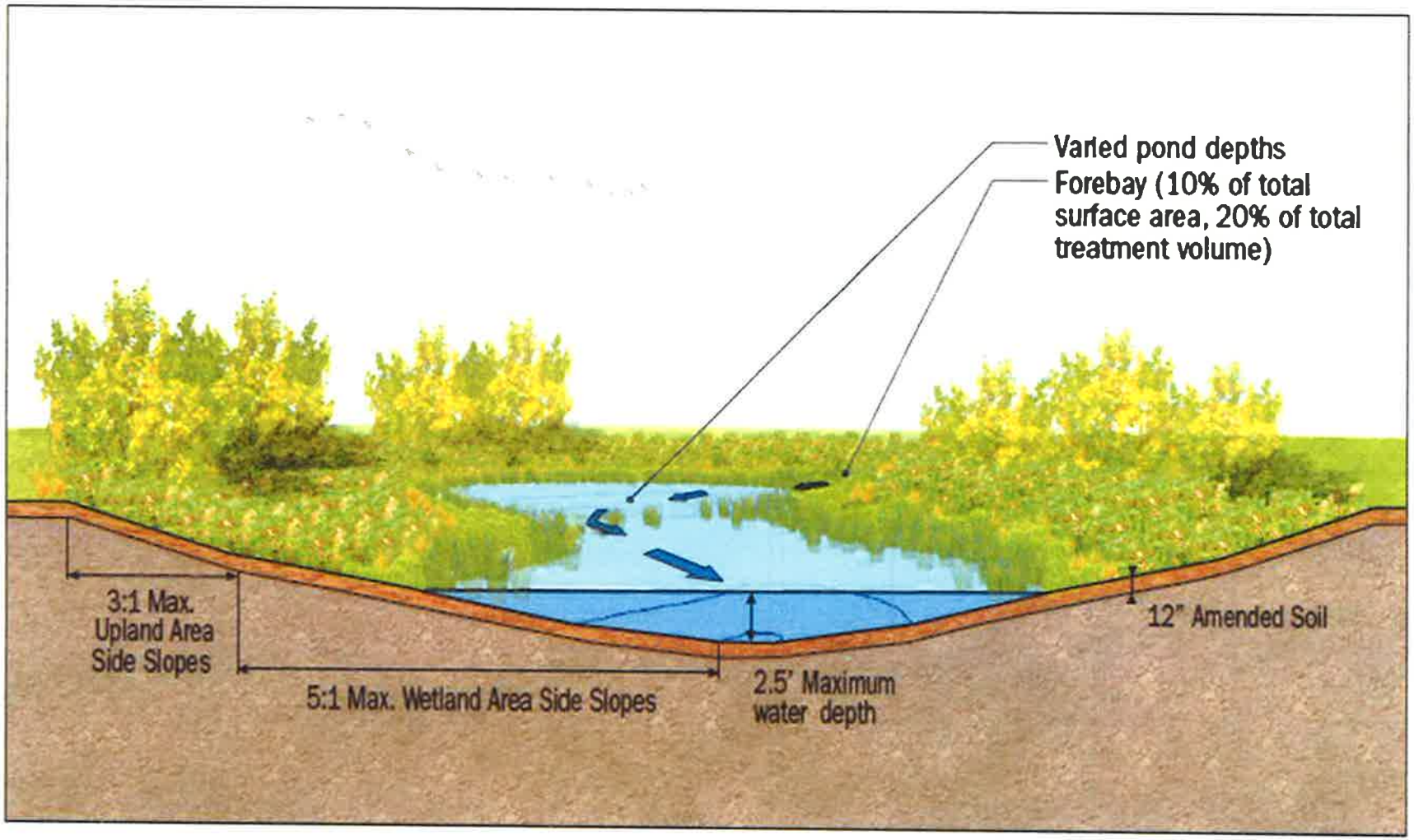
PERMEABLE PAVING – STONE
FOR SMALL SCALE RESIDENTIAL

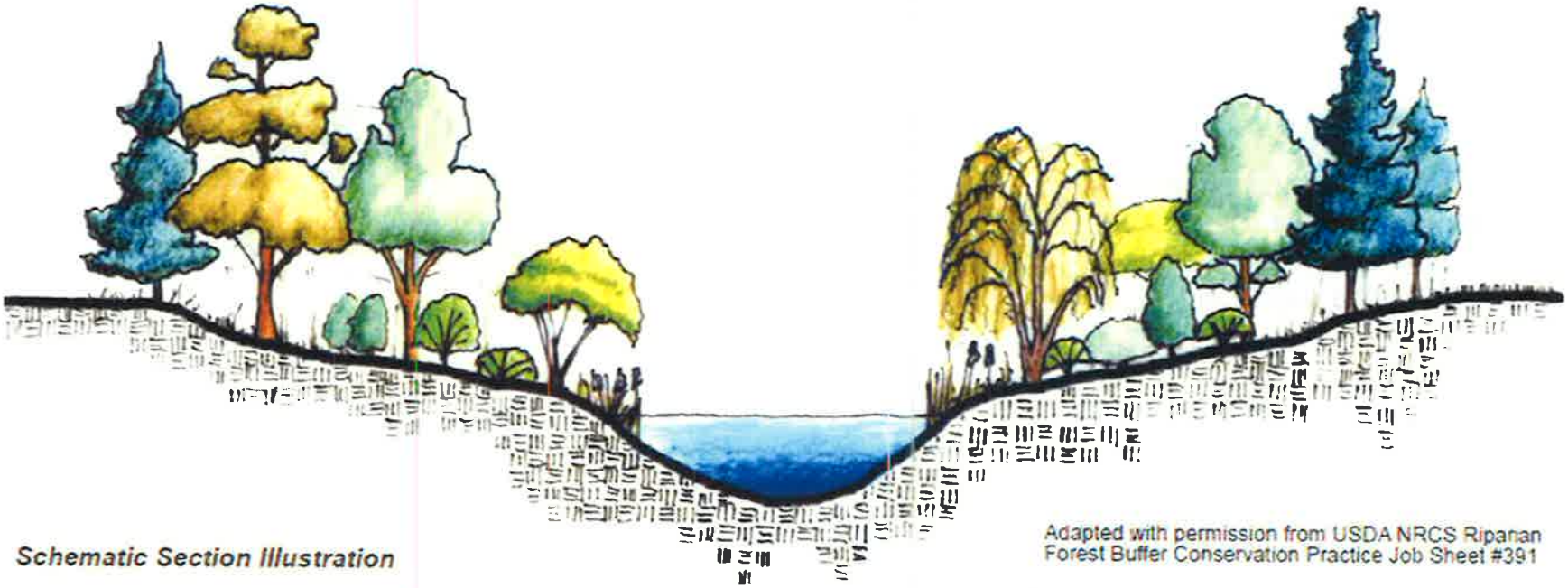



Overflow drain
Growing medium
Structural wall
Inlet
2" freeboard
6" ponding depth
18" min. depth
12"
Filter fabric
Drain rock
Subgrade
Clean Water Services – LIDA Handbook


15' minimum swale length
Check dams
(for slopes >
20H:1V)
Overflow drain
Rock mulch
Drain rock
Curb cut out
Top of swale

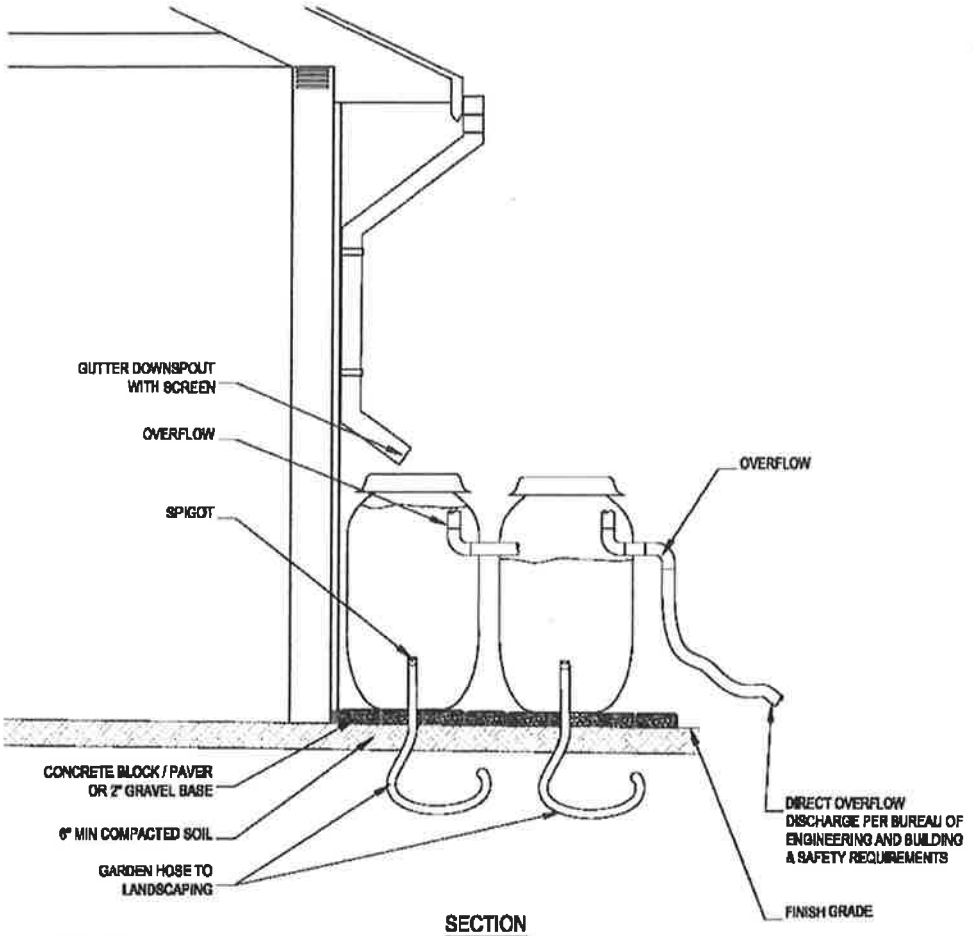

Water quality manhole (pretreatment)
Inflow pipe
Forebay (10% of total surface area, 20% of total treatment volume)
Varied pond depths
Wetland planting side slopes: 5H: 1V max.
Upland side slopes: 3H: 1V max.
Outlet orifice
Outlet drain


Varied pond depths
Forebay (10% of total surface area, 20% of total treatment volume)
3:1 Max. Upland Area Side Slopes
5:1 Max. Wetland Area Side Slopes
2.5' Maximum water depth
12" Amended Soil



Schematic Section Illustration

Adapted with permission from USDA NRCS Riparian Forest Buffer Conservation Practice Job Sheet #391



SECTION

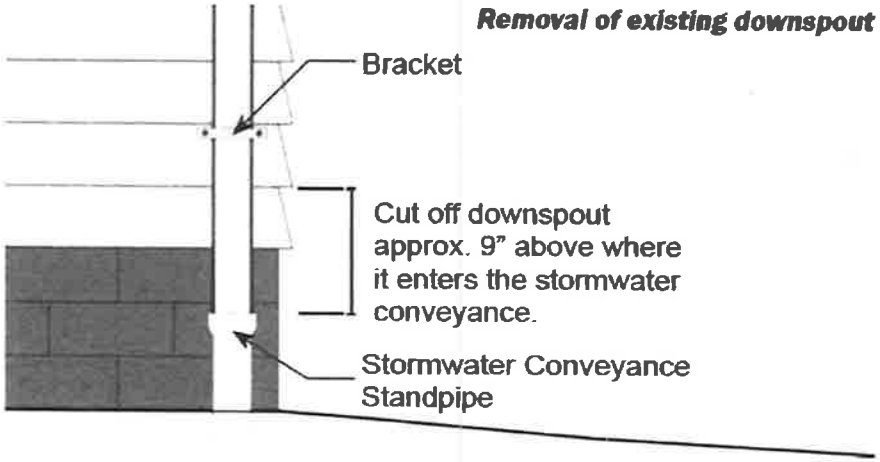
NOT TO SCALE

NOTES:

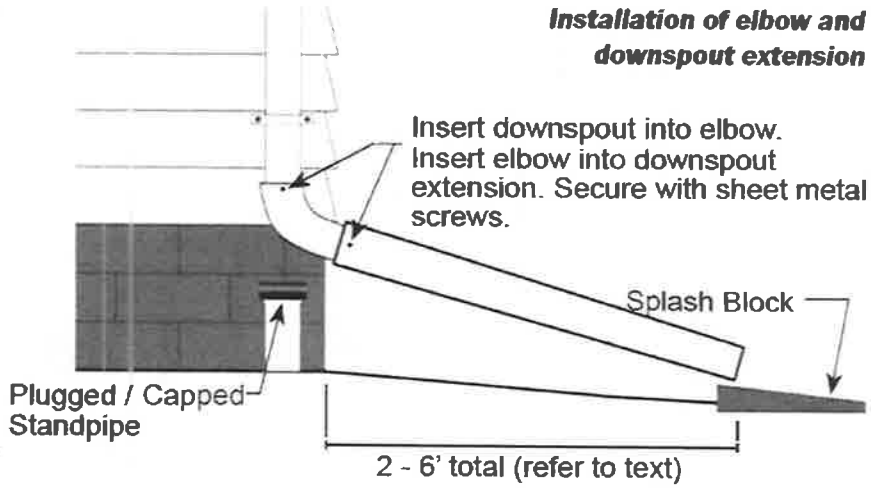
1. SCREENS ARE PRESENT ON ALL RAIN BARREL INLETS TO REMOVE DEBRIS AND LARGER PARTICLES AS THE WATER ENTERS THE BARREL. REMOVABLE CHILD-RESISTANT COVERS AND MOSQUITO SCREENING ARE IN PLACE.
2. BARREL IS CHILD SAFE: ACCESS IS CHILD-PROFF AND THE BARREL IS PROPERLY SITED AND ANCHORED ON A STABLE SURFACE TO PREVENT BARREL FROM TIPPING OVER.
3. ABOVE-GROUND BARRELS SHALL NOT LOCATED ON UNEVEN OR SLOPED SURFACE; IF INSTALLED ON A SLOPED SURFACE, THE BASE WHERE THE BARREL IS INSTALLED HAS BEEN LEVELED USING APPROPRIATE CONSTRUCTION MATERIAL PRIOR TO INSTALLATION.
4. INSTALLED RAIN BARRELS SHALL NOT BEEN PLACED ON ELEVATED PLATFORMS, DECKS OR PORCHES WITHOUT CONSULTING LOCAL BUILDING CODE OFFICIALS.
5. DIRECT OVERFLOW DISCHARGE PER BUREAU OF ENGINEERING AND BUILDING AND SAFETY REQUIREMENTS.
6. DISPERSION IS DIRECTED SO AS NOT TO KNOWINGLY CAUSE GEOTECHNICAL HAZARDS RELATED TO SLOPE STABILITY OR TRIGGERING EXPANSIVE (CLAYEY) SOIL MOVEMENT.
7. RAIN BARRELS SHALL BE OPAQUE AND DARK IN COLOR TO PREVENT UV LIGHT PENETRATION AND DISCOURAGE ALGAE GROWTH.
8. BARREL PLACEMENT SHALL ALLOW EASY ACCESS FOR REGULAR MAINTENANCE.
9. SEE RAIN BARREL FACT SHEET FOR MORE INFORMATION.

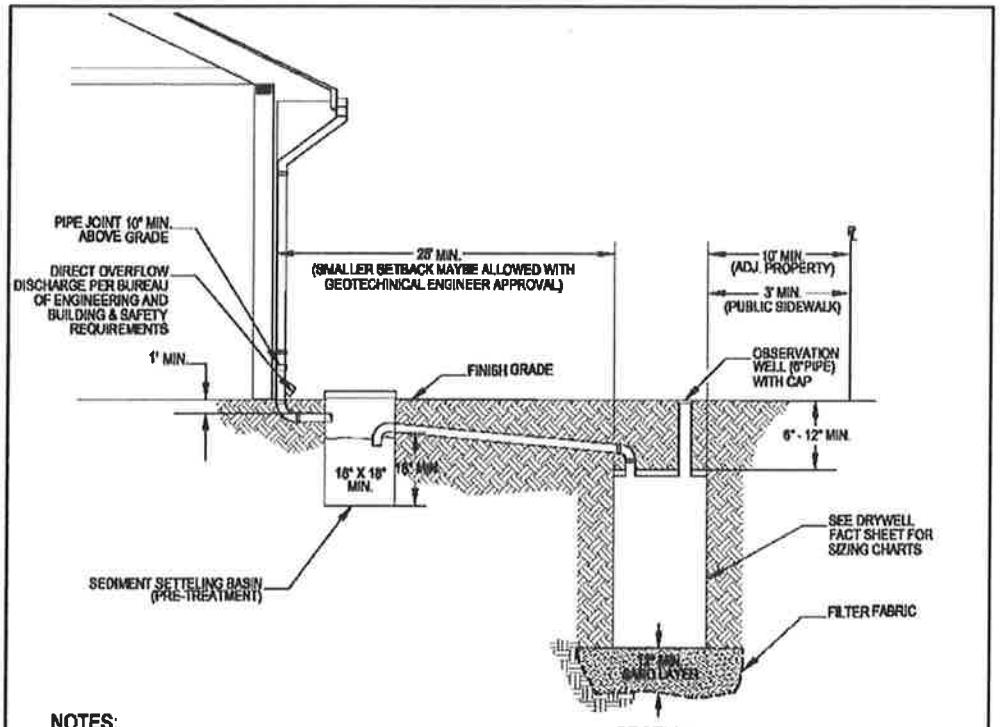
RAIN BARREL
FOR SMALL SCALE RESIDENTIAL

Removal of existing downspout



Installation of elbow and downspout extension



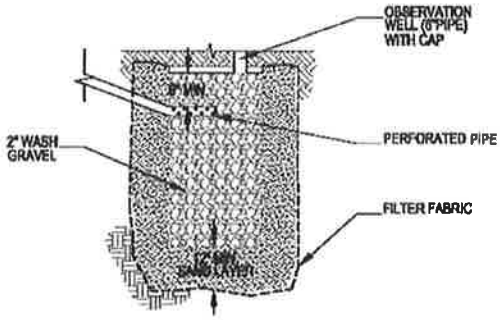


SECTION

NOT TO SCALE

NOTES:

1. PROVIDE PROTECTION FROM ALL VEHICLE TRAFFIC, EQUIPMENT STAGING, AND FOOT TRAFFIC IN PROPOSED INFILTRATION AREAS PRIOR, DURING, AND AFTER CONSTRUCTION.
2. SITTING CRITERIA: DRYWELL SHALL NOT BE LOCATED ON A SLOPE WITH GRADIENT GREATER THEN 20% (5:1, H:V)
3. TOP OF WELL MUST BE BELOW LOWEST FINISH FLOOR.
4. IF DRYWALL IS LOCATED WITHIN MINIMUM SETBACK REQUIREMENTS, THE DRYWELL SHALL BE DESIGNED BY A LICENSED ENGINEER.
5. DIRECT OVERFLOW DISCHARGE PER BUREAU OF ENGINEERING AND BUILDING & SAFETY REQUIREMENTS.
6. SEE DRYWELL FACT SHEET FOR ADDITIONAL GUIDELINES.

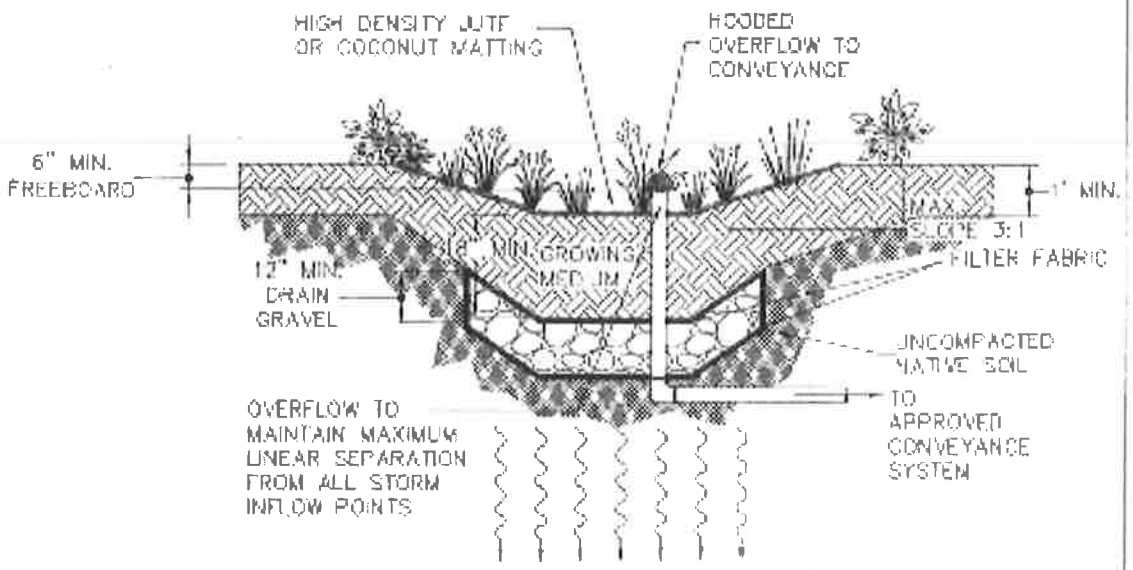


ALTERNATIVE DRYWELL SECTION

NOT TO SCALE

DRYWELL
FOR SMALL SCALE RESIDENTIAL

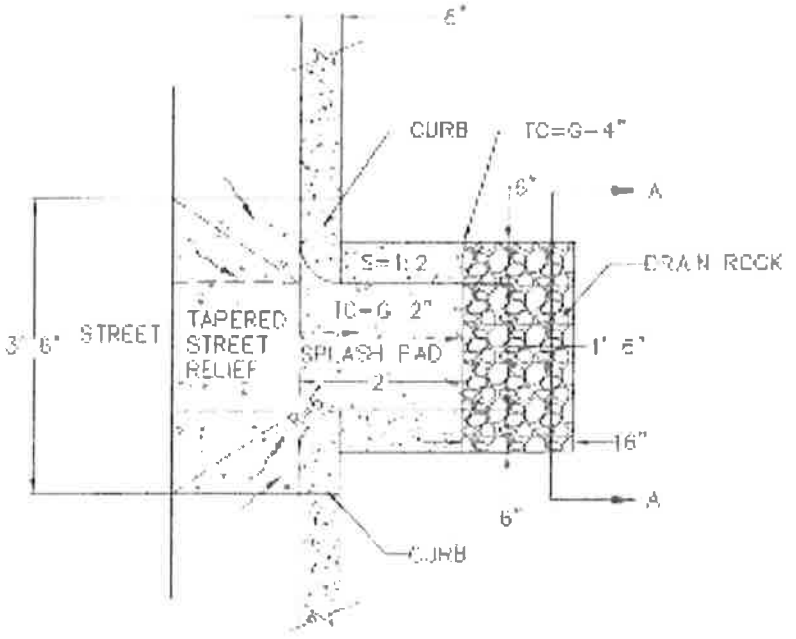
SHEET 1 OF 1 SHEETS



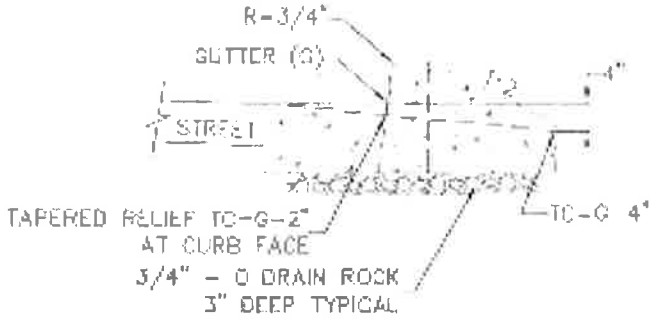
NOTES:

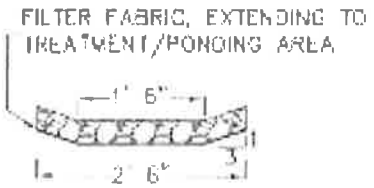
1. PUBLIC WATER QUALITY AND/OR QUANTITY SYSTEM
2. PROVIDE OVERFLOW CONVEYANCE SYSTEM, OVERFLOW CONVEYANCE HEIGHT TO ALLOW 6" MAXIMUM PONDING. PIPING TO A MINIMUM OF THE PLUMBING CODE OR CONVEY THE 25 YEAR STORM.
3. IF USING THE NATIVE SOIL INFILTRATION FOR SIZING, THE RATE SHALL BE DETERMINED BY ASTM STANDARD TESTING METHODS.
4. FLOW DISSIPATORS SHOULD BE USED IF ENTRY SLOPE TO THE BASIN IS GREATER THAN 3:1. FLOW DISSIPATORS SHALL BE CONSTRUCTED OUT OF ROCK OR GRAVEL PER DESIGN FLOW VELOCITY AT ENTRY OF THE FACILITY.
5. SEPARATION BETWEEN DRAIN GRAVEL AND GROWING MEDIUM SHALL BE APPROVED FILTER FABRIC.
6. TREATMENT AREA SHALL HAVE HIGH DENSITY JUTE OR COCONUT MATTING OVER 18" MINIMUM OF GROWING MEDIUM OR BASE STABILIZATION METHOD AS APPROVED BY THE DISTRICT.
7. VEGETATION TO BE USED IN WET AREAS OF THE BASIN IS PER APPENDIX "A" OF R&O 07-20 FOR THE WET MOISTURE CONDITIONS.
8. VEGETATION TO BE USED IN OTHER AREAS OF BASIN CONFORMS TO _____ OF THIS HANDBOOK AS APPROVED BY DISTRICT.

LIDA HANDBOOK	NON-STRUCTURAL INFILTRATION PLANTER	Clean Water Services	DRAWING NUMBER 787
			052



CURB CUT-OUT





SECTION A-A

NOTES:

1. INFLOW STRUCTURE PER LOCAL JURISDICTION. CURB CUT OUTS NOT ALLOWED ON WASHINGTON COUNTY ROADS - USE MODIFIED CG-30 SEE DETAIL, FOR INLET STRUCTURE, OR ODOT DETAIL DET 1750 FOR APPROPRIATELY SIZED CURB CUT.
2. INFLOW STRUCTURE - CURB CUTOUT SHALL HAVE MINIMUM 2" DROP AT THE FLOW LINE LEADING TO THE SPLASH PAD, SEE DETAIL.
3. FLOW RETARDING DRAIN ROCK MINIMUM SIZE 2" - ¾ MINUS OR SIZED BY DESIGN INFLOW TO BE PLACED 2.5" TO 3" DEEP BEHIND SPLASH PAD.
4. CURB PROFILE PER LOCAL JURISDICTION.

109	**LIDA HANDBOOK**	**CURB CUT OUT NON WASHINGTON COUNTY ROADS**	Clean Water Services	**DRAWING NUMBER 401**

MAINTENANCE AGREEMENTS

STATE OF UTAH **CITY OF ALPINE**

Stormwater Facilities Maintenance Agreement

WHEREAS, the Property Owner _____ recognizes that the wet or extended detention facility or facilities (hereinafter referred to as "The Facility" or "Facilities") must be maintained for Utah County Parcel Number _____

WHEREAS, the Property Owner is the owner of real property more particularly described on the attached Exhibit A; and,

WHEREAS, The City of Alpine (hereinafter referred to as "the City") and the Property Owner, or its administrators, executors, successors, heirs, or assigns, agree that the health, safety and welfare of the citizens of the City require that The Facilities be constructed and maintained on the property; and,

WHEREAS, the City requires that Facility or Facilities as shown on the approved development plans and specifications, which are more specifically described in Exhibit B hereto, be constructed and maintained by the Property Owner, its administrators; executors, successors, heirs, or assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

SECTION 1.
The Facility or Facilities shall be constructed by the Property Owner in accordance with the plans and specifications for the development and in accordance with Alpine City specifications.

SECTION 2.
The Property Owner, its administrators, executors, successors, heirs or assigns shall maintain the Facility or Facilities in good working condition acceptable to the City and in accordance with the Private Stormwater Management Facility Operation and Maintenance Manual (hereinafter referred to as the "O&M Manual") as adopted by Alpine City. In the event that an O&M Manual does not cover site specific requirements, those requirements shall be added as Special Provisions, attached as Exhibit D. The Owner agrees to cause inspection of the Facilities, at the Owner's expense, by a person experienced in the inspection of stormwater facilities. Inspections shall occur at least once every calendar year. An inspection report shall be submitted in writing to the City prior to July15th of each year for the Facilities. The inspection report shall be in accordance with the requirements set forth the O&M Manual. The Owner agrees to perform promptly all needed maintenance and report maintenance activities in accordance with the requirements set forth in the O&M Manual.

SECTION 3.
The Property Owner, its administrators, executors, successors, heirs or assigns hereby grants permission to the City, its authorized agents and employees, to enter upon the property and to

inspect the Facilities whenever the City deems necessary. Whenever possible, the City shall provide notice prior to entry. The Property Owner shall execute a public access easement(s) in favor of the City of Alpine to allow the City to inspect, observe, maintain, and repair the Facility as deemed necessary. It is expressly understood and agreed that Alpine City is under no obligation to maintain or repair the Facilities and in no event shall this Agreement be considered to impose any such obligation on the City. A fully executed original easement(s) is attached to this Agreement as Exhibit C and by reference made a part hereof.

SECTION 4.
In the event the Property Owner, its administrators, executors, successors, heirs or assigns fails to maintain the facility or Facilities as shown on the approved plans and specifications in good working order acceptable to the City and in accordance with the maintenance schedule incorporated in this Agreement, the City, with due notice, may enter the property and take whatever steps it deems necessary to return the Facility or Facilities to good working order. This provision shall not be construed to allow the City to erect any structure of a permanent nature on the property. It is expressly understood and agreed that the City is under no obligation to maintain or repair the Facility or Facilities and in no event shall this Agreement be construed to impose any such obligation on the City.

SECTION 5.
In the event the City, pursuant to Section 4 above, performs work of any nature, or expends any funds in the performance of said work for labor, use of equipment, supplies, materials, and the like, for the construction or maintenance of The Facilities or Facility, the Property Owner shall reimburse the City upon demand within thirty (30) days of receipt thereof for all the costs incurred by the City for this work. The Property Owner hereby specifically agrees that If the City is not paid for this work within 30 days from the demand by the City, that , the City may file a lien against the real property in the office of the County Recorder in the amount of such costs. The actions described in this section are in addition to and not in lieu of any
and all legal remedies available to the City as a result of the Property Owner's failure to maintain the facility or facilities.

SECTION 6.
It is the intent of this agreement to insure the proper maintenance of the Facility or Facilities by the Property Owner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or caused by stormwater runoff.

SECTION 7.
The Property Owner will make accommodation for the sediment accumulation resulting from the normal operation of the facility or facilities via removal and disposal of all accumulated sediments. Disposal will be provided onsite in a reserved area(s) or will be removed from the site. Reserved area(s) shall be sufficient to accommodate for a minimum of two dredging cycles.

SECTION 8.
The Property Owner shall inspect the property and Facility or Facilities at least once annually by a qualified inspector in accordance with the O&M Manual.

SECTION 9.
The Property Owner, its administrators, executors, successors, heirs and assigns hereby indemnifies and holds harmless the City and its authorized agents and employees for any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the City from the construction, presence, existence or maintenance of The Facility or Facilities by the Property Owner or the City. In the event a claim is asserted against the City, its authorized agents or employees, the City shall promptly notify the Property Owner and the Property Owner shall defend at its own expense any suit based on such claim. If any judgment or claims against the City, its authorized agents or employees shall be allowed, the Property Owner shall pay for all costs and expenses in connection herewith.

SECTION 11.
The Owner, its successors and assigns shall indemnify and hold harmless Alpine City, its agents and employees for any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the City arising out of or resulting from the construction, presence, existence maintenance or use of the Facility.

SECTION 12.
The Owner agrees that it will not at any time dedicate the Facilities to the public, to public use or to the City without the City's written consent, nor will it subdivide or convey the property without covenant providing that a proportionate share of the cost of maintenance and other costs associated with other of the obligations and duties contained herein runs with each subdivided part of the original tract or parcel of land.

SECTION 13.
The City shall not pay any compensation at any time for its use of the Property in any way necessary for the inspections and maintenance of the Facilities, including access to the Facilities.

SECTION 14.
This Agreement shall be recorded in the Utah County Clerk and Recorder's Office and shall constitute a covenant running with the land and shall be binding on the Property Owner, its administrators, executors, heirs, assigns and any other successors in interest.

SECTION 15.
This Agreement may be enforced by proceedings at law or in equity by or against the parties hereto and their respective successors in interest.

SECTION 16.
Invalidation of any one of the provisions of this Agreement shall in no way effect any other provisions and all other provisions shall remain in full force and effect.

MAINTENANCE AGREEMENT

SO AGREED this_____day of_____20_____

PROPERTY OWNER

BY:_____Attest:_____

Title:_____Title:_____

Approved as to form:

By:_____Date:_____
City Attorney

ALPINE, UTAH

Attest:_____
City Recorder

(SEAL)

Attachments:
Exhibit A (Plat, Legal Description,)
Exhibit B (Facilities Site Plan)
Exhibit C (Access Easement)
Exhibit D (Special Provisions)

Private Stormwater Management Facility Operation and Maintenance (O&M) Manual

for:

All Privately Owned Stormwater Facilities

Located at:

Alpine City

Prepared for:

Operators & Owners of Private Stormwater Facilities

Prepared by:

Alpine City

Adopted this day of April 9**, 2013**

by: _____

Shane Sorensen, P.E. - Alpine City Engineer

Private Stormwater Management Facility
Operation and Maintenance (O&M) Manual

Table of Contents

Private Stormwater Management Facility
Operation and Maintenance (O&M) Manual

I. Compliance with Stormwater Facility Maintenance Requirements

All property owners are responsible for ensuring that stormwater facilities installed on their property are properly maintained and that they function as designed. In some cases, this maintenance responsibility may be assigned to others through special agreements. The maintenance responsibility for a stormwater facility may be designated on the subdivision plat, the site development plan, and/or within a maintenance agreement for the property. Property owners should be aware of their responsibilities regarding stormwater facility maintenance. This document shall be referenced in all Stormwater Facilities Maintenance Agreements within Alpine City.

II. Inspection & Maintenance – Annual Reporting

Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements are included in this Private Stormwater Management Facility Operation and Maintenance (O&M) Manual.

Verification that the Stormwater facilities have been properly inspected and maintained; submittal of the required Inspection and Maintenance Forms and Inspector qualifications shall be provided to Alpine City on an annual basis. The annual reporting form shall be provided to Alpine City prior to July 15th of each year.

Copies of the Inspection and Maintenance forms for each of the stormwater facilities are located in Appendix B and C. A standard annual reporting form is provided in Appendix D. Each form shall be reviewed and submitted by the property owner or property manager to Alpine City.

Property owners are not required to provide Inspection and Maintenance Reports for stormwater facilities that have been agreed to be maintained by Alpine City. These reports will be generated through Alpine City's inspection & maintenance program.

III. Preventative Measures to Reduce Maintenance Costs

The most effective way to maintain your water quality facility is to prevent the pollutants from entering the facility in the first place. Common pollutants include sediment, trash & debris, chemicals, dog wastes, runoff from stored materials, illicit discharges into the storm drainage system and many others. A thoughtful maintenance program will include measures to address these potential contaminants and will save money and time in the long run. Key points to consider in your maintenance program include:

- Educate property owners/residents to be aware of how their actions affect water quality, and how they can help reduce maintenance costs.
- Keep properties, streets and gutters, and parking lots free of trash, debris, and lawn clippings.
- Ensure the proper disposal of hazardous wastes and chemicals.
- Plan lawn care to minimize the use of chemicals and pesticides.
- Sweep paved surfaces and put the sweepings back on the lawn.
- Be aware of automobiles leaking fluids. Use absorbents such as cat litter to soak up drippings – dispose of properly.
- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.
- Clean out the upstream components of the storm drainage system, including inlets, storm sewers and outfalls.
- Do not store materials outdoors (including landscaping materials) unless properly protected from runoff.

IV. Access and Easements

All stormwater management facilities located on the site have both a designated access location as well as a maintenance easement. For site specific access and easement locations, refer to the Stormwater Facilities Maintenance Agreement for the site.

V. Safety

Keep safety considerations at the forefront of inspection procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc) without proper training or equipment. A confined space should never be entered without at least one additional person present.

If a toxic or flammable substance is discovered, leave the immediate area and contact the local Sheriff at 911.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to the local Sheriff's Office immediately for response by the Hazardous Materials Unit. The emergency contact number is 911.

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified within the pond that is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

If any hazard is found within the facility area that poses an immediate threat to public safety, contact the local Sheriff's Office immediately.

VI. Field Inspection Equipment

It is imperative that the appropriate equipment is taken to the field with the inspector(s). This is to ensure the safety of the inspector and allow the inspections to be performed as efficiently as possible. Below is a list of the equipment that may be necessary to perform the inspections of all Stormwater Management Facilities:

- Protective clothing and boots.
- Safety equipment (vest, hard hat, confined space entry equipment).
- Communication equipment.
- Operation and Maintenance Manual for the site including stormwater management facility location maps.
- Clipboard.
- Stormwater Facility Maintenance Inspection Forms (See Appendix B).
- Manhole Lid Remover
- Shovel.

Some of the items identified above need not be carried by the inspector (manhole lid remover, shovel, and confined space entry equipment). However, this equipment should be available in the vehicle driven to the site.

VII. Inspecting Stormwater Management Facilities

The quality of stormwater entering the waters of the state relies heavily on the proper operation and maintenance of permanent best management practices. Stormwater management facilities must be periodically inspected to ensure that they function as designed. The inspection will determine the appropriate maintenance that is required for the facility.

A. Inspection Procedures

All stormwater management facilities are required to be inspected by a qualified individual at a minimum of once per year. Inspections should follow the inspection guidance found in the Standard Operating Procedure (SOP) for the specific type of facility. (Appendix A of this manual).

B. Inspection Report

The person(s) conducting the inspection activities shall complete the appropriate inspection report for the specific facility. Inspection reports are located in Appendix B.

The following information explains how to fill out the Inspection Forms:

General Information

This section identifies the facility location, person conducting the inspection, the date and time the facility was inspected, and approximate days since the last rainfall. Property classification is identified as single-family residential, multi-family residential, commercial, or other.

The reason for the inspection is also identified on the form depending on the nature of the inspection. All facilities should be inspected on an annual basis at a minimum. In addition, all facilities should be inspected after a significant precipitation event to ensure the facility is draining appropriately and to identify any damage that occurred as a result of the increased runoff.

Inspection Scoring

For each inspection item, a score must be given to identify the urgency of required maintenance. The scoring is as follows:

0 = No deficiencies identified.

1 = Monitor – Although maintenance may not be required at this time, a potential problem exists that will most likely need to be addressed in the future. This can include items like minor erosion, concrete cracks/spalling, or minor sediment accumulation. This item should be revisited at the next inspection.

2 = Routine Maintenance Required – Some inspection items can be addressed through the routine maintenance program (See SOP in appendix A). This can include items like vegetation management or debris/trash removal.

3 = Immediate Repair Necessary – This item needs immediate attention because failure is imminent or has already occurred. This could include items such as structural failure of a feature (outlet works, forebay, etc), significant erosion, or significant sediment accumulation. This score should be given to an item that can significantly affect the function of the facility.

N/A This is checked by an item that may not exist in a facility. Not all facilities have all of the features identified on the form (forebay, micro-pool, etc.).

Inspection Summary/Additional Comments

Additional explanations to inspection items, and observations about the facility not covered by the form, are recorded in this section.

Overall Facility Rating

An overall rating must be given for each facility inspected. The overall facility rating should correspond with the highest score (0, 1, 2, 3) given to any feature on the inspection form.

C. Verification of Inspection and Form Submittal

The Stormwater Management Facility Inspection Form provides a record of inspection of the facility. Inspection Forms for each facility type are provided in Appendix B. Verification of the inspection of the stormwater facilities, the facility inspection form(s), and Inspector Qualifications shall be provided to Alpine City on an annual basis. The verification and the inspection form(s) shall be reviewed and submitted by the property owner or property manager.

Refer to Section II of this Manual regarding the annual reporting of inspections.

VIII. Maintaining Stormwater Management Facilities

Stormwater management facilities must be properly maintained to ensure that they operate correctly and provide the water quality treatment for which they were designed. Routine maintenance performed on a frequently scheduled basis, can help avoid more costly rehabilitative maintenance that results when facilities are not adequately maintained.

A. Maintenance Categories

Stormwater management facility maintenance programs are separated into three broad categories of work. The categories are separated based upon the magnitude and type of the maintenance activities performed. A description of each category follows:

Routine Work

The majority of this work consists of scheduled mowings and trash and debris pickups for stormwater management facilities during the growing season. This includes items such as the removal of debris/material that may be clogging the outlet structure well screens and trash racks. It also includes activities such as weed control, mosquito treatment, and algae treatment. These activities normally will be performed numerous times during the year. These items can be completed without any prior correspondence with Alpine City; however, completed inspection and maintenance forms shall be submitted to Alpine City for each inspection and maintenance activity.

Restoration Work

This work consists of a variety of isolated or small-scale maintenance and work needed to address operational problems. Most of this work can be completed by a small crew, with minor tools, and small equipment. These items require prior correspondence with Alpine City and require that completed maintenance forms be submitted to Alpine City for each maintenance activity.

Rehabilitation Work

This work consists of large-scale maintenance and major improvements needed to address failures within the stormwater management facilities. This work requires consultation with Alpine City and may require an engineering design with construction plans to be prepared for review and approval. This work may also require more specialized maintenance equipment, surveying, construction permits or assistance through private contractors and consultants. These items require prior correspondence with Alpine City and require that completed maintenance forms be submitted to Alpine City for each maintenance activity.

B. Maintenance Personnel

Maintenance personnel must be qualified to properly maintain stormwater management facilities. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

C. Maintenance Forms

The Stormwater Management Facility Maintenance Form provides a record of maintenance activities. Maintenance Forms for each facility type are provided in Appendix C. Maintenance Forms shall be completed by the contractor completing the required maintenance items. The form shall then be reviewed by the property owner or an authorized agent of the property owner and submitted on an annual basis to Alpine City.

Refer to Section II of this Manual regarding the annual reporting of inspections and maintenance activities performed.

APPENDIX A
Standard Operating Procedures (SOP) for each facility type

STREETS/STORM DRAIN – Catch Basins

Description: This section contains information on the cleaning of catch basins in the storm drain system. This includes the processes of disposal of excess waste and the record keeping of the amounts of waste collected.

Applicability: Cleaning catch basins or storm drains.

1. Preparation:
    a. Clean off sediment and trash off grate.
    b. Do visual inspection on outside of grate.
    c. Make sure nothing needs to be replaced.
    d. Do inside visual inspection to see what needs to be cleaned.

2. Process
    a. Clean catch basin using manual or mechanical means.
    b. For manual means, place removed material in a location protected from potential runoff.
    c. Place spoils in vehicle for transport to disposal area.
    d. Dispose of spoils in an approved location for dewatering if necessary.
    e. For mechanical cleaning use a high powered vac truck to removed sediment. When sediment is removed use a high pressure washer to clean any other sediment out of catch basin.
    f. After catch basin is clean, send the rodder of the vac truck downstream to clean pipe and pull back sediment that might have moved down stream of the catch basin.

3. Clean-up
    a. When vehicle is full of spoils take them to a contained area for drying.
    b. After drying, put it into a dump truck and take it to the landfill.

4. Documentation

a. Keep logs of the date and number of catch basins cleaned. Record employees involved with the activity.

b. Record the estimated amount of waste collected from each catch basin.

c. Keep any notes or comments of any problems.

STREETS/STORM DRAIN – Curb Painting

Description: This section contains information on the painting of curbs and how to protect the drainage system from hazardous wastes. The use of BMP's in case of accidents and spills is recommended. This also includes the processes of disposal, clean up, and record keeping of any paint entering into the storm drain system.

Applicability: Curb Surface painting.

1. Preparation
    a. Calculate the amount of paint required for the job
    b. Use water based paints if possible.
    c. Determine whether the wastes will be hazardous or not and the required proper disposal of said wastes
    d. Determine locations of storm drain inlets and sewer inlets that may need to be protected. If possible, prepare surfaces to be painted without generating wastewater; eg. Use sandblasting and or scraping.
    e. If using a pressure washer to remove loose paint, place filter fabric or containment devices at entrances to storm drains or natural waterways to collect materials. (i.e. place geotextile beneath catch basin grates, use curb dyke)
    f. Use a citrus based paint remover whenever possible, less toxic than chemical strippers
2. Process
    a. Paint curb.
    b. Prevent over-spraying of paints and/or excessive sandblasting
    c. Use drip pans and drop clothes in areas of mixing paints and painting
    d. Store latex paint rollers and brushes in air tight bags to be reused later with the same color.
    e. Have available absorbent material and other BMP's ready for an accidental paint spill.
3. Clean-up
    a. Paint out brushes and rollers as much as possible. Squeeze excess paint from brushes and rollers back into the containers prior to cleaning them.

b. Pour excess paint from trays and buckets back into the paint can containers and wipe with cloth or paper towels. Dispose of the towels according to the recommendations on the paint being used.

c. Rinse water-based paint brushes in the sink after pre-cleaning. Never pour excess paint or wastewater from cleanup of paint in the storm drain.

d. Cleanup oil based paints with paint thinner. Never clean oil based brushes in a sink or over a storm drain. Filter solvents for reuse if possible and/or store in approved drum for recycling.

4. Documentation

a. Report any discharges into storm drain system

STREETS/STORM DRAIN – Culvert and Storm Water Pipe Cleaning

Description: This section contains information on the cleaning of storm drain culverts and pipes. This also includes what methods to use to remove sediment and debris from the structure. A record keeping procedure is also outlined for tracking the cleaning process.

Applicability: Cleaning of Culverts and Pipes.

1. Preparation:
   a. Clean sediment and trash off inlet to culvert/storm water pipe.
   b. If possible do visual inspection of inside of culvert/storm water pipe.
   c. Look for cracks, missing or broken pieces in the walls/sides of structure.
   d. Do inside visual inspection to see what needs to be cleaned.

2. Process
   a. Clean using a high powered vac truck, cleaning the sides of the structure and sucking out sediment on the bottom.
   b. Send high powered hose down culvert and pull back any sediment.
   c. Clean inlets and outlets.
   d. Move truck down to next storm drain.

3. Clean-up
   a. When vac truck is full of sediment take it to current designated containment area.
   b. When evaporates are dry, clean it up with a backhoe, put it into a dump truck and take it to the landfill.

4. Documentation
   a. Keep logs of culverts/storm water pipes wells cleaned.
   b. Record the amount of waste collected.
   c. Keep any notes or comments of any problems.

STREETS/STORM DRAIN – Sumps and Injection Wells (Includes Underground Storm Water Detention Structures)

Description: This section contains information on the cleaning of storm drain sumps and injection wells. This also includes what methods to use to remove sediment and debris from the structures. A record keeping procedure is also outlined for tracking the cleaning process.

Applicability: Cleaning of Sumps and Injection Wells.

1. Preparation:

   a. Clean sediment and trash off inlet to sump/injection well.

   b. Determine how water is supposed to drain from the structure and assess the ability of the structure to allow water to drain as designed.

   c. If possible do visual inspection of inside of sump/injection well.

   d. Look for cracks, missing or broken pieces in the walls/sides of structure.

   e. Do inside visual inspection to see what needs to be cleaned.

2. Process

   a. Clean using a high powered vac truck, cleaning the sides of the structure and sucking out sediment on the bottom.

   b. Remove fine sediments that might inhibit the drainage of water if the structure is designed such that the water drains out the bottom.

   c. Clean those places where to water drains if the structure is designed to drain out the sides of the sump/injection well.

   d. Clean inlets and overflow outlets.

3. Clean-up

   a. When vac truck is full of sediment take it to current designated containment area.

   b. When evaporates are dry, clean it up with a backhoe, put it into a dump truck and take it to the landfill.

4. Documentation

   a. Keep logs sumps and injection wells cleaned.

   b. Record the amount of waste collected.

   c. Keep any notes or comments of any problems.

STREETS/STORM DRAIN – Detention Ponds

Description: This section contains information on the maintenance and cleaning of storm drain detention ponds and structures. This also includes what methods to use to remove sediment and debris from the structure. A record keeping process is also outlined for maintenance.

Applicability: Maintenance of detention structures.

1. Preparation:
    a. Remove any sediment and trash from grates.
    b. Do a visual inspection to make sure grates are in good shape and everything is in good working order.
    c. Pull grates, inspect inside of structures/boxes/pipes.

2. Process
    a. Provide outlet protection where feasible to minimize the amount of debris that might leave basin during cleaning process.
    b. If necessary, clean basin by using backhoe to remove silt and sediment off the bottom
    c. Place all sediment into a dump truck.
    d. Clean structures as described for in cleaning catch basins SOP.

3. Clean-up
    a. Haul and dump sediment at the landfill.

4. Documentation
    a. Keep logs of number of detention basins cleaned including date, estimated quantity of material, individuals involved in cleaning, and a description of the type of debris removed.
    b. Record the estimated amount of waste collected.
    c. Keep any notes or comments of any problems.

STREETS/STORM DRAIN – Creek Maintenance

Description: This section contains information on the maintenance and preservation of natural water courses including creeks and streams. This also includes identifying what maintenance needs to be done and the method of how it will be accomplished. Record keeping is necessary in stream maintenance.

Applicability: Maintaining any creek or stream.

1. Preparation
    a. Monitor streams on a regular basis (Annually).
    b. Maintain access to stream channels wherever possible.
    c. Identify areas requiring maintenance.
    d. Determine method of maintenance that will be least damaging to the channel.
    e. Determine what manpower or equipment will be required.
    f. Obtain necessary permits as required by the Army Corp. of Engineers or State Engineers Office.
    g. Identify access and easements to area requiring maintenance.

2. Process
    a. Follow requirements of permits as applicable.
    b. Use techniques to minimize disruption to the stream bank or channel
    c. Install clean materials free of pollutants and contaminants.
    d. Place removed materials in an area upland of the water course to prevent them from re-entering the channel.

3. Clean-up
    a. Stabilize all disturbed soils.
    b. Haul all debris or sediment removed from area to current designated containment area.
    c. Remove all tracking from paved surfaces near maintenance site, if applicable.

4. Documentation

   a. Keep log of actions performed including date and individuals involved.

   b. Record the amount of materials removed or imported.

   c. Keep any notes or comments of any problems.

   d. Use "before" and "after" photographs to document activities as applicable.

STREETS/STORM DRAIN – Canal / Ditch Maintenance

Description: This section contains information on the maintenance and preservation of canals. This also includes identifying what maintenance needs to be done and the method of how it will be accomplished. Record keeping is necessary in canal maintenance.

Applicability: Maintaining canal or irrigation ditch.

1. Preparation
    a. Monitor canals annually and maintain as needed.
    b. Establish maintenance responsibilities with irrigation company boards and operators.
    c. Identify areas requiring maintenance with irrigation company annually at a minimum.
    d. Identify access and easements to canal area.
    e. Establish procedures for removal of material from canal maintenance. Including stockpiling of material removed or hauling methods.
    f. Determine what man power or equipment will be required.

2. Process
    a. Perform maintenance as outlined in agreement with irrigation company
    b. Install clean materials free of pollutants and contaminants.
    c. Place removed materials in an area upland of the watercourse to prevent them from re-entering the channel.
    d. Haul material away to current designated stockpile area.

3. Clean-up
    a. Stabilize all disturbed soils.
    b. Haul all debris or sediment removed from area to approved dumping site.
    c. Remove all tracking from paved surfaces near maintenance site, if applicable.

4. Documentation

   a. Keep log of actions performed including date and individuals involved.

   b. Record the amount of materials removed or imported.

   c. Keep any notes or comments of any problems.

   d. Use "before" and "after" photographs to document activities as applicable.

APPENDIX B
Inspection Form(s)

CATCH BASIN / MANHOLE / SUMP INSPECTION FORM

Date:_____

Subdivision/Business Name:_____ Inspector:_____

Subdivision/Business Address:_____

Weather: _____

Date of Last Rainfall:_____ Amount:_____Inches

Property Classification: Residential Multi Family Commercial Other:_____
(Circle One)

Reason for Inspection: Routine Complaint After Significant Rainfall Event
(Circle One)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified
1 = Monitor (potential for future problem)
2 = Routine maintenance required
3 =Immediate repair necessary
N/A = Not applicable

FEATURES

Catch Basin Location _____

1.) Grate

____Blocked
____Damaged
____Missing
____Other
_____

2.) Basin

____Sediment/Debris Accumulation
____Concrete Damage
____Woody Growth/Weeds Present
____Approximate % Full

Inspection Summary / Additional Comments:_____

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified
1 = Monitor (potential for future problem exists)
2 = Routine Maintenance Required
3 = Immediate Repair Necessary

This inspection form shall be kept indefinitely and made available to Alpine City upon request.

EXTENDED DETENTION BASIN (EDB) INSPECTION FORM

Date:_____

Subdivision/Business Name:_____ Inspector:_____

Subdivision/Business Address:_____

Weather: _____

Date of Last Rainfall:_____ Amount:_____Inches

Property Classification: Residential Multi Family Commercial Other:_____
(Circle One)

Reason for Inspection: Routine Complaint After Significant Rainfall Event
(Circle One)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified
1 = Monitor (potential for future problem)
2 = Routine maintenance required
3 =Immediate repair necessary
N/A = Not applicable

FEATURES

1.) Inflow Points
- ____Riprap Displaced
- ____Erosion Present/Outfall Undercut
- ____Sediment Accumulation
- ____Structural Damage (pipe, end-section, etc.)
- ____Woody Growth/Weeds Present

2.) Forebay
- ____Sediment/Debris Accumulation
- ____Concrete Cracking/Failing
- ____Drain Pipe/Wier Clogged (not draining)
- ____Wier/Drain Pipe Damage

3.) Trickle Channel (Low-flow)
- ____Sediment/Debris Accumulation
- ____Concrete/Riprap Damage
- ____Woody Growth/Weeds Present
- ____Erosion Outside Channel

4.) Bottom Stage (Micro-Pool)
- ____Sediment/Debris Accumulation
- ____Woody Growth/Weeds Present
- ____Bank Erosion
- ____Mosquitoes/Algae Treatment
- ____Petroleum/Chemical Sheen

5.) Outlet Works
- ____Trash Rack/Well Screen Clogged
- ____Structural Damage (concrete,steel,subgrade)
- ____Orifice Plate(s) Missing/Not Secure
- ____Manhole Access (cover, steps, etc.)
- ____Woody Growth/Weeds Present

6.) Emergency Spillway
- ____Riprap Displaced
- ____Erosion Present
- ____Woody Growth/Weeds Present
- ____Obstruction/Debris

7.) Upper Stage (Dry Storage)
- ____Vegetation Sparse
- ____Woody Growth/Undesirable Vegetation
- ____Standing Water/Boggy Areas
- ____Sediment Accumulation
- ____Erosion (banks and bottom)
- ____Trash/Debris
- ____Maintenance Access

8.) Miscellaneous
- ____Encroachment in Easement Area
- ____Graffiti/Vandalism
- ____Public Hazards
- ____Burrowing Animals/Pests
- ____Other

Inspection Summary / Additional Comments:_____

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified
1 = Monitor (potential for future problem exists)
2 = Routine Maintenance Required
3 = Immediate Repair Necessary

This inspection form shall be kept indefinitely and made available to Alpine City upon request.

STORM DRAIN PIPE(S) INSPECTION FORM

Date:_____

Subdivision/Business Name:_____ Inspector:_____

Subdivision/Business Address:_____

Weather: _____

Date of Last Rainfall:_____ Amount:_____Inches

Property Classification: Residential Multi Family Commercial Other:_____
(Circle One)

Reason for Inspection: Routine Complaint After Significant Rainfall Event
(Circle One)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:

0 = No deficiencies identified
1 = Monitor (potential for future problem)
2 = Routine maintenance required
3 =Immediate repair necessary
N/A = Not applicable

FEATURES

PIPE LABEL/LOCATION_____

1.) Pipe

____Blocked
____Damaged
____Deteriorating in any way
____Other
_____

Inspection Summary / Additional Comments:_____

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified
1 = Monitor (potential for future problem exists)
2 = Routine Maintenance Required
3 = Immediate Repair Necessary

This inspection form shall be kept indefinitely and made available to Alpine City upon request.

APPENDIX C
Maintenance Form(s)

CATCH BASIN / MAHHOLE / SUMP MAINTENANCE FORM

Subdivision/Business Name:_____ Completion Date:_____

Subdivision/Business Address:_____ Contact Name:_____

Maintenance Category: (Circle All That Apply) Routine Restoration Rehabilitation

MAINTENANCE ACTIVITIES PERFORMED

STRUCTURE LOCATION & DESCRIPTION_____

ROUTINE WORK

____ MOWING AROUND INLET OR OUTLET
____ TRASH/DEBRIS REMOVAL
____ OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
____ WEED CONTROL (HERBICIDE APPLICATION)
____ MOSQUITO TREATMENT
____ ALGAE TREATMENT

RESTORATION WORK

____ SEDIMENT REMOVAL

____ EROSION REPAIR
____ INFLOW POINT
____ OUTFLOW POINT

____ VEGETATION REMOVAL/TREE THINNING

____ REVEGETATION

____ JET-VAC/CLEARING DRAINS
____ OUTLET WORKS
____ INFLOWS

REHABILITATION WORK

____ EROSION REPAIR
____ INFLOW POINT

____ STRUCTURAL REPAIR
____ INFLOW

OTHER_____
_____
_____

ESTIMATED TOTAL MANHOURS: _____

EQUIPMENT/MATERIAL USED: _____
_____
_____

COMMENTS/ADDITIONAL INFO: _____
_____

This Maintenance Activity Form shall be kept indefinitely and made available to Alpine City upon request.

EXTENDED DETENTION BASIN (EDB) MAINTENANCE FORM

Subdivision/Business Name:_____ Completion Date:_____

Subdivision/Business Address:_____ Contact Name:_____

Maintenance Category: (Circle All That Apply) Routine Restoration Rehabilitation

MAINTENANCE ACTIVITIES PERFORMED

ROUTINE WORK

____ MOWING
____ TRASH/DEBRIS REMOVAL
____ OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
____ WEED CONTROL (HERBICIDE APPLICATION)
____ MOSQUITO TREATMENT
____ ALGAE TREATMENT

RESTORATION WORK

____ SEDIMENT REMOVAL
- ____ FOREBAY
- ____ TRICKLE CHANNEL
- ____ INFLOW

____ EROSION REPAIR
- ____ INFLOW POINT
- ____ TRICKLE CHANNEL

____ VEGETATION REMOVAL/TREE THINNING
- ____ INFLOW(S)
- ____ TRICKLE CHANNEL
- ____ UPPER STAGE
- ____ BOTTOM STAGE

____ REVEGETATION
____ JET-VAC/CLEARING DRAINS
- ____ FOREBAY
- ____ OUTLET WORKS
- ____ INFLOWS

REHABILITATION WORK

____ SEDIMENT REMOVAL (DREDGING)
- ____ BOTTOM STAGE
- ____ UPPER STAGE

____ EROSION REPAIR
- ____ OUTLET WORKS
- ____ UPPER STAGE
- ____ BOTTOM STAGE
- ____ SPILLWAY

____ STRUCTURAL REPAIR
- ____ INFLOW
- ____ OUTLET WORKS
- ____ FOREBAY
- ____ TRICKLE CHANNEL

OTHER_____

_____

_____

ESTIMATED TOTAL MANHOURS: _____

EQUIPMENT/MATERIAL USED: _____

_____

_____

COMMENTS/ADDITIONAL INFO: _____

_____

This Maintenance Activity Form shall be kept indefinitely and made available to Alpine City upon request.

STORM DRAIN PIPE MAINTENANCE FORM

Subdivision/Business Name:_____ Completion Date:_____

Subdivision/Business Address:_____ Contact Name:_____

Maintenance Category: (Circle All That Apply) Routine Restoration Rehabilitation

MAINTENANCE ACTIVITIES PERFORMED

PIPE LABEL/LOCATION_____

ROUTINE WORK

____ MOWING AROUND INLET OR OUTLET
____ TRASH/DEBRIS REMOVAL
____ OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
____ WEED CONTROL (HERBICIDE APPLICATION)
____ MOSQUITO TREATMENT
____ ALGAE TREATMENT

RESTORATION WORK

____ SEDIMENT REMOVAL
____ EROSION REPAIR
- ____ INFLOW POINT
- ____ OUTFLOW POINT

____ VEGETATION REMOVAL/TREE THINNING
- ____ INFLOW(S)
- ____ TRICKLE CHANNEL
- ____ UPPER STAGE
- ____ BOTTOM STAGE

____ REVEGETATION
____ JET-VAC/CLEARING DRAINS
- ____ FOREBAY
- ____ OUTLET WORKS
- ____ INFLOWS

REHABILITATION WORK

____ EROSION REPAIR
- ____ INFLOW POINT
- ____ OUTFLOW POINT

____ STRUCTURAL REPAIR
- ____ INFLOW
- ____ OUTLET WORKS
- ____ PIPE

OTHER_____
_____
_____

ESTIMATED TOTAL MANHOURS: _____

EQUIPMENT/MATERIAL USED: _____

_____

_____

COMMENTS/ADDITIONAL INFO: _____

_____

This Maintenance Activity Form shall be kept indefinitely and made available to Alpine City upon request.

APPENDIX D
Annual Inspection and Maintenance Submittal Form

Annual Inspection and Maintenance Reporting Form
for
Stormwater Facilities

(This form to be submitted to Alpine City prior to July 15 of each year)

Date: _____

To: **Alpine City**
Attn: Jed Muhlestein, P.E.
20 N. Main
Alpine, UT 84004

Re: **Certification of Inspection and Maintenance; Submittal of forms**

Property/Subdivision Name: _____

Property Address: _____

Contact Name: _____

I verify that the required stormwater facility inspections and required maintenance have been completed in accordance with the Stormwater Facilities Maintenance Agreement and the Private Stormwater Facility Operation and Maintenance (O&M) Manual associated with the above referenced property.

The required Stormwater Facility Inspection and Maintenance forms are hereby provided.

_____	_____
Name of Party Responsible for Inspection & Maintenance	Property Owner
_____	_____
Authorized Signature	Signature