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Land Disturbance Design & Construction Standards

July 2004

City of West Jordan
8000 South Redwood Road
West Jordan, Utah 84088

**LAND DISTURBANCE
DESIGN AND CONSTRUCTION
STANDARDS**

July 2004

Adopted by City Council on July 6, 2004

CITY OF WEST JORDAN
Engineering Department
8000 South Redwood Road
West Jordan, Utah 84088

**LAND DISTURBANCE
DESIGN AND CONSTRUCTION STANDARDS**

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SECTION 1.0

INTRODUCTION AND GENERAL POLICIES

1.1 SCOPE

The City of West Jordan, Land Disturbance Design and Construction Standards, establishes uniform policies and procedures for the design and construction of City land disturbance, grading, erosion control, revegetation of disturbed areas and control of sediments resulting from construction of private development and City projects. It is not the intent of this standard that any standard of conduct or duty toward the public shall be created or imposed by publication of this standard. This standard is not a substitute for engineering knowledge, experience or judgment of professionals in their area of expertise in the agronomy, revegetation, conservation, and engineering discipline. This standard is neither designed as, nor does it establish, a legal standard for these functions. The methods and procedures contained herein are to be reviewed by the developer's engineer or designer using them as applicable to site-specific conditions of the project they are working on. Where actual site conditions deem these standards and procedures not applicable, the engineer or designer shall request a variance from these standards or procedures as provided herein.

The design and construction of grading, erosion control, revegetation and sedimentation facilities and other appurtenances in City of West Jordan are to comply with these standards herein called "Land Disturbance Design and Construction Standards (LDDCS)", or the permit requirements of various governing bodies, except where specific modifications have been approved, in writing, by the City Engineer. All submitted plans containing engineering principals shall be signed and stamped by a Civil Engineer and other appropriate professionals. Erosion control plans, revegetation plans and/or dust control plans are to be signed and stamped by a qualified Civil Engineer or other appropriate professional. All work is to be in accordance with good agronomy, conservation, and engineering practices.

This document sets forth the procedure for designing and preparing plans and specifications and specifications for area of land disturbances throughout the City. Wherever there are differences between these standards and other county, state or federal regulations, the most stringent or highest requirement shall govern. The specifications and standard drawings contained in this document are for all land disturbances throughout the City. The City has also prepared culinary water, road and bridge, and storm drain/flood control design and construction standards for those specific areas. The developer/developer's engineer is to obtain the other design and construction standards to determine how to design these other facilities.

1.2 AUTHORITY

Title 81 of the City of West Jordan Municipal Code, establishes the legal authority for the erosion, sediment control and revegetation requirements set forth in this document. Title 81 – Land Disturbance was established as a requirement of the State of Utah's Utah Pollution Discharge Elimination System permit (UPDES) which is a federally mandated requirement of the State.

Since the passage of the Clean Water Act (CWA), the quality of our Nation's waters has improved dramatically. Despite the progress, however, degraded water bodies still existed and the federal

government moved to improve the water quality in these water bodies. According to the 1996 Nation Water Quality Inventory, a biennial summary of State surveys of water quality, approximately 40-percent of surveyed U.S. water bodies are still impaired by pollution and did not meet water quality standards. A leading source of this impairment was indicated to be polluted runoff. According to the Inventory, 13-percent of impaired rivers, 21-percent of impaired lake acres and 45-percent of impaired estuaries are affected by urban/suburban storm water runoff and 6-percent of impaired rivers, 11-percent of impaired lake acres and 11-percent of impaired estuaries are affected by construction site discharges.

Phase I of the EPA's storm water program was promulgated in 1990 under the CWA. Phase I relies on National Discharge Elimination System (NPDES) permit coverage to address storm water runoff from: (1) "medium" and "large" municipal separate storm sewer systems (MS4s) generally serving populations of 100,000 or greater, (2) construction activity disturbing 5 acres of land or greater, and (3) ten categories of industrial activity.

The Storm Water Phase II Final Rule is the next step in EPA's effort to preserve, protect, and improve the Nation's water resources from polluted storm water runoff. The Phase II program expands the Phase I program by requiring additional operators of MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to control polluted storm water runoff.

Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of storm water discharges that have the greatest likelihood of causing continued environmental degradation.

Although the NPDES permit program is a national program, its implementation and permitting is delegated to the states. In the case of Utah, the program then becomes known as the Utah Pollution Discharge Elimination System (UPDES) program. Cities and other governmental entities are then required to receive a permit through the State of Utah under the UPDES permit program.

On March 10, 2003 Phase II of the NPDES became active and all cities smaller than 100,000 are required to submit a NPDES permit and application. In the case of cities in Utah, this became a UPDES permit application that is submitted to the State of Utah, Department of Environmental Quality (DEQ).

The City of West Jordan (City) is subject to Phase II regulations. The City's UPDES permit requires, at a minimum, that the City develop, implement, and enforce a storm water management program designed to reduce to the "maximum extent practicable" the discharge of pollutants from the storm drain system to protect water quality, and to satisfy the requirements of the CWA.

The City's storm water management program must include the minimum control measures included in the General Permit. Implementation of BMPs that comply with permit requirements constitutes compliance with the standard of reducing pollutants to the maximum extent practicable.

In the City's permit application, the City identified and submitted the following information to the State DEQ:

1. The City will implement BMPs for each of the following six minimum control measures:
 - a. Public Education and Outreach

- b. Public Involvement/Participation
 - c. Illicit Discharges and Improper Disposal
 - d. Construction Site Storm Water Runoff Control
 - e. Post-Construction Storm Water Management in New Development and Redevelopment
 - f. Pollution Prevention/Good Housekeeping for Municipal Operations
2. The measurable goals for each of the BMPs including, as appropriate, the months and years in which the City was to undertake required actions, including interim milestones and the frequency of the action; and
3. The person(s) responsible for implementing or coordinating the City's storm water management program.

1.3 INTERPRETATION

The City Engineer will decide all questions of interpretation of "Best Management Practices" as it applies to good agronomy, revegetation, conservation, and engineering practices. The City Engineer may use the future ASTM standards and various standards obtained in published engineering studies and industry publications to guide him or her.

1.4 DEFINITIONS AND TERMS

Whenever in these specifications or in any document or instruments where these specifications govern, the following terms, abbreviations or definitions are used, the intent and meaning shall be interpreted as follows:

ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
A.B.	Aggregate Base
A.S.B.	Aggregate Subbase
A.C.	Asphaltic Concrete Type A
ACI	American Concrete Institute
ADT	Average Daily Traffic in vehicles per 24 hours
ANSI	American National Standards Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BMP	Best Management Practice
cfs	Cubic feet per second
EP	Edge of pavement
ES	Edge of shoulder
F	Degrees, Fahrenheit
ft.	Foot
gpm	Gallons per minute
L.O.D.	Limits of Disturbance
Max.	Maximum
Min.	Minimum

O&M	Operations and Maintenance
P.C.C.	Portland Cement Concrete
	Structures Class A (6 sack)
	Pavement Minimum Class B (5 sack)
	Curb, gutters, driveways and walks Class B (5 sack)
	Higher classes shown on plans will govern
PLS	Pure live seed
psi	Pounds per square inch
PUE	Public Utility Easement
TYP	Typical
UBC	Uniform Building Code
UOSHA	Utah Occupational Safety and Health Administration
UPC	Uniform Plumbing Code

Symbols

C	Centerline
ROW	Right of way line
FL	Flow line
PL	Property line
“R”	Value
≥	Equal to or greater than
≤	Equal to or less than

DEFINITIONS

“Actual Restoration and Revegetation Costs”	Costs set by City resolution or ordinance. In the absence of City resolution and/or ordinance or the actual restoration and revegetation costs will be determined by three competitive revegetation bids conforming to this chapter and 10 percent of the excavation portion of the original bid. In the event the actual revegetation costs are challenged by the applicant the cost will be determined as stated herein.
“Agricultural activity”	Plowing, disking, and harrowing the ground surface for the purpose of planting and cultivating crops on parcels historically used for this purpose.
“Anchored Mulch”	Mulch which employs netting, staple, or fastener to anchor material to the soil and/or a mulch material that is crimped or tacked to the soil surface by mechanical means.
“Applicant”	Means any person who submits an application for a permit pursuant to Title 81, “Land Disturbance”.

“Approved”	Unless specifically otherwise indicated, this shall mean approval by the City Engineer.
“Bale Dike”	A bale dike is a temporary barrier consisting of bales installed across a slope, at the toe of a slope, and/or around the perimeter of the construction site.
“Bale Sediment Barrier”	A semi-pervious sediment barrier is a temporary barrier consisting of bales and a rock spillway placed across small drainages or gently sloping swales.
“Best Management Practices”	Practices, procedures or designs used as a standard for a given industry. In this specific case, these ‘practices’ are for the erosion control industry. Best Management Practices (BMPs) for controlling nonpoint sources of pollution are the methods, measures, practices, or a combination of practices determined to be the most effective and practicable means (including technological, economic, and institutional considerations) to control nonpoint pollutants at levels compatible with environmental quality goals. As used in this document, BMPs are synonymous with erosion and sediment control measures.
“Biochemical Oxygen Demand (BOD)”	Consumed during a biochemical oxidation of matter over a specified period of time.
“Bioengineering”	Bioengineering is a method of construction using living plants, or plants in combination with non-living or structural materials. The practice brings together biological, ecological, and engineering concepts to produce living, functioning systems to prevent erosion, to stabilize slopes and to enhance wild life habitat. The application of vegetative practices combined with structural practices to provide a system of practices that create a stable site condition.
“Brushlayering”	Cuttings or branches of easily rooted woody species are layered between successive lifts of soil fill to construct a reinforced slope or embankment. Live branch cuttings laid in crisscross fashion on terraces between successive lifts of soil.
“Buffer Setback”	A strip of land that separates land uses for aesthetic reasons or separate incompatible uses, i.e. residential from Industrial.
“Buffer Strip”	An undisturbed strip of land containing grasses, shrubs and trees adjacent to water bodies engineered for the treatment of storm water.
“Buttress Fill”	A buttress fill is a designed compacted earth fill used for providing lateral support to an unstabilized earth or rock mass.

“Cellular Confinement System”	A three-dimensional, honeycomb earth-retaining structure used to mechanically stabilize the surface of earth and fill slopes.
“Check Dam”	A check dam is a small temporary dam constructed across a swale, gully, or drainage way to collect sediment and slow water velocities.
“City”	City of West Jordan, Utah
“City Engineer”	City Engineer shall mean the City Engineer of City of West Jordan, or the person(s) engaged by the City and authorized to perform the duties assigned to the City Engineer, and shall include any deputies and representatives.
“Civil Engineer”	A professional engineer in the branch of civil engineering holding a valid certificate of registration issued by the State of Utah.
“Class IV Landfill”	A landfill that is to receive only construction/demolition waste, yard waste, inert waste, dead animals, or upon meeting the requirements of Section 26-32a103.5 and section R315-320-3, waste tires and materials derived from waste tires.”
“Clearing & Grubbing:	Moving, removing, displacing, and/or stockpiling, by manual or mechanical means, trees, and other vegetation and/or the top organic layer as described in the geotechnical report. In the absence of a geotechnical report the organic layer will not be greater than eight (8”) inches.
“Coir Rolls and Coir Mats”	Coir rolls and coir mats are manufactured from coconut fibers and are frequently used as the structural and rooting medium for bioengineering systems.
“Community Development Director”	That person charged with the responsibility of directing all phases of the Community Development Department and the enforcement of all State statutes and City laws pertaining to his/her office, or his/her duly authorized representative.
“Compaction”	The act of compacting or consolidating soil and rock material to a specified density, and the resulting compacted state of the material.
“Construction site”	Any land area on which the activity of clearing and grubbing, grading, excavating, or filling is occurring.
“Continuous Berm”	A continuous berm is a temporary diversion dike or sediment barrier constructed with infill material, either soil, sand or aggregate, encased within geosynthetic fabric.

“Contract Documents”	The documents used in the construction of a given project including: written and drawings. Written documents may include, but not limited to, the ‘Bidding and Agreement Forms and Bonds’, “Conditions of the Contract” and “Technical Specifications”. The drawings for the project are also legally considered part of the Contract Documents and are referenced as such in the written portion of the Contract Documents.
“County”	Salt Lake County, Utah
“Crib Structure”	A hollow structure constructed of mutually perpendicular, interlocking beams or logs.
“Curb Inlet Sediment Barrier”	Curb inlet sediment barriers are temporary barriers constructed from concrete block and gravel or gravel filled sandbags.
“Cutting”	A branch or stem pruned from a living plant.
“Day”	Shall be interpreted as a calendar day, unless otherwise specified.
“Dentrification”	A biological process in which nitrate (NO ₃), a compound of nitrogen often found in sewage or water, is turned into nitrogen gas, which can dissipate into the atmosphere.
“Detention”	The holding back or delaying of the flow of water, through manmade or natural means.
“Detritus”	A loose mass of decaying material
“Developer”	An individual or organized group; partnership, corporation, etc.; proposing to subdivide or improve land which will require culinary water from the City’s system. Also defined in Title 89
“Developer’s Engineer”	The engineer licensed by the State of Utah as a civil engineer, employed by the developer, under whose direction construction plans, profiles and details of the work are prepared and submitted to the City for review and approval.
“Dredging”	The practice of deepening a waterway by mechanical means by the removal of sediments.
“Drop Inlet Sediment Barrier”	A drop inlet sediment barrier is a temporary barrier placed around a drop inlet. The sediment barrier may be constructed of bales, wattles, and gravel, gravel and stone, block and gravel, or silt fence material.
“Dry Ravel”	Pertains to slopes whose soil materials are of such a consistency that they separate without the action of water, causing rills, gullies and

	other types of erosion. This would occur in soil materials where there is very little binder material such as clays and finer silts.
“Earthen Berm”	An earth mound used to direct flow of runoff around or through an area.
“Easement”	A recorded document in which the landowner gives the City permanent rights to construct and maintain City facilities across private or other property.
“Emergent Plants”	Aquatic plants that are rooted in the soil but whose leaves are at or above the water surface.
“Energy Dissipator”	An energy dissipator is a structure designed to slow water velocity and control erosion and encourage sediment entrapment at the outlet of a channel or conduit.
“Enforcement Authority”	The City Engineer, the Engineering Inspector and other designated representatives of the City Engineer, or any duly appointed Code Enforcement Officer or police official charged with the responsibility for enforcement of the provisions of the laws and ordinances of the City of West Jordan.
“Engineer”	A professional engineer or firm of professional civil engineers appointed by and acting for the Engineering Department in the case of a City sponsored capital project. In the case of a developer-sponsored project, the term refers to the engineer hired by the developer and may also be referred to as “developer’s engineer”.
“Engineering Department”	The City department responsible for planning, designing and construction of the City’s roadways and bridges, culinary water, sewer, secondary water and storm drainage systems.
“Engineering Geologist”	An engineering geologist registered by the State and capable of applying the geological sciences to engineering practices for the purpose of assuring that the geological features affecting the location, design, construction, operation, and maintenance of engineering works are recognized and adequately provided for.
“Engineering geology”	The application of geologic knowledge and principles in the investigation and evaluation of naturally occurring rock and soil for use in the design of civil works.
“Erosion”	The process of detachment of soil particles or other surface material by the action of wind, water, snow or ice.
“Erosion Control”	Erosion control is any practice that protects the soil surfaces and prevents the soil particles from being detached by rainfall or wind.

	Erosion control, therefore, is a source control that treats the soil as a resource that has value and should be kept in place.
“Erosion Control Blankets and Mats”	The installation of protective mulch blankets or soil stabilization mats (turf reinforcement mats) to the prepared soil surface of a steep slope, channel or shoreline.
“Erosion Control Hazard”	An area or areas located within the boundaries of the City, which has been identified by the City Engineer and/or the Erosion Control Specialist as an erosion control hazard area due to the existence of steep slope terrain and/or erosive soils.
“Erosion Control Measures”	The structural and nonstructural Best Management Practices (B.M.P) that prevents displacement of soil particles by wind or water. This includes seeding, mulching, vegetative buffer strips, sod, plastic coverings, riprap, gabions, channel armoring methods, and other measures that prevents the displacement of soil particles.
“Erosion Control Plan Preparer”	A person having the qualifications list herein for Erosion Control Specialist.
“Erosion Control Specialist”	A person having at least ten years of professional level experience in the erosion and sediment control field or a civil engineer having at least six years of professional level experience in the erosion and sediment control field or a Soil Scientist having certified by the American Registry of Certified Professionals in Agronomy and having two years of professional level experience.
“Established Vegetation”	Vegetation that has been planted, germinated, and has growth to accomplish the following: (a) provide a ground cover equivalent to an adjacent undisturbed site. (b) a growth of a native community that is representative of an adjacent undisturbed site. (c) the lack of rill and gully erosion.
“Expansive Soil”	Soil with an expansion of four-percent or more with a sixty-pound per square foot load applied under standard test methods as set forth by the City Engineer.
“Face Planting”	Planting live cuttings and other vegetation in the frontal openings of retaining structures.
“Field Acceptance”	Field acceptance is when the Engineering Department inspector approves the physical installation of the water system, roads, storm water, sewer, etc.
“Fill”	Deposits of soil, rock, or other materials placed by man.

“Filter Fabric”	A geotextile of relatively small mesh or pore size that is used to (a) allow water to pass through while preventing sediment from passing through, (b) preventing the mixing of soils into a B.M.P
“Filter Strips”	Vegetated strips of land designated to filter storm water and encourage the settlings of pollutants. The vegetation is usually comprised of grasses, not trees or shrubs. Filter strips may be considered as a particular kind of buffer, one specifically engineered to reduce pollutant loads.
“Final Acceptance”	The City Engineer acceptance or final acceptance follows field acceptance and is when the City Engineer approves both physical improvements as well as the administrative items associated with development, and the Infrastructure Maintenance and Operations Department accepts ownership and operations and maintenance responsibilities.
“Finished Grade”	The final grade or elevation of the building site, slope or terrace (0.1 plus or minus feet).
“Gabion”	Rectangular wire baskets filled with stones used as pervious, semi-flexible building blocks. Live rooting branches may be placed between the rock-filled baskets.
“Geotechnical Engineer”	A civil engineer as described herein with experience of at least ten years as a geotechnical engineer.
“Grade”	The elevation of the ground surface as measured from a known vertical control. Existing Grade means grade currently on the site. Natural grade means the grade unaltered evidenced by the presence of indigenous plants and grasses.
“Grade Stabilization”	The maintenance of a gentle, non-eroding gradient on a watercourse of land surface.
“Grading”	Includes the act or result of digging, excavating, transporting, spreading, depositing, filling, compacting, settling, or shaping of land surfaces and slopes, and other operations performed by or controlled by human activity involving the physical movement of rock or soil.
“Grading and Erosion Control Design and Construction Standards”	The City of West Jordan Land Disturbance Design and Construction Standards.
“Gravity Retaining Walls”	Retaining structures that resist lateral earth forces and overturning primarily by their weight.

“Gulley”	A narrow, rocky valley or channel with steep sides, made by a fast flowing stream
“Headcut Structure”	Where a gully grows and lengthens at its upstream end is called the headcut or ‘nick point’. Headcut structures consist of rocks, sandbags or other erosion resistant materials placed at the gully headcut to prevent erosion. These components may be used with live willow stakes to promote vegetative growth.
“Hydraulic Planting”	Hydraulic planting is a method of applying erosion control materials (mulch) to bare soil and establishing erosion-resistant vegetation on disturbed areas and critical slopes.
“IBC”	International Building Code
“Induced Wetlands”	Those areas that are inundated by seasonal irrigation water which is intended for agricultural purpose.
“Infrastructure Maintenance and Operations Department”	The City department responsible for operations and maintenance of the City’s roadway, culinary water, secondary water, sanitary sewer, and storm drainage system.
“Inspector”	An employee or agent of the City engaged to observe and record field compliance with design criteria, plans and construction standards.
“Land Disturbance”	Any disturbance of native soils, plants, or environment, which causes degradation of the environment and makes it more subject to erosion. Such activities include clearing and grubbing, grading excavation, filling, dredging, construction of earth-filled dams and any other types of earthwork.
“Land Disturbance Design and Construction Standards”	The City of West Jordan Land Disturbance Design and Construction Standards which have been prepared by City staff and reviewed, approved by the City Manager.
“Land Disturbance Permit”	The land disturbance permit required by the City in order to initiate any type of land disturbance including pioneering roads, deposition of fill material, excavation of soil material, general grading, or other activity conducted by man which will disturb natural vegetation or soil.
“Landfill”	A disposal facility where solid waste is placed in or on the land and which is not a land treatment facility or a surface impoundment. The definition of a landfill is as found in the state codes R315-301-2- 37.

“Land Grading for Minimizing Erosion”	Land grading for minimizing erosion is grading that is intended to minimize the impacts of surface erosion and runoff.
“Landscape Architect”	A landscape architect licensed as such under the laws of the State.
“Landtreatment Landfarming”	Landtreatment, landfarming, or landscaping facility, means a facility or a part of a facility where solid waste is applied onto or incorporated into the soil surface for the purpose of biodegradation,” The definition of a landtreatment facility is found in the state codes R315-301-2- 38
“Lateral Earth Pressure”	The horizontal pressure exerted by soil against a retaining structure.
“Limits of Disturbance (L.O.D.)	Means the area of total land disturbance including area to be graded, soil stockpile areas, staging areas and additional area required to accomplish the required grading.
“Lined Channels”	Vegetation lining a natural or constructed waterway, swale or dike to protect it from erosion.
“Live Branch Cuttings”	Living, freshly cut branches of woody shrub and tree species that propagate from cuttings embedded in the soil.
“Live Cribwall”	A hollow, structural wall formed out of mutually perpendicular and interlocking members, usually timber, in which live cuttings are inserted through the front face of the wall into the crib fill and or natural soil behind the wall.
“Live Fascines”	Bound, elongated sausage like bundles of live cut branches that are placed in shallow trenches, partly covered with soil, and staked in place to arrest erosion, shallow soil mass movements, and establish vegetation.
“Live Staking”	Live stake planting involves the insertion and tamping of live, vegetative cuttings into the ground in a manner that allows the stake to take root and grow.
“Lot Level”	Design, construction and infrastructure related specifically to a given lot. The comparison of ‘lot level’ facilities versus ‘subdivision level’ facilities is the issue of concern.
“Manufacturer’s Recommendation”	The published recommendations of the manufacturer of a specific product for a specific application. In some situations additional manufacturer recommendations would be in order to receive and use. These recommendations are to address the site-specific conditions, site-specific recommendations, and be authored by an employee of

	the manufacturer. All recommendations will not be interpreted by the City as a guarantee or warranty.
“Mass Movement”	The movement of large, relatively intact masses of earth and or rock along a well-defined shearing surface as a result of gravity and seepage.
“Minimize Disturbance and Buffer Strip”	Minimizing disturbance and maintaining buffer strips is a planning process which retains natural vegetative cover and also maintains undisturbed vegetative buffer strips near watercourses.
“Mulch Protection”	A verifiable method of protecting the seed prior to, during and after germination, until the vegetation is established enough to prevent erosion for specific site protection. The mulch protection is to last a minimum of three months to a maximum of four years.
“Mulching”	Mulching is the application of a protective layer of virgin wood fiber or other suitable material to the soil surface. Mulch and/or hydromulch are also used in conjunction with seeding and hydroseeding of critical areas for the establishment of temporary or permanent vegetation. Mulching with straw or wood fiber mulch is commonly used as a temporary measure to protect bare or disturbed soil areas that have not been seeded.
“NPDES”	The National Pollution Discharge Elimination System of the U.S. Environmental Protection Agency and its related requirements. Phase I of the NPDES became effective in 1993 and governed large and medium sized municipalities, and construction sites of 5 acres or more. Phase II was approved on October 29, 1999 and will directly affect activities in City of West Jordan, including all construction sites of 1 acre or more.
“Native Planting Window”	The time period during which native planting materials or seeds are most likely to produce live plant material. This usually occurs during the spring and fall of each year when natural moisture may be available in assisting native plant species in germinating.
“Natural Runoff Channel or Stream”	The predevelopment condition of naturally occurring channels or streambeds. Streambeds or channels caused by naturally occurring water flows. Not man-made.
“Normal Inspection Hours”	Services provided pursuant to or in connection with the provisions of this title shall mean from 8:00 a.m. to 5:00 p.m., Monday through Friday, except holidays. Holidays shall be defined as those week-days (exclusive of Saturday's) shown as nonworking days on the working day calendar of the City.

“Notice of Noncompliance/ Notice to Correct”	The notice issued by the Enforcement Authority for required action to achieve compliance with the provisions of this chapter.
“Notice of Violation”	A notification issued by the City of a violation or alleged violation of the grading, erosion control, or sedimentation control provisions of this chapter, in which is specified the nature of the violation and the degree of sanctions imposed.
“Opacity”	The factor that is used to determine the thickness or density of fugitive dust leaving a site.
“Overland Release”	An area, swale, or structure that provides for the passage of storm water runoff exceeding the design-frequency storm event of the storm water conveyance system.
“Owner”	May be either the City, individual homeowner, or Developer of the project, depending upon the stage the project. Typically the Developer is the Owner up to and including the time the project is accepted by the City. After final acceptance, the City would be typically considered to be the Owner or ownership responsibilities would be passed on to individual homeowners. The City will own public rights-of-way and private property owners will have ownership of the lots.
“Permanent Seeding”	The establishment of a permanent, perennial vegetative cover on disturbed areas from seed.
“Permit”	See land disturbance permit.
“Permit Holder”	The applicant in whose name a valid permit is issued pursuant to this chapter and the applicant’s agents, employees, and designated representatives.
“Person”	Any individual, corporation, partnership, association of any type, public agency, or any other legal entity.
“Photodegradable polypropylene”	Material used in conjunction with erosion blankets and turf reinforcement mats which deteriorates with exposure to sunlight. It initially protects the slope or other denuded area from wind and water erosion, provides seed bed protection, and then deteriorates allowing plant materials to grow up through the material.
“Plans”	Drawings of erosion control measures, roadways, bridges, water pipelines, reservoirs or other structural/nonstructural devices.

“Planting Date”	The date native seed can be applied without temporary irrigation, October 15, through May 1, or as determined by the City’s Engineering Department
“Plate No.”	Where not specified to the contrary, this refers to plates attached to these standards.
“Project”	A site that has obtained Final Plat approval from City Council.
“Pure Live Seed (P.L.S.)”	The actual amount of seed applied to a disturbed area to be revegetated. To determine P.L.S. multiply the percent of purity shown on the seed tag by the percent germination shown on the seed tag then by 100.
“Quadrant Frame Method”	The method of random sampling of an area to determine successful revegetation. The following items will be compared to an adjacent undisturbed site: (a) on herbaceous canopy cover equivalent to an adjacent undisturbed site to provide protection against drought and erosion from wind or water. (b) a growth of a native vegetative that is representative of a adjacent undisturbed site species abundance. (c) the lack of rill and gully erosion.
“Required”	Unless specifically otherwise indicated, this shall mean a requirement of the City Engineer.
“Restoration and Revegetation Costs”	Costs required for the restoration of disturbed areas and which are set by City resolution or ordinance on a subdivision level.
“Retention”	The holding of runoff in an area without release except by means of evaporation, infiltration, or emergency bypass.
“Revetment”	A facing, as of stone or concrete, to sustain an embankment.
“Riparian Area”	A strip of land that borders a stream or river, often coincides with the maximum water surfaces elevation of the 100 year or record storm.
“Riprap”	Riprap is a layer of stone or rock designed to protect and stabilize areas subject to erosion.
“Rock Lined Channel”	Rock-lined channels are channels or roadside ditches lined with rock or riprap.
“Rough Grade”	The approximate elevation of the ground surface conforming to the proposed design (0.5 plus or minus feet).
“Scheduling”	Sequencing the construction project to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking. The construction sequence schedule is an orderly listing of

all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for a project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

“Sediment”	The transport of soil or earth material by wind, water, snow or ice
“Sediment Control”	The structural and nonstructural Best Management Practices that contains the deposited, displaced soil particles caused by erosion. This may include (but not limited to) dikes, sediment detention traps, sediment detention basins, filters, fences, barriers, swales, berms, drains, check dams, and other measures that control the deposition of soil or earth material.
“Sedimentation”	The deposition of soil or earth material by wind, water, snow or ice.
“Sequence of Construction”	The suggested procedure of land disturbance and land reclamation to accomplish the goals of this chapter within the City.
“Sheetflow”	A runoff characteristic which water flows over the land as a thin even layer, not concentrated.
“Silt Fence”	A silt fence is a temporary sediment barrier consisting of filter fabric attached to supporting posts and entrenched in the soil.
“Site”	A parcel or parcels of real property owned by one or more than one person on which activity regulated by this chapter is occurring or is proposed to occur.
“Slope”	A portion of ground forming a natural or artificial incline, including a retaining wall.
“Slope Drain”	A temporary slope drain is a flexible tubing, pipe, overside drain, or other conduit extending from the top to the bottom of a cut or fill slope.
“Slope Scaling”	This remedial activity (usually done by manual labor) involves grading the slope to fill in rills and gullies, slumps, and other depressions that concentrate surface runoff. Slope scaling is necessary to repair slopes prior to wattling, brush packing or erosion control blanket installation.
“Solid Waste Landfill”	Solid waste means any garbage, refuse sludge, including sludge from a waste treatment plant, water supply treatment plant, or air pollution control faulty, or other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community actives but does not include solid or dissolved materials in a domestic

	sewage or in a irrigation return flows or discharges for which a permit is required under Title 19, Chapter 5, Water Quality Act or under the Water Pollution Control Act, 33 U.S.C., Section 1251, et, seq. The definition of a solid wasteland fill is found in the state statues 19-6-102-17(a).
“Slough Wall”	A wall designed to retain nuisance earth material and keep it in place.
“Soil”	All earth material, of whatever origin, which overlies bedrock.
“Soils Engineer”	A civil engineer duly registered by the State who is experienced in soil mechanics and slope stability analysis. His primary duties shall encompass the investigation of proposed grading sites and plats as related to the stability of the finished graded product. The soils engineer shall have proper laboratory facilities available in which to perform any and all testing required to properly evaluate materials under consideration.
“Staff Engineer”	A registered civil engineer employed by the City and designated by the City Engineer to act on the City’s behalf.
“Standard Drawings”	The City’s standard drawings for construction projects contained in this standard in Appendix A. Standard drawings also refers to those drawings contained in other design and construction standards of the City including Culinary Water, Road and Bridge, Storm Drain and Flood Control design and construction standards.
“Step Transect Method”	The method of sampling of an area to determine successful revegetation. The following items will be compared to an adjacent undisturbed site: (a) on herbaceous canopy cover equivalent to an adjacent undisturbed site. (b) a growth of native vegetative that is representative of a adjacent undisturbed site species abundance. (c) the lack of rill and gully erosion.
“Structural Streambank Stabilization”	Stabilization of eroding streambanks with designed structural measures.
“Structure”	Anything constructed or erected which requires location on the ground or is attached to something having location on the ground.
“Subdivision Level”	Design, construction and infrastructure related generally to subdivision systems such as drainage, culinary water, wastewater systems, etc. The comparison of ‘subdivision level’ facilities versus ‘lot level’ facilities is the issue of concern.
“Surface Roughening”	A technique for roughening a bare soil surface with furrows running across the slope, stair stepping, or tracking with construction

	equipment. Tracks must be accomplished with indentations running on the slope contour
“Swales”	Shallow grassed trenches that are wider than they are deep that provide a specific pathway for incoming flow.
“Technical Specifications”	Sections of the construction specifications in Appendix B of the Land Disturbance Design and Construction Standards
“Temporary Sediment Basin”	A pond created by excavation in construction of an embankment and designed to retain or detain runoff sufficiently to allow excess sediment to settle.
“Temporary Seeding”	The establishment of a temporary vegetative cover on disturbed areas by seeding with appropriate and rapidly growing annual grasses and/or forbs.
“Terrace”	A horizontal surface or step in a slope.
“Theoretical Detention Time”	The time for a runoff event is the average time parcels of water reside in the basin over the period of release from the B.M.P.
“Topsoiling”	Topsoiling is the preservation and use of topsoil to enhance final site stabilization with vegetation.
“Vegetated Structures”	A retaining structure in which living plant materials, cuttings, or transplants have been integrated into the structure.
“Vegetative Cuttings”	Live, cut stems and branches of plants that will root when embedded or inserted in the ground.
“Vegetative Measures”	The use of live cuttings, seeding, sodding, and transplanting in order to establish vegetation for erosion control and slope protection work.
“Verifiable Testing Method”	A method or material that has been tested by an independent testing facility under similar conditions. Example, existing site conditions have sandy soil with slope of a slope of 2 feet horizontal to one foot vertical (2:1). An acceptable erosion control material would have published test results in sandy soil with slope of 2:1. (i.e. Texas Transportation Institute, Utah Water Research Lab)
“Waterbars and Rolling Dips”	Ridges or ridge-and-channels constructed diagonally across a sloping road or utility right-of-way that is subject to erosion.
“Water Quality B.M.P”	A B.M.P. specifically designed for pollutant removal

“Watercourse”	A river, stream, creek, canal, basin, lake, pond, waterway, or channel, natural or man-made, having a defined bed and banks. Whenever a watercourse consists of both an ordinary channel and an overflow channel, the watercourse is deemed to include all property lying between the banks of the overflow channel. Watercourse would include both perennial and ephemeral flows situations.
“Wattles”	Wattles or live fascines are live branch cuttings, usually willows, bound together into long, cigar shaped bundles used to stabilize slopes and streambanks. Wattles may also be straw materials used for temporary sediment control.
“Wet Weather Plan”	A detailed erosion and sediment control plan and construction sequence that clearly shows how construction will process after October 1 of each year Until May 1, of each year.
“Wetlands”	Those areas that are inundated or saturated by surface or ground water at a frequency sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, such as swamps, bogs and marshes. Jurisdictional wetlands are those wetlands regulated by the U.S. Army Corps of Engineers.
“Yard Waste”	Vegetative cover matter resulting from landscaping, land maintenance, and clearing operations including grass clippings, pruning, and other discarded material generated from yards, gardens, parks, and other similar types of facilities. Yard waste does not include garbage, paper, plastic, sludge, septage, or manure.

1.5 APPLICABLE CODES AND POLICY

A. Ordinances, requirements and applicable standards of governmental agencies having jurisdiction within the City’s service area shall be observed in the design and construction of roadways. Such requirements include but are not limited to current revisions of the following:

1. Municipal Code of City of West Jordan
2. State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste, Solid Waste Permitting and Management Rules, R315-301 through 320
3. State of Utah, Department of Environmental Quality, Division of Air Quality (Dust Control Permit Requirements)
4. State of Utah, Department of Environmental Quality, Division of Water Quality (UPDES Requirements)
5. U.S. Army Corp of Engineers
6. Natural Resources Conservation Service

A complete listing of all reference material is included in the back of these standards.

B. The clearing, grubbing and disposal of vegetative material needs to be in accordance with State and county regulations, which apply to solid waste. This type of material has been determined to

meet the requirements of solid waste as defined earlier in this section. Regulations which affect this disposal include:

1. R315-301-4 Prohibition of Illegal Disposal or Incineration of Solid Waste states:

“No person shall incinerate, burn, or otherwise dispose of solid waste in any place except at a facility which is in compliance with the requirements of Rules 315-301 through 320 and other applicable rules.”

2. The regulations dealing with landfills are enforced on the local level by the counties the landfill or alleged violation to landfill regulations is in. In the event, the counties regulations are more restrictive than the State regulations the counties regulations govern. Salt Lake County regulations are more restrictive than the states, so the Salt Lake County’s regulations govern. The contact person for Salt Lake County is:

Ms. Mary Pat Buckman - Salt Lake County

1.6 ENGINEERING DEPARTMENT JURISDICTION

The Engineering Department is responsible for all land disturbance activities throughout the City until said areas have been stabilized with vegetation, asphalt, concrete and accepted by the City.

1.7 INFRASTRUCTURE MAINTENANCE AND OPERATIONS DEPARTMENT JURISDICTION

The Infrastructure Maintenance and Operations (IMO) Department is responsible for the operation and maintenance of all public roadways, sanitary sewer, storm drainage, secondary water and culinary water systems within the public right-of-way of the City.

1.8 COMMUNITY DEVELOPMENT DEPARTMENT – BUILDING DIVISION

The Building Division is responsible for the residential and commercial building sites after final grade has been reached. The revegetated areas outside of the right-of-way and storm water management facilities are the only exceptions.

1.9 DEVELOPER ENGINEER’S RESPONSIBILITY

These standards establish uniform policies and procedures for the design and construction of the City grading, erosion, revegetation and sediment control facilities. This standard is not a substitute for the knowledge, experience, or judgment of professionals in their respective area of expertise in the agronomy, revegetation, conservation, and engineering discipline. The methods and procedures contained herein shall be reviewed by the developer’s engineer or designer using them as applicable to site-specific conditions of the project they are working on. Where actual site conditions deem these standards and procedures not applicable, the engineer or designer shall request a variance from these standards or procedures as provided herein.

It is the developer engineer’s responsibility to be aware of the City’s ordinance for grading, erosion, revegetation, and sedimentation control improvements and to indicate any areas, which requires work in these areas. This responsibility shall include investigating any changes from the Master Plan

necessitated by development subsequent to the Master Plan, although the above shall not relieve the developer from the responsibility to provide an approved system consistent with Engineering Department requirements.

All plans, specifications, report or documents pertaining to erosion control, vegetation or revegetation shall be prepared or reviewed by certified professionals. Each of these documents shall be signed and stamped with a professional engineer seal, to indicate responsibility for them. A wet stamp is required on all documents except reproducible plans, where a stamp on the original is acceptable.

A “Preliminary Review” and or “Plans Approved for Construction” stamp or signature of the City on the plans does not in any way relieve the developer’s engineer of the responsibility to meet all requirements of the City. The plans shall be revised or supplemented at any time it is determined that the City’s requirements have not been met. Generally, plans that are signed as being authorized for construction will not require revisions based upon subsequent revisions to these standards, however, when in the Engineering Department’s opinion, a change to the project is necessary, based upon a significant change in the standards, which significantly affects public safety, future maintenance costs, or similar concerns, such a change may be required during construction by the City Engineer. Changes may also be required in the case where a developer does not proceed to construction within the time allowed in the agreement with the City.

1.10 REFERENCED SPECIFICATIONS

References to standards such as AASHTO, APWA or ASTM shall refer to the latest edition or revision of such standards unless otherwise specified.

1.11 CITY ENGINEER ACCEPTANCE

The City Engineer will not accept the land disturbance until all applicable requirements of these standards and of the City of West Jordan Municipal Code have been met.

1.12 METRIC UNITS

These standards do not contain metric conversions in some sections because of the extent of numerical data or information.

1.13 CONSTRUCTION SPECIFICATIONS

Nothing contained in the construction specifications in Appendix B, or in any other part of this standard as implying the City will pay for any of these improvements. In addition to the construction specifications being used for defining private development work, they are also used for City capital improvement projects, and therefore contain some language about methods of payment.

SECTION 2.0

DESIGN CRITERIA

2.1 INTRODUCTION

- A. General - The City boundary includes the region generally east of the Oquirrh Mountains, south of 10200 South, west of the Jordan River, and north to 10200 South. A map showing the City's boundary is contained in the standard drawings at the back of this document.

Within the boundaries of City of West Jordan there are several historical and environmental features, which have contributed to the past and present character of City of West Jordan. The Kennecott Copper Mine, the historical Bonneville Lake shoreline and the wetland areas scattered throughout the City of West Jordan area are just a few of these features.

These features also serve as winter rangeland for deer and elk and the wetland areas support several species of migratory birds. The educational and recreational experiences to be found in these areas are second to none. However, during the development surge in the late 1990's, City of West Jordan experienced several development related items, which appeared to threaten these unique areas, which have concerned City of West Jordan. The City of West Jordan recognizes that the preservation of the mountain ranges, wetlands and other sensitive areas, enhance the natural scenic beauty of the area and also sustains the long-term potential for maintaining property values. This philosophy also encourages quality development while maintaining the original identity and character of the sensitive areas that originally attracted people to the West Jordan area.

The sensitive areas spoken of also include elements, when balanced, provides environmentally sound ecological systems which prevent flooding, erosion and other natural hazards. For these reasons, the City Council has determined that in order to promote and protect health, safety, and welfare of the residents of the City of West Jordan and at the same time recognizing individual rights to develop private property, which will not be prejudicial to the public interest, it has been necessary to enact the standards and procedures contained herein.

The City's Engineering Department is responsible for all studies, design and construction for all land disturbance, grading, erosion control, revegetation efforts, and sedimentation facilities and the Infrastructure Maintenance and Operations Department is responsible for all operations and maintenance once they have been accepted by the City.

- B. Design Professionals Qualifications – A number of design professionals are involved in the land disturbance design and implementation phase of a project. These include civil engineers, geotechnical engineers, erosion control specialists, and other professionals necessary to properly design and inspect the project. The following are generalized list of work activities which require professional qualifications to perform:
1. Grading – Work under this item is required to be done by a combination of Civil Engineer and Geotechnical Engineer. These specialties are to be registered in the State of Utah. In addition to the design of a portion on the project, the engineer who performed the design is also to perform the inspection and verification of the work and a certification is to be provided to the

City indicating the work performed meets the requirements of the original design. If design changes are contemplated during construction, the design engineer is to approach the City with a proposed revised plan, which is to be reviewed and approved in writing by the City prior to initiating work on the revision.

2. Drainage – Work under this item is required to be done by a Civil Engineer. The Civil Engineer is to be registered in the State of Utah. In addition to the design of this portion on the project, the engineer who performed the design is also to perform the inspection and verification of the work and a certification is to be provided to the City indicating the work performed meets the requirements of the original design. If design changes are contemplated during construction, the design engineer is to approach the City with a proposed revised plan, which is to be reviewed and approved in writing by the City prior to initiating work on the revision.
3. Erosion and Sediment Control, Vegetation and Revegetation – Work under this item is required to be done by a qualified Certified Professional Erosion and Sediment Control Specialist or a person having adequate education and years of experience to indicate the person has sufficient knowledge to properly complete these types of designs and plans. The following general categories of persons may be considered qualified to perform this type of work. If through performance of the work it becomes apparent the individual does not possess the necessary knowledge to properly complete the work, the design firm will be requested to find another individual to complete the work or the City may require another firm be retained to complete the work.
 - a. A person having at least ten years of professional level experience in the erosion and sediment control field and has been accepted for testing to become a Certified Professional Erosion and Sediment Control Specialist, or
 - b. A Certified Professional Erosion and Sediment Control Specialist who is actively involved in designing, installing, or regulating projects within the erosion control field, or
 - c. A Civil Engineer/Landscape Architect having at least six years of professional level experience in the erosion and sediment control field, or
 - d. A Soil Scientist having certification by the American Registry of Certified Professionals in Agronomy and having two years of professional level experience in erosion and sediment control, or
 - e. A person have a Bachelor of Science* degree plus six years of professional level experience in the erosion and sediment control field.
 - f. A person with a Master of Science* degree plus four years of professional level experience in the soil erosion and sediment control field, or
 - g. A person with a Ph. D* plus two years of professional level experience in the soil erosion and sediment control field.

*Note: Degree in engineering (agricultural, civil, or environmental), geology, soil science, natural resource science or management, or a related field is acceptable.

Professionals, which are required to be licensed, are to be registered in the State of Utah. In addition to the design of this portion on the project, the professional who performed the design is also to perform the inspection and verification of the work and a certification is to be provided to the City indicating the work performed meets the requirements of the original design. If design changes are contemplated during construction, the design professional is to approach the City with a proposed revised plan, which is to be reviewed and approved in writing by the City prior to initiating work on the revision.

- C. Master Plan Compliance – In designing facilities within the City, Developers and their engineers shall comply with the City's current master plans, for the Land Disturbance Design and Construction Standards, Storm Drainage, Flood Control and Transportation master plans apply specifically, Parks and Trails, along with other master plans, which the City has adopted.
- D. Development Processing Manual – The City is in the process of completing a Development Processing Manual for private development work being processed through the City. The purpose of this manual is to document the City's processes for various types of private development and provide the Developer with documentation, which will assist in completing development work within the boundaries of City of West Jordan.

The manual was also prepared to assist City departments in understanding, coordinating and administering the processes and ensuring the processes and procedures are followed. To do this, various flow charts, schedules and checklists have been included in this manual. The flow charts are contained in the 'Executive Summary'; the schedules are included in Sections 1 through 14, and checklist for the various processes are included in Appendix A through J. The Developer or Developer's Engineer is responsible for completing the checklists and submitting them to the City with various drawings required as part of the development processing.

This manual is meant as an aid and is not intended to replace the ordinances, codes, design and construction standards or other processes in place at the City. Should the Developer need additional information, he or she should search out the details in these ordinances, codes and standards.

- E. Construction of the Project – In planning for construction of the project, the Developer needs to take into account the amount of disturbance, which may impact the project and in what order will need to be created to construct the project. Strict controls need to be placed on the Developer's contractor to minimize the amount of disturbed soil and maximize the amount of natural vegetation preserved.

1. Project Phasing – Vegetation cover and associated roots of native plants provide tensile strength to the soil and reduce the potential for excessive erosion. When vegetation can be maintained in an undisturbed state, the amount of sediment coming off the site is minimal and the inclusion of structural/nonstructural Best management Practices (BMP's) is reduced.

The construction project should be designed, selected and laid out so that it fits into existing land contours. Changing the contours significantly from existing grade will disturb more soil and increase development costs in grading, erosion control measures, sediment control and revegetation and will also disturb the aesthetic value of the land.

Clear and grub only those portions of the site where it is necessary for construction. The point to be emphasized is the less soil disturbed relates directly to reduced development costs.

2. Maximize the natural vegetation preserved - Preservation of natural vegetation on a site needs to be planned before the site disturbance begins. Preservation requires good site management to minimize the impact of construction activities on existing vegetation. The following is to be clearly indicated on the construction plans:
 - a. Survey and stake the limits of disturbance (LOD) and have the City Inspector or Erosion Control Specialist review staking.

-
- b. Clearly mark the trees and shrubs not to be disturbed within the LOD.
 - c. Create barriers to prevent the ground at the base of the trees and shrubs from being disturbed.
 - d. Create natural vegetation buffer filter strips that are adjacent to roads and streams. The buffer filter strip width is to be designed based on riparian habitat, vegetative growth and pollutants to be removed for the water. Each buffer requires a site-specific design refer to the B.M.P. buffer section for design criteria.

 - F. Responsible Agencies – The following are agencies with which the Developer will, or may need to coordinate during construction of the project:
 - 1. Utah Department of Environmental Quality, Division of Air Quality – The Utah Department of Environmental Quality, Division of Air Quality is responsible for ensuring compliance with its requirements for all areas of the City. The Developer or his contractor is responsible for obtaining an air quality permit from this agency and is responsible for ensuring that operations of the project comply with the permit if the site is over one (1) acre.
 - 2. Utah Department of Environmental Quality, Division of Water Quality – The Utah Department of Environmental Quality, Division of Water Quality is responsible for ensuring compliance with its requirements for all areas of the City under the Utah Pollution Discharge Elimination System (UPDES) requirements. The Developer or his contractor is responsible for obtaining a UPDES permit from this agency and is responsible for ensuring that operations of the project comply with the permit.
 - 3. Utah Department of Environmental Quality, Division of Solid and Hazardous Waste – The Utah Department of Environmental Quality, Division of Solid and Hazardous Waste is responsible for ensuring compliance with its requirements for all areas of the City as it regards green waste or other solid waste. The Developer or his contractor is responsible for obtaining the necessary permits and approvals from this agency for the project and is responsible for ensuring that operations of the project comply with these permits.
 - 4. City of West Jordan – City of West Jordan also has several ordinances and standards, which the Developer and his contractor need to be aware of and comply with. These include:
 - a. Hillside Overlay District Ordinance
 - b. Title 81 - Land Disturbance Ordinance
 - c. Land Disturbance Design and Construction Standards
 - d. Title 90, Chapter 4 – Stormwater Discharges and Stormwater Quality Management Ordinance
 - e. West Jordan City Design and Construction Standards

 - G. Hillside Overlay District – In preparing plans and designs for a project, the Developer also needs to take into account requirements of the Hillside Overlay District Ordinance. The Developer must obtain a copy of the ordinance and comply with its provisions. The following checklists are provided in Appendix D for the developer's convenience:
 - 1. Hillside Overlay District Ordinance, Conceptual Approval (Concept Plan) Checklist
 - 2. Hillside Overlay District Ordinance, Preliminary Approval (Preliminary Plat) Checklist
 - 3. Hillside Overlay District Ordinance, Final Approval (Final Plat) Checklist

An additional discussion of the ordinances provisions is contained in the City's Development Processing Manual.

2.2 PRINCIPLES OF EROSION AND SEDIMENT CONTROL

A. General - Severe erosion is caused by the action of wind, rainfall, snow and runoff on bare soil. Clearing, grading, and other construction activities remove the vegetation and compact the soil, increasing both runoff and erosion. Excessive runoff causes gully erosion, increased stream bank erosion, poor water quality and results in increased off-site erosion, sedimentation, mudflows and flooding problems. Effective erosion and sediment control can be achieved by careful attention to the following principles:

1. Protect the land surface from erosion.
2. Manage runoff and keep water surface velocities low.
3. Capture sediment on-site.
4. Integrate erosion and sediment control with the construction schedule.
5. Inspect and maintain the erosion and sediment control practices before, during and after construction.

The following are principles for controlling erosion and off-site sedimentation from construction sites:

1. Fit the development to the existing topography, soils, and vegetation as much as is possible.
2. Schedule construction operations in order to minimize soil exposure during the wet season.
3. Minimize disturbance and soil exposure by retaining natural vegetation, adopting phased construction techniques, and using temporary cover.
4. Vegetate and mulch all denuded areas to protect the soil from winter rains. The primary efforts for controlling sediment pollution from construction sites are to minimize raindrop impacts on bare soil.
5. Utilize proper grading, barriers, or ditches to minimize concentrated flows and divert runoff away from denuded slopes or other critical areas.
6. Minimize the steepness of slopes and control the length of slopes by utilizing benches, terraces, contour furrows, wattles or diversion ditches.
7. Utilize riprap, channel linings, or temporary structures in the channel to slow runoff velocities and allow the drainage ways to handle the increased runoff from disturbed and developed areas.
8. Keep the sediment on-site by utilizing sediment basins, traps, or sediment barriers.
9. Monitor and inspect sites frequently to assure the measures are functioning properly and correct problems promptly.

B. Vegetation as a Solution

Dense, healthy vegetation and the associated leaf litter protect the soil from raindrop impact. Raindrop impact is a major force in dislodging soil particles, which then allows them to move down slope or form a crust on the soil surface. When a crust forms on the soil surface the rainfall infiltration rate decreases and runoff increases.

Vegetation also protects the soil from sheet and rill erosion. It shields the soil surface from the transport of soil particles and scour from overland flow (sheet flow) and it decreases the erosive energy of the flowing water by reducing velocity.

The shielding effect of the plant canopy and leaves is augmented by roots and rhizomes that hold the soil in place, improve the soil's physical condition, and increase the rate of infiltration, further decreasing runoff. Plants also remove water from the soil through transpiration, thus increasing its capacity to absorb water.

Suitable vegetative cover provides excellent erosion protection, and reduces the need for high cost, low efficiency, and high maintenance sediment control measures. Vegetative cover is relatively inexpensive to achieve and tends to be self-healing; it is often the only practical, long-term solution of stabilization and erosion control on most disturbed sites.

Initial investigation of site characteristics and planning for vegetation stabilization reduces its cost, minimizes maintenance and repair, and makes other erosion and sediment control measures more effective and less costly to maintain. Permanent erosion control (post-construction landscaping) is also less costly where soils have not been eroded.

Exposed subsoils are generally difficult to amend, are infertile, and require more irrigation. Natural, undisturbed areas can provide low-maintenance landscaping, shade, and privacy. Large trees increase property values when they are properly protected during construction.

Besides preventing erosion, healthy vegetative cover provides a stable land surface, reduces heat reflectance and dust, restricts weed growth, and complements architecture. The result is a pleasant environment for employees, tenants and customers, and an attractive site for homes.

Property values can be increased dramatically by small investments in erosion control. The final landscaping represents a small fraction of total construction costs, but can contribute greatly to an increased market value of the development. Healthy vegetation and planned development will reduce concentrated flows and peak discharge, thus reducing channel erosion and flooding. Good, healthy vegetative cover greatly reduces the environmental impacts that poor water quality and habitat reduction is having on rivers and streams.

C. Scheduling

1. **Purpose:** Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of surface ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing provide the timely installation of erosion and sedimentation controls, and restore protective cover quickly can significantly reduce the erosion potential of a site.
2. **Design Considerations:**
 - a. **Project design considerations:** Design project to integrate into existing land contours. Significant regrading of a site will require more costly erosion and sedimentation control measures and may require installation of on-site drainage and sediment control facilities.
 - b. **Incorporate existing natural areas:** Inventory and evaluate the existing site terrain and vegetation. Disturbance of highly erosive natural areas (e.g., steep, unstable slope areas

- and watercourses) should be minimized, while protecting other areas may enhance site aesthetics. Construction should not disturb these areas
- c. Avoid rainy periods: Schedule major grading operations during dry months of April through October. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install temporary sediment trapping devices.
 - d. Practice erosion and sediment control year round: Erosion may be caused during dry seasons by "freak" rainfall, wind and vehicle tracking. Therefore, keep the site stabilized year-round, and maintain wet season sediment trapping devices. Material which becomes too dry and causes a dust problem will need to be wetted to meet City, County and State requirements.
 - e. Apply perimeter control practices: Protect the disturbed areas from off-site runoff and prevent sedimentation damage to areas below the development site by applying perimeter control devices.
 - f. Minimize soil exposed at one time: Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.
 - g. Trenching: Close and stabilize open trenches as soon as possible. Sequence trenching projects so that most open portions of the trench are closed before new trenching is begun.
 - h. Maintain erosion and sediment control during construction period, start to finish.

D. Land Grading for Minimizing Erosion

1. Purpose: Where land grading is necessary for road or building construction, these land-grading practices are intended to minimize the erosion potential and facilitate plant establishment.
2. Design Considerations: Design considerations should include the following:
 - a. existing contours;
 - b. land use;
 - c. vegetation;
 - d. soil;
 - e. drainage;
 - f. slope stability;
 - g. slope length;
 - h. slope angle;
 - i. space limitations;
 - j. erosion potential of land disturbance; and
 - k. erosion and sediment control measure practicality.
 - l. Existing or proposed wetlands

Development should fit existing topography as much as possible so that land disturbance is minimized.

Slope steepness and excessive slope lengths should be kept to a minimum. Benches, steps, or contour furrows can be installed on long slopes to break up the slope length. A bench should be graded back towards the slope and drain with a gentle gradient to a stable outlet.

Drainage from upland areas should be diverted away from exposed slopes.

E. Minimize Disturbance and Buffer Strip

1. Purpose: Erosion can be reduced ninety-eight (98%) percent by protecting the soil from raindrop impact. Existing native vegetation usually provides the best soil protection. One of the most effective erosion control measures is to only disturb areas immediately needed for construction.

Water quality and wildlife habitat degradation can be greatly reduced by maintaining streamside buffer strips and riparian corridors. These buffer strips act to filter sediment from the surface runoff before it reaches the watercourse. The small drainage and intermittent streams and channels are the sediment delivery systems to rivers and lakes. If sediment can be kept out of the delivery systems, by maintaining buffer strips, then the sediment will not impact the fisheries or cause other water quality impacts.

2. Planning Considerations:
 - a. Existing native vegetation should be incorporated into the final landscaping plan. It is adapted to the site, drought tolerant, and will provide shade and erosion protection. Shrubs or trees can be thinned and pruned for beauty and fire hazard reduction.
 - b. Existing trees should be protected as per City ordinances or other development requirements.
 - c. If the area is not disturbed then it does not require erosion control and concentrated flows down slope will be greatly reduced.
 - d. Buffer strips around the perimeter of a site can reduce or eliminate off-site sedimentation.
3. Design Criteria:
 - a. Designate areas of no disturbance. Clearly show on the SWPPP plans, and flag in the field areas of no disturbance and construction vehicle exclusion.
 - b. Designate trees and shrubs that are to be preserved.
 - c. Designate watercourse buffer-filter strips on the site design plan. See Guide to Small Roads, USDA-SCS for more information.
 - d. Maintain and preserve riparian and naturally vegetated buffer strips along watercourses.
 - e. The width of a buffer strip between a road and the stream is recommended to be 50 feet plus four times the slope of the land in percent, measured between the road and the top of stream bank. Coordinate with setback requirements for canal and channel setbacks.
 - f. Buffer width in feet = $50 + 4(\% \text{ slope})$.
Example: For a 10% slope, buffer length is $50 \text{ feet} + (4)(10) = 90 \text{ feet}$.

2.3 APPLICATIONS OF EROSION AND SEDIMENT CONTROL PRACTICES

- A. General – The common reason erosion and sediment control practices are ineffective is that the wrong BMP is implemented for the type of control needed. A sediment control BMP should not be used for erosion control and an erosion control BMP should not be used when a runoff control is needed. When the needed control is treated with the wrong type of BMP, failure normally occurs.

For example, a silt fence is placed across a slope to prevent erosion. Maybe the designer wanted to stop sheet and rill erosion. In actual practice the silt fence collected and concentrated water, which was diverted to a low spot where the fence becomes overloaded and failed. An erosion control BMP should have been chosen to treat the erosion problem. Silt fences are intended for sediment control and should, therefore, be installed in relatively flat areas suitable for ponding water and depositing sediment. A good way to avoid confusion when choosing

BMPs is to have a clear understanding of what type control is needed and what are the corresponding BMPs.

There are three general categories of controls that have distinct treatments associated with them;

1. erosion control
2. runoff control
3. sediment control.

- B. Erosion Control - Erosion control is any practice that protects the soil surfaces and prevents the soil particles from being detached by rainfall or wind. Erosion control, therefore, is a source control that treats the soil as a resource that has value and should be kept in place.

What are some erosion control BMPs?

1. Key Point: The most efficient and economical long-term method of controlling sheet, rill and raindrop impact erosion is to establish vegetative cover from seed. Vegetation can reduce erosion by more than ninety (90%) percent by protecting the soil from raindrop impact and sheet erosion.

When erosion control BMPs are implemented and maintained, the amount of sediment associated with runoff waters can be dramatically reduced. Whenever possible prioritize or design for erosion control first and sediment control second. Some important points to remember:

- a. Existing or new vegetative cover is the primary erosion control practice.
 - b. Retain existing vegetation by minimizing disturbance and scheduling large land disturbances during periods of expected dry weather.
 - c. Establishing cover immediately after disturbance (staging) is important.
 - d. Temporary erosion control is usually achieved by seeding and watering with fast growing annual grasses and/or protecting the soil with mulch or erosion blankets. Plant seed mix is to be approved by the Engineering Department and the Parks Department staff.
 - e. Permanent erosion control usually involves planting perennial grasses, shrubs, and trees.
2. Key Point: The selection of the right plant material for the site, choosing the correct mulching technique and proper seedbed preparation are critical for effective erosion control. Surface roughening, contour furrows, and stepped slopes are essential to establish vegetation. Straw bales are not recommended in the city.
 3. Costs - Non-structural erosion control practices are generally more cost-effective than sediment control. For example, the cost of temporary seeding one acre would be comparable to the cost of installing 200 LF of silt fence (for a 1 acre drainage) or equivalent to the cost of constructing a temporary sediment trap designed for a one-acre drainage. However, the practice of temporary seeding would probably be more effective, while the silt fence and sediment trap will require regular and costly maintenance.
 4. Key Point: Erosion control is, generally, more cost-effective than sediment control and requires less maintenance and repair.

- C. Runoff Control (See Appendix A - 5200)

1. **General** - Construction activities usually result in the removal of vegetative cover and increases in impermeable surfaces, both of which increase the volume and velocity of runoff. Increases of storm water volume and velocity lead to increased erosion (gulling) in the sediment transport and off-site delivery (sedimentation). These increases must be addressed when implementing erosion and sediment control.

Runoff control measures are those practices, which mitigate for the erosive and sediment transport forces of storm water during and after construction activities. Some examples of runoff control might include, outlet protection (energy dissipators), diversion dikes and swales, temporary slope drains, rock lined channels, turf reinforcement mats, grass-lined channels, and temporary stream crossings.

2. **Key Point:** Runoff control involves the use of structures to reduce velocities and/or safely carry storm water in a manner, which reduces erosion and sediment transport.

The energy equation, $E = mv^2$, where E = erosive Energy, m = unit density of water, and v = the runoff velocity, demonstrates that if you reduce the velocity of running water by 1/2 you will reduce the erosive energy by 4 times. To reduce runoff energy implement practices which use the **4 D's**.

Decrease - decrease the amount of runoff

Detain - decrease the velocity

Divert - divert runoff to less erodable areas

Dissipate - spread the runoff out

Rill and gully erosion is caused by concentrated runoff. Methods that reduce runoff velocity, such as check dams, vegetated channels or riprap, will also reduce the potential for sediment transport. An alternative to reducing the runoff energy of storm water is to convey that runoff through or along non-erodable surfaces, i.e., culverts and slope drains.

3. **Key Point:** Temporary check dams, especially straw bale dams, are not recommended for any flowing water conditions. Straw bales and silt fences are sediment control BMPs, not runoff control BMPs and should not be placed in channel flow (runoff) areas.

What are some runoff control BMPs?

D. Sediment Control (See Appendix A – 5300)

1. **General** - Sedimentation is the deposition of soil particles that have been transported by water or wind. The amount of sediment produced during construction is directly proportional to the degree and effectiveness of erosion control practices implemented. The quantity and size of the particles transported increases with the velocity of the runoff or wind.

Sediment control is used to keep sediment, the product of erosion, on-site. Sediment control involves the construction of structures that allow sediment to settle out of suspension. Sediment control structures, therefore, require frequent inspection and maintenance. Generally, sediment is retained on-site by two methods: a) slowing runoff velocities, as they flow through an area, sufficiently so that sediment cannot be transported, and b) impounding sediment-laden runoff for a period of time so that the soil particles settle out.

Sediment controls are not filters. Practices referred to as "sediment filtering" actually works by slowing water velocities and allowing sediment impoundment to de-water in a very slow and controlled manner. For effective sediment control planning and design, materials such as geotextiles, silt fences, straw wattles and straw bales should be considered for their ability to impound water and slow runoff velocities, not for their ability to "filter" sediment.

2. Key Point: Effective sediment control involves ponding sediment-laden runoff long enough for the soil particles to settle out of suspension. Reducing runoff velocities will also reduce sediment transport and thereby help retain sediment on-site.

What are some effective sediment control BMPs?

3. Key point: Structural sediment control can be divided into three general types; 1) sediment basins, 2) sediment traps, and 3) sediment barriers.
 - a. Temporary sediment basins are recommended for the outlet of disturbed drainage areas ranging from 5 ac. to 100 ac. , see Appendix A 5332. Sediment basins should be designed by a qualified professional.
 - b. Temporary sediment traps are recommended for disturbed drainage areas less than 5 ac. A typical sediment trap designed to handle 0.5-inches of runoff over a 24 hour period would require a settling zone capacity of 67 yd³ / ac. of contributing drainage area and a sediment storage capacity of 33 yd³ / ac. of drainage area.
 - (1) Excavated sediment traps require less rigorous design work, are smaller in size and they are easier to construct, therefore, a preferable alternative is to sub-divide large projects into smaller sub areas (less than 5 ac) and utilize numerous sediment traps. Multiple traps and / or additional volume may be required to accommodate site-specific rainfall and soil conditions. This approach may facilitate phased construction along relatively narrow highway right of way.
 - (2) Excavated storm drain inlets are small excavated sediment traps located at storm drain inlets are effective as part of phased construction. The design capacity of excavated inlet sediment traps shall be 67 yd³ / acre of contributing drainage area. These excavations are temporary and they are not very effective for trapping small particles (silt and clay) and they should not be used where runoff velocities are high.
 - c. Sediment barriers are BMPs that are intended to separate sediment from sheet flow runoff. They function by reducing runoff velocity and ponding small quantities of storm water. Sediment barriers are only intended for areas experiencing sheet flow and they must be installed in areas that can pond water and accumulate sediment and, most importantly, the must be accessible for cleanout. Sediment barriers are the most common type of practices used on construction sites. The most common types of sediment barriers are as follows:
 - (1) Silt fence
 - (2) Straw bale dike
 - (3) Continuous berms
 - (4) Storm drain inlet barriers
 - (5) Straw wattles

2.4 BIOENGINEERING TECHNIQUES

- A. General: Bioengineering uses plants and structures to function together in mutually reinforcing or complimenting roles. The structural components initially protect and stabilize the site and create a stable zone for the plants to grow.

Bioengineering techniques are used to prevent erosion on upland slopes, to protect stream banks and channels against wave erosion in the coastal zones, or water quality ponds and these biotechnical earth support methods can also be utilized to provide slope stability.

B. Conditions Where Practice Applies: Soil bioengineering techniques are generally appropriate for:

1. Slopes to prevent surface erosion
2. Cut and fill slopes stabilization
3. Shallow mass wasting
4. Gully repair
5. Stream bank stabilization
6. Shoreline stabilization
7. Wetland mitigation
8. Watershed rehabilitation

C. Planning Considerations:

1. Soil bioengineering generally requires minimal access for equipment and workers and cause relatively minor site disturbance during installation. These practices are therefore considered appropriate for environmentally sensitive areas, such as parks, woodlands, riparian areas and scenic corridors where aesthetic quality, wildlife habitat and similar values may be critical.
2. Bioengineering systems are often more cost effective than the use of vegetation or structural solutions alone. Using indigenous materials accounts for some of the cost effectiveness because plant costs are limited to labor for harvesting, handling and the direct costs of transporting plant material to the site.
3. In bioengineering, the plant material itself may provide both the structural and vegetative components of the design. For example, in willow wattles, live staking and brushlayering the woody material is used to provide initial structural protection and later, vegetative cover.
4. Bioengineering systems are most effective when installed during the dormant season, usually late fall, winter or early spring. Constraints on planting times or availability of the required quantities of suitable plant materials during allowable planting times may limit the usefulness of bioengineering methods.
5. Bioengineering systems are strong initially and grow stronger with time as the vegetation becomes established. Bioengineering systems may withstand heavy rainfalls immediately after installation. Even if vegetation dies, its plant material and surface residue continues to play an important protective roll during vegetation establishment.
6. Soil bioengineering is useful on small, highly sensitive or steep sites where the use of machinery is not feasible.
7. Bioengineering practices are limited by the available medium for plant growth-rocky or gravelly slopes may lack sufficient fines or moisture to support plant growth or hard pans may prevent the required root growth. Adequate natural precipitation may also limit the applicability of bioengineering techniques.

- D. Design Criteria: Choose plant materials that are adapted to the site conditions. Local stands of willow or other suitable species are already well suited to the climate, soil conditions and available moisture and they make good candidates for survival on most sites.

When choosing live willow material for bioengineering applications, remember that young (less than 1 year old) wood or suckers will often sprout easier under optimum conditions, but healthy, older wood (1 to 4 years old) has greater vegetative (energy) reserves necessary to consistently sprout and the older wood is much stronger. If possible, mix younger wood with older wood for the bioengineering application such that a majority of the material is 1 to 4 years old.

Research indicates that all cuttings should be soaked for a minimum of 24 hours, whether they are stored or harvested and immediately installed (Hoag 1991; Hoag et al. 1991; Hoag et al. 1992). Some research recommends soaking the cuttings for as much as 10 to 14 days (Briggs and Munda 1992; Frenchel et al. 1988).

- E. Bioengineering Measures: The following practices have specific construction recommendations in this manual. For more information of these practices refer to the appropriate BMP.
1. Vegetated rock gabion: Is a structure built of metal wire baskets filled with rock and soil. These structures are then interplanted with woody plant material. See Appendix A - 5405
 2. Straw rolls: Are long bags or nets filled with straw or similar material. They are placed along the contour of a slope or stream bank in order to reduce erosion and sedimentation. Commonly uses wood or live stakes to anchor the roll in place. See Appendix A – 5250.
 3. Live stake planting: Live stake planting is the planting of live, rootable, vegetative cuttings into the ground. See Appendix A - 5220
 4. Branchpacking: Consists of alternative layers of live branch cuttings and compacted backfill to repair small-localized slumps and holes in slopes.
 5. Brushlayering: Cuttings or branches are layered between successive lifts of soil fill to construct a reinforced slope. See Appendix A – 5200.
 6. Willow Wattles: Are woven bundles of woody branches typically from a species that is very rootable. This bundle is placed along the contour of a slope or stream bank in order to reduce the length of the slope and provide vegetation as a buffer zone. They commonly have wood or live stakes to anchor the wattle in place. See Appendix A – 5260.
 7. Coir rolls: Fiber filled mesh logs used to stabilize shorelines, stream banks and wetlands. Coir rolls resist stream bank and wave erosion and provide a stable substrate for plant establishment. See Appendix A – 5250.
 8. Coir mats: Coir mats are dense, biodegradable mats are usually made of coconut fiber (coir), used to protect stream banks and wetland shores from erosion, trap sediment and provide a stable substrate for wetland plants. See Appendix A – 5210.
- F. Inspection and Maintenance: Regular inspection and maintenance of bioengineering installations should be conducted, particularly during the first year. Prompt correction of any failures is essential to prevent major problems from developing. For the first 3 months, weekly inspections

need to be made. After the three-month period, inspections can go to every two weeks for tow months, and then every mother thereafter.

2.5 SUBDIVISION AND LOT DESIGN FOR GRADING AND DRAINAGE

- A. General – The City’s basic philosophy of subdivision and lot design for grading and drainage is that the lot is to be so designed that the lot drainage be directed toward the street for disposal by the City’s storm drainage system. It is also the City’s philosophy to have each lot graded so as to maximize the amount of infiltration of storm water into the individual lot without increasing the potential for damage to structures constructed on the lot. Designers of subdivisions are also to include features on each lot, which prevent wherever possible, the cross-drainage of one lot to another, except in dedicated drainage easements. Where storm water drainage cannot be directed toward the public street, the designer is to provide for a subdivision level drainage system which is a private drainage system in the side and/or rear yards which provide for cross-lot drainage. Subdivision level storm water is to be disposed of to an approved storm water facility, which is to be approved by the City Engineer.
- B. Preliminary Design Report - The developer is responsible for preparing a preliminary design report for this portion of the work and submitting it to the Engineering Department for review and approval, prior to proceeding forward with final design. The preliminary design report shall include preliminary information on geological, geotechnical and soils related issues related to the specific project. It shall also include preliminary information regarding the proposed storm drainage system for the project indicating how the applicant intends to grade the lots, streets and other portions of the project to address storm water runoff for the entire project. The intent of the preliminary design report is to provide sufficient information for general approval by the City prior to proceeding to final design. One of the purposes of this report is to streamline the development process by minimizing the need for costly revisions to the designs by involving the City early in design procedures. The applicant is to receive approval of the report prior to proceeding to final design.
- C. Geotechnical Report - A geotechnical report, including a soils engineering and engineering geology report shall be required for the project as part of the final design report. If the project lies within the Hillside Overlay District, these reports are required as part of the preliminary approval. The report shall include the following minimum requirements:
1. Subsurface soil conditions including depth to, and consistency of, cemented deposits or bedrock, if encountered. Presence of collapsible/expansive soils.
 2. Groundwater levels as observed during fieldwork, seasonal fluctuations, and recommended remedial measures during and after construction.
 3. Geologic setting of site, geologic hazards, nearest location to the proposed construction, as well as means to mitigate such hazards.
 4. Liquefaction potential of the upper soils and recommended remedial measures.
 5. Excavatability of subsurface soil and/or bedrock deposits.
 6. Site grading recommendations including a discussion of anticipated excavation requirements, cut and fill slope stability, treatment and/or removal of unsuitable bearing soils, if encountered, and suitability of on-site material for use as structural fill.
 7. Compaction requirements of native subgrade, general, fill and structural fill.
 8. Recommendations for winter fill placement.
 9. Recommendations regarding foundation type and depth, foundation alternatives, if warranted, and allowable bearing pressures, estimated total settlement and differential settlements.

10. Lateral earth pressures and drainage requirements for design of retaining walls.
11. Pavement section design and construction recommendations.
12. Basement level and surface drainage control.
13. Recommendations (specifications) for utility trench backfill within roadways.
14. Corrosive soil conditions and recommended cement type to be utilized.
15. Identify areas of contaminated soils and remediation plan.
16. Recommendations regarding the scope of services for construction observation and testing during construction. The geotechnical engineering firm would be best consulted for obtaining additional information regarding their proposed scope of work and type and frequency of testing during construction.

The consultant will present his/her opinions and recommendations in a formal written report, complete with logs of the explorations and laboratory test results, signed and stamped by an in-house professional geotechnical engineer.

- D. Grading and Drainage Report - The developer shall prepare a grading and drainage report which is to include plans for storm water management, erosion control, and grading describing the methods by which surface water, natural drainages, flooding, erosion and sedimentation loss, and hydrologic hazards will be controlled during and after construction. The plan shall include:

1. Stamps and Signatures of Licensed Professionals – The report is to include the stamps and signatures of the registered professionals who have prepared the report. Their stamps and signatures shall be affixed to the first interior page of the report. The professionals preparing this report are to be licensed professionals in the State of Utah for their respective professions. Those preparing the report shall include: a licensed civil engineer for the grading and drainage portions of the project, a certified erosion control specialist for the erosion and sedimentation loss portions of the work. The City may accept other professionals who have had at least 6 years experience with erosion and sedimentation loss for this portion of the report including landscape architects and civil engineers. The City reserves the right to accept or reject qualifications of professionals proposed to prepare the report.
2. Grading Plan – The report is to include a grading plan for the project. This plan is to show present and proposed topography to include elevations, lines and grades including the location and depth of all proposed fills and cuts of the finished earth surfaces using a contour interval of one or two feet.
3. Graded Area – The report is to include the proposed are to be graded, which is to be clearly delineated on the plan. Identify depths of cuts and fills.
4. Drainage and Erosion Calculations and Details; Hydrologic Hazards – The report is to include all assumptions, information, calculations and proposed details used for design and construction of debris basins, impoundments, diversions, dikes, waterways, drains, culverts and other water management or soil erosion control measures shall be shown. Drainage calculations shall determine runoff volume and peak discharge using the “Rational Method”, “SCS Curve Number Method”, or appropriate equivalent. Data provided is to include:
 - a. Rainfall depth, duration and distribution
 - b. Watershed slope and drainage area delineation
 - c. Land condition or watershed surface
 - d. Existing and proposed topography of the drainage area

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- e. Description of soil conditions of watershed. Erosion calculations are to employ predictions of soil loss sheet erosion using the Universal Soil Loss Equation or appropriate equivalent. Data to be provided should include factors of:
 - (1) Rainfall intensity and duration. See West Jordan City Standards.
 - (2) Soil erodibility
 - (3) Land slope and length of slope or topography
 - (4) Condition of the soil surface and land management practices in use
 - (5) Surface cover, grass, woodland crops, pavements, etc.
 5. Erosion Control During Construction – The grading and drainage report will be prepared by the developers engineer in which he will describe the methods intended to be employed to control the erosion and sedimentation increase while in construction.
 6. Interim Stabilization during Construction – The developer/builder is responsible for interim stabilization of all disturbed areas during the period of construction to prevent erosion offsite effects and for final stabilization once construction is completed. The report prepared will address these issues.
 7. Limit of Watershed/100-Year Flood Plain Maps – The report is to include maps of the development site (1"=200'), which define the boundaries of any 100-year flood plain and the limits of the watershed.
 8. Existing Drainage Channels/Permits – The report shall include a separate map, which indicates the historic drainage channels associated with the project. Existing drainage channels shall remain as historically located except that roads and utilities may be installed across such channels as approved by the Planning Commission. Where these channels must be modified, permits must be obtained from Salt Lake County Flood Control, applicable canal companies, the Utah Division of Water Rights, as appropriate, and the US Corps of Engineers, as applicable. The developer shall provide copies of approval letters to the City. Structures and or lots shall be arranged so as to insure adequate setbacks from all drainage channels based upon the 100-year storm.
 9. Storm Water Collection Facilities – The report shall show any existing and proposed storm water collection facilities associated with the project. Storm water and sediment collection facilities shall be required to be constructed on development sites in accordance with the following:
 - a. Such facilities shall be the first improvements or facilities constructed on the development site.
 - b. Such facilities shall be designed to detain the storm water flows, including sediment loads, of a 10-year storm while allowing offsite discharge not to exceed 0.2 cubic feet per second per acre.
 - c. Such facilities shall be so designed as to divert surface water away from cut faces or sloping surfaces of a fill.
 - d. The existing natural drainage system will be improved as required by the City.
 - e. Where drainage channels are required, wide shallow swales lined with appropriate vegetation, rock, or other approved material are to be used instead of cutting narrow, deep drainage ditches.
 - f. Flow retarding devices, such as detention ponds, check dams and recharge berms are to be used where practical to minimize increases in runoff volumes and peak flow rates due to development.

10. Minimize Disturbance of Vegetation Cover – The Developer is to indicate in the report how he intends to minimize the disturbance of vegetative cover within the project. Construction of the development shall be such that it minimizes the disturbance of vegetation cover.
 11. Erosion Control Measures to Reduce Suspended Solids – The report to be prepared is to indicate the erosion control measures, which will be employed at the site, during construction and for the long-term. Erosion control measures on the development site shall be required to minimize the increased suspended solids loading in runoff from such areas. A drainage system shall be designed to control storm water erosion during and after construction.
 12. The report shall indicate that no grading or stripping is to be permitted unless the appropriate equipment is used and except as part of a development plan approved by Engineering and the Planning Commission
 13. Hydrologic Hazards - A description of any hydrologic hazards associated with the proposed site and adjacent area is required and are to be discussed in the report. Hydrologic hazards might include high water table, surface water impoundments, gradient of the property, flood plains, etc.
- E. Final Design Report - The developer is responsible for preparing a final design report for this portion of the work and submitting it to the City for review and approval, prior to the approval of the land disturbance permit. The final design report shall include the preliminary design report, the geotechnical report, the grading and drainage report and the final grading design and design of the subdivision drainage facilities related to the erosion and sediment report indicating the BMPs to be used for a specific project. The intent of the final design report is to provide sufficient information to the City to obtain their approval prior to proceeding with the preparation of plans and specifications.
- F. Subdivision Design for Grading and Drainage – Each subdivision is to be designed to provide a subdivision level drainage system. This subdivision level drainage system is to be composed of both public and private drainage facilities. The public drainage systems are to be located within the City's street right-of-ways and other fee parcels and the private systems are to be located within easements which are to be controlled by easement restrictions and covenants, codes and restrictions (CC&R's), and enforced by private agreements or through neighborhood associations. Drainage facilities located within private easements are not being considered as City responsibilities.
- In cases where lots cannot be graded to allow for the total amount of storm drainage to go to the streets, the designer shall provide for side yard and rear yard drainage facilities, which will convey individual lot drainage from each, lot and dispose of it properly. All attempts are to be made to drain individual lot storm water to the street.
- G. Lot Design for Grading and Drainage – Each lot is to be designed to provide for drainage into the subdivision level drainage system. This lot level drainage system is to be composed of private drainage facilities, i.e. grass-line swales, grading to allow drainage toward the street, rear yard storm water drainage facilities to pass water from one lot to another, etc. The private drainage systems are to be located within dedicated easements, which are to be administered and controlled by private parties. Drainage facilities located within private easements are not to be considered as the City's responsibility.

In cases where lots can not be graded to allow for the total amount of storm drainage to go to the streets, the designer shall provide for side yard and rear yard drainage facilities which will convey individual lot drainage to the subdivision level storm water drainage system. All attempts are to be made to drain individual lot storm water to the street.

No streets with cul-de-sacs are allowed unless measures are approved by the City Engineer. The facilities must meet minimum standards of the building codes as well.

- H. Structure Design for Drainage – All attempts need to be made to divert lot level storm drainage to the public right-of-way. This includes all impervious surface areas on each lot including roof drains, driveways, and other impervious surfaces. In the case of roof drains, the designer of the subdivision and lot are to provide for roof drainage discharge to the public street, wherever possible. The lot designer must provide for facilities to convey this type of storm water from the downspout to the curb and gutter by overland flow. The City will not allow the boring or cutting of curb and gutter to installation of piping systems for this purpose. The Engineering Department and Building and Safety Division are to review and approved these measures.

2.6 CLEARING, GRUBBING AND STRIPPING (See Appendix B – Section 02112)

- A. General – All clearing, grubbing and stripping work to be completed shall first be designed by a registered Geotechnical engineer and approved by the City. It consists of clearing of all structures, trees, brush and other organic and deleterious materials from the project site so that excavation and grading can begin. In preparing for this phase of work, the Developer needs to know that only certain options are open for disposing of material cleared from the site. The Developer or his contractor must obtain prior approval of the process requested.

During the clearing, grubbing and stripping work if the soils and/or vegetation indicate the area is a wetland, all work will cease at no cost to the City, until mitigation plan can be reviewed by the Army Corp of Engineers or the Natural Resource Conservation Service (NRCS).

- B. Vegetative Material Disposal - For trees, brush and other vegetative materials only the following disposal options are approved:
1. Burn the material – This is an option but a number of agencies will need to be consulted and permits obtained prior to using this method. Permits/approvals will need to be received from:
 - a. West Jordan Fire Department (WJFD).
 - b. State of Utah, Department of Environmental Quality, Division of Air Quality (DEA)
 - c. State of Utah, Department of Environmental Quality, Division of Water Quality
 - d. City of West Jordan, Community Development and Engineering departments
 - e. Other agencies as needed.
 2. Haul material to an approved landfill – This option will require that the Developer collect all vegetative material and haul it to a City approved landfill. The Developer will need to provide evidence that a landfill will accept the material and then evidence must also be provided which indicates the material was actually deposited at said landfill. The City must approve this method and destination prior to the Developer proceeding with this work.
 3. Chip and shred the material – If the Developer selects this disposal option, all vegetative materials will need to be disposed of through a mechanical chipping/shredding process. The machine to be used shall be a tub grinder through which all material shall be processed. Once the vegetative material has been processed through the tub grinder, the material will be

evening distributed across the topsoil it is to be mixed into and thoroughly mixed. See Appendix B – Section 02112.

The Developer and his contractor are hereby put on notice that any deviations from these three processes will result in the Developer and his contractor removing the material from where it has been deposited and properly disposing of the material. Disposal of the material by cutting it, running a tracked bulldozer over it to crush it and then mixing it with soil and disposing of the material on site is illegal and unacceptable. The use of such unapproved methods will be reported to the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste who also has jurisdiction of illegal landfills.

- C. Man-made Materials Disposal - For all man-made materials, such as processed wood, concrete, dry wall, adhesives, etc., only disposal at an approved landfill site is acceptable. The Engineer shall design the work covered under subsection 2.2 to meet the following technical specification section:

1. Section 02112. – Clearing, Grubbing and Stripping

- D. Topsoil – The topsoil contains valuable native seeds that commonly are not available to include in a native revegetation seed mix; an example is the State's native flower Sego Lily. Therefore, the construction plans should clearly identify the locations of the topsoil stockpile areas.

The Developer's engineer should use the project geotechnical report to determine the area required to stockpile the topsoil. To minimize the handling of the topsoil, construction sequencing should also be used in determining the topsoil stockpile locations. The construction should be clearly indicated.

1. Stockpile locations indicate by drawing a line around the area and adding a distinctive pattern within the area.
2. Sediment controls used to keep the topsoil from contaminating the surrounding areas.
3. Erosion controls to prevent wind, water, snow and ice erosion.

2.7 DUST CONTROL

- A. General – The Developer is responsible for controlling the dust produced at his project and shall provide the necessary mitigation to keep the dust to the acceptable limits identified in the air quality permit obtained from the State of Utah, Department of Environmental Quality, and Division of Air Quality. Ignorance of these codes and statutes is not an acceptable reason for not complying with these requirements.

2.8 GRADING AND EXCAVATION

- A. General – All grading work shall be done under the City's supervision, which shall include an engineering geotechnical consultant, retained and paid by the City and reimbursed by the Developer. The consultant shall be answerable to the City only.
- B. Grading – All grading work to be completed shall first be designed by a registered geotechnical engineer and approved by the City. As part of the approval process, the Developer shall prepare plans and specifications for the project, which identify existing topography and geology and indicate methods and processes to be used in doing the grading. Once the City has approved the

work, a geotechnical engineer shall have a representative on site at all times grading is being done and must oversee grading. The geotechnical engineer shall be retained and paid by the City and reimbursed by the Developer to the City. Once work has been completed, the Developer engineer shall prepare record drawings indicating the 'as-constructed' condition of the work.

The Engineer shall design the work covered under subsection 2.8 to meet the following technical specification sections:

1. Section 02200 – Earthwork
 2. Section 02210 – Site Grading
- C. Excavation – Excavation shall be performed to the lines and grades indicated on the Contract Documents. During excavation, material satisfactory for backfilling shall be stockpiled in a safe manner. Excavated material not required or not satisfactory for backfill shall be removed from the site. Excavation shall be braced and supported as need to prevent the ground, adjacent to the excavation, from sliding or settling. Localized slides or settlements shall be promptly removed and corrected by the Contractor.
1. Requirements. All land disturbance related construction or work shall have the land disturbance permit available on-site and shall be subject to inspections by authorized employees of the City, and certain types of work to be determined by the City Engineer shall have either continuous or constant inspection and supervision by a registered civil engineer, and/or other appropriate consultants, soils engineer, and engineering geologist as a condition of the issuance of the land disturbance permit. Prior to issuing a stamped and signed grading certificate by the civil engineer responsible for the grading operation, a final inspection shall be made of all construction or work for which a land disturbance permit has been issued.
 2. Exposure of work. Whenever any work on which inspections are required, as specified in this section, is covered or concealed by additional work without having first been inspected, the Construction Manager may require, by written notice, that such work be exposed for examination. The work of exposing and recovering shall not entail expense to the City.
 3. Notices. The land disturbance permit holder or his agent shall notify the Construction Manager twenty-four (24) hours in advance of the time when the grading operation is ready for each of the following inspections:
 - a. Initial inspections. When the land disturbance permit holder is ready to begin work but before any clearing and grubbing is started;
 - b. Toe inspections. After the natural ground is exposed and prepared to receive fill but prior to the placing of any fill. Approval for placing fill shall not be made until all debris and unsuitable material has been removed from the site to an approved location;
 - c. Subdrain inspections. Inspections shall be required on all subdrains after the installation but prior to the placement of any fill;
 - d. Excavation inspections. After the excavation is started but before the vertical depth of the excavation exceeds ten (10') feet;
 - e. Fill inspections. After the fill emplacement is started but before the combined vertical height of the lift exceeds ten (10') feet;
 - f. Drainage device inspections. After the forms, steel reinforcement, and pipe are in place but before any concrete is placed;
 - g. Rough grading. When all the rough grading has been completed. This inspection may be called for at the completion of the rough grading without the necessity of the City Engineer having previously reviewed and approved applicable reports;

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- h. Rough grading certification. A conditional interim certificate may be issued to the City Engineer to allow the issuance of building permits. This certificate shall in no way exonerate the applicant from completing the grading;
 - i. Final certification. When all work, including the installation of all drainage structures, other protective devices, the compaction of trench backfill, and planting and slope stabilization, has been completed and the "as built" plan and required reports have been submitted;
 - j. Other inspections. In addition to the called inspections provided by this section, the City Engineer may make any other inspections of any work to ascertain compliance with the provisions of this chapter and other laws; and
 - k. Interrupted grading. When the land disturbance permit holder is ready to resume work, but before any grading or brushing is started, the land disturbance permit holder or his agent shall notify the Construction Manager twenty-four (24) hours in advance of the time when the grading operation is ready.
 4. Certification. The City Engineer shall certify to the Building Official through the Developer's Engineer, upon the completion of the grading work, that all grading work has been done in compliance with all approved grading plans and reports and that all applicable Building Code regulations shall be administered by the office of the Building Official thereafter.
 5. Issuance of certificates. Upon the final inspection when it is found that the work authorized by the land disturbance permit, including the installation of all drainage structures, has been satisfactorily completed in accordance with the requirements of this chapter, a grading certificate covering such work shall be issued by the Developer's Engineer to the City Engineer.
 6. Final reports. Upon the completion of the work, the City Engineer may require the following reports and information:
 - a. A report from a registered civil engineer certifying that all grading, lot drainage, and drainage facilities have been completed in conformance with the approved plans and the provisions of this chapter and that the graded site will support residential or commercial type structures, whichever is applicable;
 - b. A soils engineering report including, but not limited to, certification of the soil bearing capacity, summaries of field and laboratory tests, locations of tests, expansive soil classification lot by lot, and slope tests taken in the fills showing the limits of compacted fill on an "as built" grading plan;
 - c. An engineering geology report by the engineering geologist, based on the final contour map, including specific approval of the grading as affected by geological factors. Where necessary, a revised geologic map, cross sections, and any recommendations necessary shall be included; and
 - d. When "as built" grading plans are required, as determined by the City Engineer, such plans shall be signed by the supervising civil engineer, the soils engineer, and the engineering geologist, when applicable, for their portions of the work.
 - e. Electronic copy of detention basins with volumes and calculations.

The Engineer shall design the work covered under subsection 2.4 to meet the following technical specification section:

1. Section 02222 – Excavation and Backfill for Structures

- D. Fills – All work performed under this item shall be under the direct supervision of a registered geotechnical engineer. The Developer shall be responsible for design and obtaining approval of the design from the City, prior to proceeding with construction. A geotechnical engineer shall also have a representative at the site during all times work is being performed on this work. The geotechnical engineer and his staff shall be retained by the City and directly paid for by the City from a deposit for this work from the Developer. The Contractor shall comply with these design and construction standards and the Contract Documents for the project in constructing the work.
1. Height. No finished fill slope shall exceed a vertical height of twenty-five (25') feet unless approved by the City Engineer and Planning Commission. If a fill slope is permitted above such height, a horizontal terrace with a minimum width of twenty-five (25') feet may be required to be installed at each one hundred (100') feet of vertical height, and intervening terraces also may be required.
 2. Slope. No fill shall be made which creates any exposed surface steeper in slope than three (3) horizontal to one vertical. Exceptions are:
 - a. The City Engineer may authorize a fill slope which is steeper in slope than two (2) horizontal to one vertical and is less than six (6') feet in height, if:
 - (i) The applicant can demonstrate that because of special circumstances applicable to the property, including size, shape, topography, location, or surroundings, the strict application of this section would deprive such property of the ability to be reasonably developed; and
 - (ii) The applicant produces sufficient data from a soils engineer, an engineering geologist, and a landscape architect to demonstrate that the material of which the slope is composed and that the material underlying the slope is capable of permanent stability on a steeper slope, and that the required slope planting can be adequately maintained.
 3. Unstable material. The City Engineer may require that the fill be constructed with an exposed surface less than three (3) horizontal to one (1) vertical if, under particular conditions, such flatter surface is necessary for stability or safety.
 4. Fill slope limits. Toes of fill slopes shall not be made nearer to a project property boundary line than one-half (1/2) of the height of the fill but need not exceed a horizontal distance of twenty (20') feet. Fill slopes shall not be divided horizontally by property lines, and fill slopes occurring on a side or rear lot line shall be made a part of the downhill lot. If the City Engineer determines such requirement is unnecessary because of special conditions, he may make adjustments as a condition of the land disturbance permit.
 5. Intervening terraces. Terraces shall be paved (reinforced concrete or gunite) terraces, shall have a minimum width of six (6') feet, shall be extensively landscaped in accordance with an approved landscaping plan, and shall be spaced at vertical intervals of twenty-five (25') feet; provided, however, for slopes less than forty (40') feet in vertical height, the terraces shall be approximately at mid-height. For slopes less than three (3) horizontal to one vertical, or where soil conditions require additional intervening terraces may be required.
 6. Compaction. All fills shall be placed, compacted, inspected, and tested in accordance with the provisions of this subsection. If the strict enforcement of the provisions of this subsection is determined by the City Engineer to be unnecessary because of the proposed or probable use of the land, he may waive the requirements. The requirements of this subsection shall not be waived when structures are to be supported by the fill, or if the fills are being placed in areas

- to be designated as hillside, or where they are necessary as a safety measure to aid in preventing the saturation, settling, slipping, or erosion of the fill.
- a. The natural ground surface shall be prepared to receive fill by removing vegetation, non-complying fill, topsoil, and/or porous, compressible soil. Where natural slopes are five (5) horizontal to one (1) vertical or steeper, and the height of the fill is twenty (20') feet or greater, benching into sound bedrock or other competent material shall be required. Fill slopes, which toe on natural slopes, shall be provided with adequate drainage.
 - b. No deleterious material shall be permitted in fills. Except as otherwise permitted by the City Engineer, no rock or similar irreducible material with a maximum dimension greater than eight (8") inches shall be buried or placed in fills.
 - c. Upon recommendations made by a soils engineer and approved by the City Engineer prior to the grading of any project, rock with dimensions from eight (8") inches to thirty-six (36") inches may be placed in compacted fill. Such oversized rocks shall not be in the upper ten (10') feet of compacted fill or nearer than twenty (20') feet to the surface of any fill slope. Such rock areas shall be shown on "as built" plans and certified to be compacted by the soils engineer.
 - d. The fill shall be spread in a series of layers, each not exceeding eight (8") inches in thickness, and shall be compacted by an approved method after each layer is spread.
 - e. The moisture content of the fill material shall be controlled at the time of spreading and compacting to obtain the required relative compaction and avoid excessive pore pressure as the fill increases in depth.
 - f. All fills shall be compacted to a minimum of ninety (90%) percent (unless under roadways) of the maximum density as determined by ASTM D 1557-66T, Method A or C, modified to three (3) layers. If the required degree of relative compaction cannot be attained on sloped surfaces, the slope shall be cut back until the compacted inner core is exposed.
 - g. The field density shall be measured in accordance with the procedure specified in ASTM D 1556-58T, or a later revision, using the optional base plate and making a suitable adjustment for volumes of rocks in the test hole or other approved testing methods giving equivalent test results.
 - h. A field density test, as set forth in this subsection, shall be taken for each eighteen (18") inches of fill, or portion thereof, measured vertically from the lowest point of the area to be filled, or for each one thousand (1,000) cubic yards of fill placed. In addition, in the case of subdivisions, at least one field density test shall be taken on each lot, which receives fill.
 - i. All fills regulated by the provisions of this chapter shall be tested for relative compaction by the soils engineer. A certificate of compliance with the terms of this section and the land disturbance permit, setting forth densities, relative compaction, the expansive soil report, allowable bearing value, and other soil characteristics, shall be prepared and signed by the soils engineer. The Developer is responsible for paying for these tests. Such report shall be submitted to, and be approved by, the City Engineer before any final approval of the fill is given and before any foundation construction begins.
 - j. If building is not commenced within one year following the final certification and approval by the City Engineer, a reevaluation as to the adequacy of the intended use and a report shall be filed with the City Engineer for approval. Such report shall contain data on compaction, stabilization, and expansive soils.
7. Fills toeing out on natural slopes. Fills toeing out on natural slopes, which are steeper than three (3) horizontal to one vertical, shall not be permitted.

8. Combined cut and fill slopes. Combined cut and fill slopes shall meet the requirements of subsections (a), (b), (c), and (d) of this section insofar as steepness, height, and benching are concerned except that, where the slope exceeds twenty-five (25') feet in height, the required drainage bench shall be placed at the top of the cut slope. Fill placed on or above the top of an existing or proposed cut or natural slope steeper than three (3) horizontal to one vertical shall be set back from the top of the slope a minimum distance of six (6') feet.
9. Existing fills. All existing man-made fills on any and all sites shall be properly evaluated, and, if deficiencies exist, recommendations and design criteria for corrective measures shall be included within the soils engineering report.
10. Progress reports.
 - a. Periodic soils reports by a soils engineer certifying the compaction or acceptability of all fills may be required. Such reports shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill and the removal of all soil and unsuitable materials, the bearing capacity of the fill to support structures, the placement and compaction of fill materials, and the inspection of buttress fills, subdrains, and similar devices. The frequency of such reports shall be at the discretion of the City Engineer and shall be a condition of the land disturbance permit. If the report is not submitted in a timely manner, the City Engineer may temporarily revoke or put on hold the Land Disturbance permit and all work should cease until such time as the report is submitted.
 - b. The City Engineer may require sufficient inspections by an engineering geologist to ensure that all geologic conditions have been adequately considered. Where geologic conditions warrant, the City Engineer may require periodic geologic reports. Such inspections and reports may be required to include, but need not be limited to, the inspection of cut slopes, canyons during clearing, operations for groundwater and earth material conditions, benches or keys prior to the placement of fill, and possible underground water spring locations.
11. Measure of settlement. On fills of forty (40') feet or more, if recommended by the soils engineer, the City Engineer or the Building Official may require the determination of the settlement characteristics of such fills to establish that any movements have substantially ceased.
12. In such cases, a system of bench marks shall be installed by a civil engineer or land surveyor at critical points on the fill, and accurate measurements of both horizontal and vertical movements shall be taken and evaluated by the soils engineer for a period of time sufficient to define the settlement behavior. The evaluation period shall in all cases include the period from October 15 through March 15.

The Engineer shall design the work covered under subsection 2.4 to meet the following technical specification sections:

1. Section 02291 – Embankment
2. Section 02292 – Dam Embankment Construction

E. Buttress Fills

1. General. A buttress fill is a designed compacted earth fill used for providing lateral support to an unstabilized earth or rock mass. All buttress fills shall be designed in accordance with the recommendations and design criteria, including the subdrain system, submitted by the soils engineer or engineering geologist with the approval of the City Engineer.
 2. Foundation. The ability of the foundation soil to support the buttress shall be investigated, and additional benching shall be required to what is otherwise specified for ordinary fills. The soils engineer shall provide specifications for keying the base of the buttress and for bonding the buttress to the natural ground.
 3. Subdrains. Subdrains which blanket the entire back face of the buttress or which occur at intervals shall be provided to prevent the buildup of hydrostatic pressure. The details of subdrains shall be provided by the soils engineer.
 4. Safety factor. The buttress fill shall be designed for a minimum safety factor of 1.50 based upon the smaller value of yield or ultimate shear strength of the fill material.
- F. Topsoil – The Developer shall design the project to retain the topsoil on-site and not export it to an off-site location. Topsoil shall be stripped, processed and stockpiled or live hauled to an adjacent reclaim area in accordance with the requirements of the Contract Documents and Section 3.0 of these standards
- G. Slope Preparation – Care must be taken to properly prepare the slopes for acceptance of seed erosion control blankets or other approved erosion control material. Clods, rock, tree, brush and other plant material and other obstructions shall be removed from the slope so that direct contact of the soil erosion blanket can be maintained for the entire blanket.

The Engineer shall design the work covered under subsection 2.4 to meet the following technical specification section:

1. Section 02293 – Slope Contouring
- H. Building Lots Requiring Additional Fill – Lots requiring additional fill dirt in excess of 12-inches shall submit the following information for review, prior to construction. The International Building Code, Appendix 33 and City Ordinances are to be followed in the event a conflict exists than the more restrictive ordinance shall govern.
1. Geotechnical report addressing the following:
 - a. Is existing soil able to receive the proposed additional fill?
 - b. Is proposed fill material to be used correct for such usage?
 - c. Procedure of placing additional fill
 - (1) Maximum lift eight inches
 - (2) Compaction to be 95% minimum
 - (3) Correct moisture
 - d. Surface treatment to prevent erosion
 - e. Maximum finish slope to be no greater than two (horizontal) to one (vertical)
 - f. Slope setbacks to be as per International Building Code Appendix, Chapter 33, Excavation and Grading section 3314-Setbacks
 - (1) Top of Slope: Height of slope divide by five (H/5); minimum of two feet and maximum of ten feet with additional setback for drainage surface waters.

(2) Toe of Slope: Height of slope divided by two (H/2) minimum of two feet and maximum of ten feet.

2. Final report from Geotechnical Engineer.
 - a. The conditions and procedure in the original geotechnical report was followed. Final report shall be written by author of original Geotechnical report

2.9 EROSION CONTROL AND DRAINAGE DEVICES

- A. Intervening Terraces - Paved (reinforced concrete or gunite) intervening terraces shall have a minimum width of six (6') feet and may be installed on the face of all cut and fill slopes at intervals not to exceed twenty-five (25') feet measured along a vertical plane.

The longitudinal slope of intervening terraces shall not be less than two (2%) percent or more than twelve (12%) percent, and any change in the rate of grade within these allowable slopes shall increase the grade in the direction of the flow.

A single run of an intervening terrace shall not exceed two hundred (200') feet to a down-drain. If soil in paved terrace areas is termed "expansive", the paved terraces shall be designed by a registered civil engineer to resist the expansive characteristics of the area.

- B. Diverter Terraces - Where recommended by a soils engineer, paved (concrete or gunite) diverter terraces, a minimum of thirty (30") inches in width and one (1') foot in depth, shall be installed at the top of all cut slopes where the tributary drainage area above has a slope exceeding ten (10) horizontal to one vertical and a horizontal projection greater than fifty (50') feet. The diverter terrace design shall be shown on each plan for City approval, based on the recommendations of the soils engineer and engineering geologist to the satisfaction of the City Engineer.

- C. Vee Channels - Where a slough wall is required at the toe of the slope, the City Engineer may require a vee channel to be constructed behind the wall to carry off the slope waters.

- D. Inlet Structures, Down-drains, and Outlet Structures.

1. Inlet structures. Inlet structures shall be of concrete and galvanized metal. The inlet shall be grated or grided or of such entry shape as to prevent the entry of objects of greater than four (4") inches dimension and permit objects of a maximum of two (2") inches dimension. Inlet structures shall be placed on the bench and shall be so shaped as to provide small entry losses. An overflow structure into the "vee" down-drains shall be provided.
2. Down-drains. Down-drains shall be of concrete, corrugated galvanized iron hot-dipped in asphalt, or equivalent. Pipe down-drains shall have a diameter of a size required by runoff calculations but not less than twelve (15") inches. Open channel down-drains shall be designed by a civil engineer and shall have a minimum capacity equal to four (4) times the capacity of the required pipe size. The alignment of down-drains shall be such as to maintain a constant velocity head.
3. Cleanouts. Cleanouts shall be provided at all points of severe change in grade and at points of entry to public rights-of-way.

4. Outlet structures. Outlet structures shall be of concrete, galvanized iron hot-dipped in asphalt, or equivalent. Where outletting into streets, the structure shall be of City standards or a design approved by the City Engineer. Where outletting into natural watercourses or other approved locations, the structure shall be provided with adequate velocity reducers, diversion walls, riprap, concrete aprons, or any similar energy dissipator. All slope drainage shall be collected and disposed of in the drainage device.
- E. Runoff Computations - Runoff shall be based upon the proper fifty (50) year isohyetal map, and the runoff calculation shall be based upon the latest methods adopted by the City Engineer.
- F. Drainage Dispersal Walls - A drainage dispersal device shall be constructed whenever it is necessary to convert channel flow to sheet flow, and the structure shall be of a design approved by the City Engineer.
- G. Subdrains - Subdrains shall be installed to collect any active or potential springs or seeps, which will be covered by the fill. Subdrains shall be installed after any watercourse has been excavated to firm material in preparation for receiving the fill. Individual design shall be shown on each plan for the City Engineer's approval. Upon the recommendation of the soils engineer and engineering geologist, and upon the approval of the City Engineer, the installation of subdrains may be eliminated.
- H. Site Drainage - All building pads with cut or fill shall be constructed to carry surface waters to the nearest practical street, storm drain, or natural watercourse approved by the City Engineer and/or appropriate governmental agency as a safe place to deposit such waters. At least a two (2%) percent grade toward the approval disposal area shall be required for building pads. Where recommended by the soils engineer, eave or ground gutters shall be provided to receive all roof water and deliver it through a non-erosive device to a street or watercourse. Compacted fill berms shall be required to be constructed at the top of all slopes where diverter terraces are not required by the City Engineer.

2.10 SLOPE EROSION PROTECTION

- A. General – Storm water from construction sites can cause a great deal of damage to a construction project, as well as the existing City maintained storm drain system. To repair these damages, additional funds are required from Developers and other to repair these damages, which costs can be avoided. This section provides the Developer with a few “Best Management Practices” (BMP) accepted nation wide, by the international erosion control industry and the City of West Jordan. The purpose of this section is to indicate BMP’s approved by the City and does not attempt to make an exclusive list of approved BMP’s. Should the Developer wish to use BMP’s not indicated here, the proposed BMP will be submitted to the City for approval, seven days before the preconstruction meeting is held with the City before implementing proposed BMP. It is unacceptable to use an unapproved BMP, and is the basis of a work stop order being placed on the project. The work stop will remain in force until said BMP is approved by the City or removed and replaced with an approved BMP.
- B. Sediment and Erosion Control BMP – For the convenience of the Developer, engineer and builder, the City has prepared several tables, which indicate the BMP required for various situations and conditions. The situations include construction sites, slopes, soil types and then indicate the sediment control and erosion control BMP’s approved by the City. Please refer to the following tables. If there is a conflict between the tables and the written description of the Sediment and

Erosion Control BMP, the written description will control. The table is not an inclusive list of all approved BMP and actual site conditions may mandate the use of additional BMP not listed.

The difference between sediment control and erosion control is that sediment control contains the soil that has been eroded from the area of disturbance to the lowest point of the drainage, on or offsite. Due to regrading, sediment removed for streets and maintenance of the sediment control BMP, sediment control is more expensive to pay for than properly designed and installed erosion control.

Erosion control is based on the principal that the soil stays in the location of final grading. Erosion control BMPs are designed so the soil remains stable and does not become displaced during rainfall or other source of water events.

SEDIMENT AND EROSION CONTROL BEST MANAGEMENT PRACTICES				
Area	Soil Type	Slope	Type of Protection	
			Sediment Control	Erosion Control
Construction Site	Clay	>4:1 (25%)	Silt fence, silt barriers, construction entrance, inlet protection, wattles, sediment basins	Construction phasing, temporary and permanent seeding/mulch, mulch, riprap, surface roughing
		>3:1 (33.3%)	Silt fence, silt barriers, construction entrance, inlet protection, wattles, sediment basins	Construction phasing with temporary or permanent seeding/mulch, riprap, or mulch/tackifier, anchored straw, soil retention blankets, surface roughing
		>2:1 (50%)	Silt fence, silt barriers, construction entrance, wattles, inlet protection	Construction phasing with temporary or permanent seeding/mulch (anchored), riprap, or anchored mulch, soil retention blankets, or anchored straw
Construction Site	Sand	>4:1 (25%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing with surfacing roughing or temporary or permanent seeding/mulch (tackifier), or mulch with tackifier, anchored straw
		>3:1 (33.3%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing with temporary or permanent seeding/anchored mulch, mulch, riprap or anchored mulch, soil retention blankets

		>2:1 (50%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing, temporary and permanent seeding/mulch, mulch, riprap, anchored mulch, soil retention blankets, reinforced turf mats

SEDIMENT AND EROSION CONTROL BEST MANAGEMENT PRACTICES				
Area	Soil Type	Slope	Type of Protection (Best Management Practices)	
			Sediment Control	Erosion Control
Slopes	Clay	>4:1 (25%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing, temporary and permanent seeding/mulch, mulch, riprap, surface roughing, soil vegetation blankets
		>3:1 (33.3%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing, temporary and permanent seeding/mulch, riprap, mulch/tackifier, anchored straw, surface roughing, soil vegetation blankets
		>2:1 (50%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing, temporary and permanent seeding/mulch, riprap, anchored mulch, anchored straw, surface roughing
Slopes	Sand	>4:1 (25%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing with surfacing roughing or temporary or permanent seeding/mulch or mulch/tackifier
		>3:1 (33.3%)	Silt fence, silt barriers, construction entrance, inlet protection, sediment basins	Construction phasing with temporary or permanent seeding/mulch, mulch with tackifier or anchored straw or anchored mulch or soil retention blankets
		>2:1 (50%)	Silt fence, silt barriers,	Construction phasing with

			construction entrance, inlet protection, sediment basins	temporary or permanent seeding/mulch, mulch with tackifier or anchored mulch, or soil retention blankets, or reinforced turf mats

- C. Erosion Control BMP – The Developer shall design and provide temporary erosion control measures as part of the project. Erosion control measures are to be used for disturbed areas, which will remain, untouched for more than 14 day but less than 21 days. These measures may include mulch and temporary seeding for interior slope stabilization and are discussed more thoroughly in Section 3.0 of these standards.
- D. Erosion Control – The Developer shall design the project to provide erosion control measures. Erosion control measures are those, which will be constructed to provide for long-term (2-5 year) protection of soils on the project. Erosion control measures are those that prevent the displacement of soil particles. Examples of erosion controls include bonded fiber matrix mulches, tackifiers, erosion control or soil retention blankets. The majority of these measures are discussed more thoroughly in Section 3.0 of these standards, except for the interceptor, roadway and toe ditches which are discussed below.
- E. Interceptor, Roadway and Toe Ditch – The Engineer shall design the facility to include interceptor, roadway and/or toe ditches where it is deemed necessary to collect storm water and direct it to a discharge location. These ditches shall receive an increased amount of armoring in the way of soil erosion blankets, turf reinforced mats, energy dissipaters and riprap as determined by hydraulic design ‘The Tractive Force Theory’ as indicated in the Federal Highway Administration Hydraulic Engineering Circular No. 15 Design of Roadside Channels with Flexible linings is the method acceptable to the City. The design will be the determining factor of channel material used.

The Engineer shall design the work covered under subsection 2.5 to meet the following technical specification section:

1. Section 02273 – Interceptor, Roadway and Toe Ditch
- F. Brushlayering See Appendix A - 5200
1. Purpose: This technique is used to stabilize slopes, particularly road fill slopes where construction has or will result in unstable soil conditions. A modified brushlayering technique often referred to as ‘trenchpacking’ or ‘branchpacking’ can be installed with hard labor to repair existing rills and gullies or steep fill slopes. Both ‘brushlayering’ and ‘branchpacking’ place live branches horizontally in successive layers up the face of the slope. The brushlayer branches, especially after rooting, reinforce slopes by serving as tensile inclusions, which provide frictional resistance to sliding or other types of displacement. The protruding brush retards runoff and reduces surface erosion.
 2. Conditions Where Practice Applies: Brushlayering is best used concurrently with construction of fill slopes or embankments. Cuttings are placed by hand while heavy equipment is used to fill and compact each successive lift of soil fill. Brushlayering is similar in principle to other reinforced earth practices except that the reinforcing

material is live branches. This practice is also a good remedial action intended to repair gullies or existing slopes, but may have limited applications in arid areas unless irrigated. Brushlayering performs several functions for erosion control, earth reinforcement and slope stability:

- a. Breaking up the slope length into a series of shorter slopes separated by rows of brushlayer.
 - b. Reinforcing the soil with the unrooted branch stems.
 - c. Reinforcing the soil as roots develop, adding significant resistance to sliding or shear displacement.
 - d. Providing slope stability and allowing vegetative cover to become established.
 - e. Trapping debris on the slope.
 - f. Aiding infiltration on dry sites.
 - g. Drying excessively wet sites.
 - h. Adjusting the site's microclimate, thus aiding seed germination and natural regeneration.
 - i. Redirecting and mitigating adverse slope seepage by acting as horizontal drains.
3. Planning Consideration:
- a. Plant material harvest and installation should be performed during its dormant season, late fall to early spring.
 - b. Use site reconnaissance to identify willow species, growth form, and soil and site conditions on adjacent sites and compare their conditions to the construction site. Planting will be more successful as the soil, site conditions and species selected match stable and vegetated nearby sites.
 - c. The ideal plant materials for wattling are those that: 1) root easily; 2) are long, straight and flexible; and 3) are in plentiful supply near the job site. Willow (*Salix* spp.) makes ideal wattling material. Some species of *Baccharis*, *Cornus*, and *Populus* also have very good rooting ability.
 - d. Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on site before construction begins.
 - e. When choosing live willow material for bioengineering applications, remember that young (less than 1 year old) wood or suckers will often sprout easier under optimum conditions but healthy, older wood (1 to 4 years old) has greater vegetative (energy) reserves necessary to consistently sprout and the older wood is much stronger. If possible, mix younger wood with older wood for the bioengineering application such that a majority of the material is 1 to 4 years old.
 - f. Research indicates that all cuttings should be soaked for a minimum of 24 hours, whether they are stored or harvested and immediately installed (Hoag 1991; Hoag et al. 1991; Hoag et al. 1992). Some research recommends soaking the cuttings for as much as 10 to 14 days
 - g. Willows have several different growth forms, from shrubs to large trees. Small to medium sized shrub-type and rhizomatous or creeping-type willows are used for planting channel banks. Upland willow species are found in relatively dry areas and should be used on similar sites. Tree-type willows are selected for the upper bank and flood plain area.
 - h. If branch cuttings are not pre-soaked then they shall be harvested no earlier than 48 hours prior to installation. Cuttings must be kept moist and cool at all times between cutting and installation therefore, all cuttings need to be thoroughly wet and covered with moistened wrapping before being transported.
 - i. Construction personnel shall be made aware that brushlayering uses live plant material and must be treated as such.
 - j. Spacing between the brushlayers is determined by the erosion potential of the slope (i.e., soil type, rainfall, and length and steepness of the slope). Spacing may be from 3-8 feet

(1-2.5 m). On long slopes, brushlayer spacing should be closer at the bottom and spacing may increase near the top of the slope.

Steep slopes (2:1) should not exceed, approximately, 30 feet in slope length. Reinforced earth design guidelines suggest that the slope height should not exceed 3 times the width of the reinforced volume. Therefore, for brushlayering with 6-8 foot long cuttings, the slope height should not exceed 8-24 feet.

G. Cellular Confinement System for Slope Stabilization (See Appendix A – 5205)

1. Purpose: Cellular Confinement System (CCS) is a permanent erosion control practice intended to stabilize steep slopes. The expandable panels create a cellular system that confines topsoil infill, protect and reinforce the plant's root zone, and permits natural subsurface drainage. The honeycomb shaped cells encapsulate and prevent erosion of the infill material. The cellular confinement systems are used for:
 - a. Revetments - filling the cells with rock, gravel, or topsoil can provide an alternative to hard armor revetment systems.
 - b. Erosion control on steep slopes - cells can be infilled with soil and vegetated or infilled with granular materials for sterile arid regions. Slopes as steep as 1:1 can be treated with cellular confinement systems.
 - c. Flexible channel lining systems, either vegetated or rock filled.
 - d. Framework for earth retaining structures.
 - e. Road stabilization - cells confine and reinforce select fill materials, thereby increasing load-bearing capacities.
 - f. Temporary low-water stream crossings.

H. Erosion Blankets and Turf Reinforcement Mats Slope Installation (See Appendix A – 5210)

1. Purpose: Erosion control blankets are used to temporarily stabilize and protect disturbed soil from raindrop impact and surface erosion, to increase infiltration, decrease compaction and soil crusting, and to conserve soil moisture. Mulching with erosion control blankets will increase the germination rates for grasses and forbs and promote vegetation establishment. Erosion control blankets also protect seeds from predators, reduce desiccation and evaporation by insulating the soil and seed environment.

Some types of erosion control blankets and turf reinforcement mats are specifically designed to stabilize channelized flow areas. These blankets and mats can aide the establishment of vegetation in waterways and increase the maximum permissible velocity of the given channel by reinforcing the soil and vegetation to resist the forces of erosion during runoff events. Stems, roots and rhizomes of the vegetation become intertwined with the mat, reinforcing the vegetation and anchoring the mat.

2. Conditions Where Practice Applies: Establishing vegetation in channels or on slopes may require additional measures beyond seeding and straw mulching. Conditions where erosion control blankets and mats are appropriate may include:
 - a. Slopes and disturbed soils where mulch must be anchored and other methods such as, crimping or tackifying are neither feasible nor adequate.
 - b. Steep slopes, generally steeper than 3:1.
 - c. Slopes where erosion hazard is high.
 - d. Critical slopes adjacent to sensitive areas such as streams and wetlands.

- e. Disturbed soil areas where planting is likely to be slow in providing adequate protective cover.
 - f. Channels with flow exceeding 2-4 ft./sec.
 - g. In channels intended to be vegetated and where the design flow exceeds the permissible velocity. Allowable velocity, with turf reinforcement mats after vegetative establishment, is up to 10 ft/sec.
3. Specifications: Erosion control blankets are generally a machine produced mat of organic, biodegradable mulch such as straw, curled wood fiber (excelsior), coconut fiber or a combination thereof, evenly distributed on or between photodegradable polypropylene or biodegradable natural fiber netting. Synthetic erosion control blankets are a machine-produced mat of ultraviolet stabilized synthetic fibers and filaments. The nettings and mulch material are stitched to ensure integrity and the blankets are provided in rolls for ease of handling and installation.

Soil stabilization and turf reinforcement mats are high strength, flexible, machine produced, three-dimensional matrix of nylon, polyethylene, polypropylene or polyvinyl chloride that have ultra violet (UV) stabilizers added to the compounds to ensure endurance and provide 'permanent vegetation stabilization'.

4. Planning Considerations: Erosion control blankets and turf reinforcement matting can be applied to problem areas to supplement nature's erosion control system (vegetation) in its initial establishment and in providing a safe and 'natural' conveyance for high velocity storm water runoff. These products are being used today in many applications where previously a structural lining or armoring would have been required. Care must be taken to choose the type of blanket or matting which is more appropriate for the specific needs of a project. There are many soil stabilization products available today and it is very difficult to cover all the advantages, disadvantages and specifications of all the manufactured blankets and mats. therefore, as with many erosion control type products, there is no substitute for a thorough understanding of manufacture's instructions and recommendations and a site visit by a designer or plan reviewer to verify a product's appropriateness.

I. Live Staking (See Appendix A – 5220)

1. Purpose: Using a system of live stakes creates a root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting excess soil moisture. The practice is commonly used in conjunction with other practices to provide for a more stable site conditions (i.e., used to anchor blankets, coir mats, turf reinforcement mats, straw rolls, etc.).
2. Planning Consideration:
 - a. Live stake harvest and installation should be performed during its dormant season, late fall to early spring.
 - b. Use site reconnaissance to identify willow species, growth form, and soil and site conditions on adjacent sites and compare their conditions to the construction site. Planting will be more successful as soil, site and species selected match stable, vegetated nearby sites. Live staking may have limited applications and success in arid environments unless irrigated.
 - c. If native willows or cottonwood are not found in the vicinity, live staking may not be a good option.

- d. Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on site before construction begins.
- e. Planting willows, in some cases, can adversely interact with other natural forces; such as water hydraulics.

Willows have several different growth forms, from shrubs to large trees. Small to medium sized shrub-type and rhizomatous or creeping-type willows are used for planting channel banks. Upland willow species are found in relatively dry areas and should be used on similar sites. Tree-type willows are selected for the upper bank and flood plain area.

J. Waterbars and Rolling Dips (See Appendix A – 5230)

1. Purpose: To limit the accumulation of erosive volumes of water on roads by diverting surface runoff at predesigned intervals.
2. Planning Considerations: Construction of access roads, power lines, pipelines, and other similar installations often requires clearing long narrow right-of-ways over sloping terrain. Roads concentrate runoff. Gully formation may be especially severe in tire tracks and ruts. To prevent gully erosion, runoff can often be diverted across the width of the right-of-way to undisturbed areas by using waterbars or rolling dips.
3. A waterbar is a berm and excavation built diagonally across the road. Waterbars generally become less effective if driven over during wet weather, and are difficult to cross with low clearance vehicles. Rolling dips are gently sloping excavations running diagonally across the road surface, and are more appropriate for winter use. Rolling dips are more difficult to construct, but are much easier to traverse and require less maintenance.
4. Frequent rolling dips are often preferable, both economically and hydrologically, to improperly spaced cross road drains such as culverts.
5. Give special consideration to each individual outlet area, as well as to the cumulative effect of added diversions. Never outlet waterbars or rolling dips onto unprotected fill slopes. Use gravel to stabilize the diversion where significant vehicular traffic is anticipated.
6. Design Criteria: (See Appendix A – 5230)
 - a. Waterbars Height: 18-inch minimum measured from the channel bottom to the ridge top.
 - b. Side Slope: 2:1 or flatter; 3:1 or flatter where vehicles cross.
 - c. Base width of ridge: 6-foot minimum.
 - d. Spacing of waterbars/rolling dips is shown in the Table below.

Table 1.

Slope (%)	Spacing ft.	Spacing High Erodable ft.
<5	125	100
5 to 10	100	75

10 to 20	75	50
20 to 35	50	25
>35	25	25

- e. An additional check for appropriate spacing is the distance it takes for the unrocked, unprotected running surface of a nearby road to develop a 1-inch rill is a rough measure of the appropriate spacing distance.
- f. Grade and angle: Positive grade not to exceed 2%. A crossing angle of approximately 60 degrees is preferred.
- g. Outlet: Diversions should have stable outlets, either natural or constructed. Site spacing may need to be adjusted for field conditions to use the most suitable areas for water disposal - into brush, onto a ridgeline, or onto an energy dissipator.

K. Slope Drain (See Appendix A – 5235)

1. Purpose: To convey concentrated runoff down the face of a cut or fill slope without causing erosion.
2. Conditions Where Practice Applies: This practice applies to construction areas where storm water runoff above a cut or fill slope will cause erosion if allowed to flow over the slope. Temporary slope drains are generally used in conjunction with diversions to convey runoff down a slope until permanent water disposal measures can be installed.
3. Planning Considerations: Constructed slopes are often exposed to erosion between the time they are graded and permanently stabilized. During this period, the slope is very vulnerable to erosion, and temporary slope drains together with temporary diversions can provide valuable protection.

It is very important that these temporary structures be sized, installed, and maintained properly, because their failure will usually result in severe erosion of the slope. The entrance section to the drain should be well entrenched and stable so that surface water can enter freely. The drain should extend downslope beyond the toe of the slope to a stable area or appropriately stabilized outlet. Appropriate TRM or rock lining should be installed to ensure stable drains.

Other points of concern are failure from overtopping from inadequate pipe inlet capacity and lack of maintenance of diversion channel capacity and ridge height.

4. Design Criteria:
 - a. Capacity: Peak runoff from the 10-year storm. See reference material for determining the peak runoff.
 - b. Pipe size: Unless they are individually designed, size drains according to the Table below:

Maximum Drainage Area per pipe	Pipe Diameter inches

0.50 ac.	12
0.75 ac.	15
1.00 ac.	18
>1.00 ac*	as designed

*Inlet design becomes more complex beyond this size.

- c. Conduit: Construct the slope drain from heavy-duty, flexible materials such as non-perforated, corrugated plastic pipe, or open top overside drains with tapered inlets. Install reinforced, hold-down grommets or stakes to anchor the conduit at intervals not to exceed 10 feet (3 m) with the outlet end securely fastened in place. Corrugated plastic pipe must have one (1) anchor assembly for every 20 feet of slope drain. The conduit must extend beyond the toe of the slope.
- d. Entrance: Construct the entrance to the slope drain of a standard flared-inlet section of pipe with a minimum 6-inch. Make all fittings watertight. A standard T-section fitting may also be used at the inlet. An open top flared inlet for overside drain may also be used.
- e. Temporary Diversion: Generally, use an earthen diversion with a dike ridge or berm to direct surface runoff into the temporary slope drain. Make the height of the ridge over the drain conduit a minimum of 1.5 feet and at least 6 inches higher than the adjoining ridge on either side. The lowest point of the diversion ridge should be a minimum of 1-foot above the top of the drain so that design flow can freely enter the pipe.
- f. Outlet Protection: Protect the outlet of the slope drain from erosion with an energy dissipator.

L. Biolog/Straw Rolls (See Appendix A – 5250 Biolog Rolls)

1. Definition: Straw rolls are manufactured from straw that is wrapped in tubular black plastic netting. They are approximately 9-inches in diameter by 25-30-feet long. Rolls are placed and staked along the contour of newly constructed or disturbed slopes.
2. Purpose: Straw rolls are intended to capture and keep sediment on the slopes. Straw rolls are useful to temporarily stabilize slopes by reducing soil creep and sheet and rill erosion until permanent vegetation can get established. Installed, straw rolls shorten the slope length, thereby interrupting the raveling and rilling processes, and reduce the slope steepness. They catch soil material that moves down the slope by the freeze/thaw processes. Organic matter and native seeds are trapped behind the rolls, which provide a stable medium for germination. Rolls trap fertile topsoil and retain moisture from rainfall, which aids in growth of tree seedlings planted along the upslope side of the rolls.
3. Design Considerations: Sites appropriate for straw rolls are:
 - a. Slopes susceptible to sheet and rill erosion;
 - b. Slopes producing dry ravel;
 - c. Slopes susceptible to freeze/thaw activity; or slopes difficult to vegetate because of soil movement. Straw rolls are not intended for use in concentrated flow situations.
 - d. Spacing of biolog/straw rolls – spacing is to be calculated using the soil loss tolerance factor of “1”.

It is imperative, especially on steeper slopes, that a sufficient trench is constructed to place the roll in. Without it, the roll will not function properly, runoff will scour underneath it, and trees or shrubs planted behind the roll will not have a stable environment in which to become established.

Straw rolls will last an average of one to two years. This is an important factor when planning the optimum length of time the slope will need mechanical stabilization.

Straw rolls can be staked with willow stakes if site conditions warrant and the moisture retained by the straw roll will encourage willow establishment.

a. Advantages:

- (1) Straw rolls are a relatively low-cost solution to sheet and rill erosion problems.
- (2) They can replace silt fences or straw bales on steep slopes.
- (3) Rolls are a short-term solution to help establish native vegetation.
- (4) Rolls store moisture for vegetation planted immediately upslope.
- (5) Plastic netting will eventually photo degrade, eliminating the need for retrieval of materials after the straw has broken down.
- (6) Straw becomes incorporated into the soil with time, adding organic material to the soil and retaining moisture for vegetation.
- (7) Depending on slope steepness, straw rolls are installed at 25-50-foot intervals on the slope.

b. Disadvantages:

- (1) Rolls only function for one or two seasons.
- (2) Pilot holes through the rolls must be predriven with a metal rod.
- (3) If not installed properly with a sufficient trench, rolls may fail during the first rain event.

Straw rolls may require maintenance to ensure that the stakes are holding and the rolls are still in contact with the soil. This is especially true on steep slopes in sandy soil.

M. Surface Roughening (See Appendix A – 5255)

1. Definition: Roughening is a technique for roughening a bare soil surface with furrows running across the slope, stair stepping (5215), or tracking with construction equipment.
2. Purpose: Surface Roughening is intended to aid the establishment of vegetative cover from seed, to reduce runoff velocity and increase infiltration, and to reduce erosion and provide for sediment trapping.
3. Conditions Where Practice Applies: All construction slopes require surface roughening to facilitate long-term stabilization with vegetation, particularly slopes steeper than 3:1.
4. Planning Considerations: Rough slope surfaces are preferred because they aid the establishment of vegetation, improve water infiltration, and decrease runoff velocity. Graded areas with smooth, hard surfaces may be initially attractive, but such surfaces increase the potential for erosion. A rough, loose soil surface gives a mulching effect that provides more favorable moisture conditions than hard, smooth surfaces; this aids seed germination.

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include grooved or serrated slope grading, furrowing, and tracking. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling

N. Wattles (See Appendix A – 5260)

1. Purpose: Wattling functions to reduce erosion and stabilize slopes in several ways:
 - a. The wattle bundles, binding rope and stakes are all structural components, which combine to stabilize the surface layers of the slopes by resisting hydraulic and gravitational forces.
 - b. Wattling prevents rills and gullies by reducing the effective slope length and thereby dissipating the energy of water moving downslope. Wattles immediately reduce surface erosion.
 - c. The terraces formed by a series of wattles trap sediment and detritus. Infiltration is increased as runoff is slowed and on dry sites this increases the available water for plant establishment.
 - d. Vegetation establishment is enhanced because wattling provides a suitable microsite for plants by reducing surface erosion, increasing infiltration rates and by forming a series of terraces with shallower slope angles.
2. Conditions Where Practice Applies: Wattling may be used for road fills, road cuts, gullies or slumped areas, eroded slopes or eroding stream banks.
 - a. Repair of small earth slips and slumps or to protect slopes from shallow slides 1-2 feet deep.
 - b. Wattling may be used to stabilize entire cut or fill slopes or localized gully areas of slopes.
 - c. Wattling may be installed during construction (dormant season) or as a remedial action on existing slopes.
 - d. Wattling is useful on slopes requiring other planting materials such as, woody vegetation, transplants, grasses, and forbs. Wattling also enhances conditions for natural invasion and the establishment of other plants from the surrounding plant community.
3. Planning Consideration:
 - a. Plant material harvest and installation should be performed during its dormant season, late fall to early spring.
 - b. Use site reconnaissance to identify willow species, growth form, and soil and site conditions on adjacent sites and compare their conditions to the construction site. Planting will be more successful as the soil, site conditions, and species selected match stable and vegetated nearby sites.
 - c. The ideal plant materials for wattling are those that: 1) root easily; 2) are long, straight and flexible; and 3) are in plentiful supply near the job site. Willow (*Salix* spp.) makes ideal wattling material. Some species of *Baccharis*, *Cornus*, and *Populus* also have very good rooting ability.
 - d. Choose plant material adapted to the site conditions and confirm the availability of plant material that will be used on site before construction begins. Wattling may have limited applications and success in arid environments unless irrigated.
 - e. When choosing live willow material for bioengineering applications, remember that young (less than 1 year old) wood or suckers will often sprout easier under optimum conditions but healthy, older wood (1 to 4 years old) has greater vegetative (energy) reserves necessary to consistently sprout and the older wood is much stronger. If possible,

- mix younger wood with older wood for the bioengineering application such that a majority of the material is 1 to 4 years old.
- f. Research indicates that all cuttings should be soaked for a minimum of 24 hours, whether they are stored or harvested and immediately installed (Hoag 1991; Hoag et al. 1991; Hoag et al. 1992). Some research recommends soaking the cuttings for as much as 10 to 14 days.
- g. Planting willows, in some cases, can adversely interact with other natural forces; such as water hydraulics to cause increased drainage to willows can partially block or deflect currents adversely.

Willows have several different growth forms, from shrubs to large trees. Small to medium sized shrub-type and rhizomatous or creeping-type willows are used for planting channel banks. Upland willow species are found in relatively dry areas and should be used on similar sites. Tree-type willows are selected for the upper bank and flood plain area.

- O. Retaining Walls – The Developer shall design and include retaining walls where necessary. These measures are discussed more thoroughly in Section 3.7 of these standards.
- P. Temporary Landscape Irrigation System – In cases where soil erosion control measures are selected by the Developer to meet his project needs, a landscape irrigation system will need to be designed and constructed. The design of such systems shall be done by a licensed Landscape Architect, registered in the State of Utah and shall be reviewed and approved by the City prior to construction. These measures are discussed more thoroughly in Section 3.8 of these standards.

2.11 CHANNEL EROSION PROTECTION

- A. General – Protection of channels used in storm water transmission is an important feature in the transmission of storm water flows from their place or origin to either a sedimentation basin, storm water detention basin, or other storm water facility. Since the storm water flows are concentrated in these channels, special care must be taken to ensure that sufficient protection is provided within the channel cross-section to eliminate excessive erosion. The following information is to be considered when designing facilities associated with storm water channels.
- B. Energy Dissipators (See Appendix A – 5000) – The need for energy dissipaters for reduce water velocities/scour shall be identified through the preparation of a scour and sediment transport study to be prepared for projects which discharge their storm waters into an existing and/or natural runoff channel or stream.

The Developer's engineer is to submit design calculations for each energy dissipater in the scour and sediment transport study.

Energy dissipaters designed with the design procedure as shown in HEC 14 Material and include the following:

1. The sedimentation basin stabilized with vegetation and mulch protections as required by these standards.
2. All material used within the energy dissipater shall be capable of allowing vegetative growth in, around or through the structure.

3. Temporary irrigation system if vegetation is planted outside the native planting window.

C. Grass-Lined Channel (See Appendix A – 5010 and 5015)

1. Purpose: Lined protection of drainage ways reduces erosion by lowering water velocity over the soil surface and by binding soil particles with roots. The drainage way is any ground surface over which concentrated runoff travels. It is typically a manmade waterway, swale or ditch. It may also be the upslope flow of water and directs the concentrated flow along the surface of the barrier. Lined channels should be used where:
 - a. A vegetative lining can provide sufficient stability for the channel grade by increasing maximum permissible velocity;
 - b. Slopes are generally less than five (5%) percent;
 - c. Site conditions required to establish vegetation i.e., climate, soils and topography are present.
2. Design Considerations:
 - a. Grass-lined channels resemble natural systems and are usually preferred where design velocities are suitable. Select appropriate vegetation and construct channels early in the construction schedule before grading and paving increase runoff rates.
 - b. Generally, grass-lined channels are constructed in stable, low areas to conform to the natural drainage system, but they may also be needed along roadways or property boundary. To reduce erosion potential, design the channel to avoid sharp bends and steep grades. Meandering channels are preferred as they replicate natural systems and assist in slowing velocities.

The channel cross section should be wide and shallow with relatively flat side slopes so surface water can enter over the vegetated banks without erosion. Riprap may be needed to protect the channel banks at intersections where flow velocities approach allowable limits and turbulence may occur. Cross-section designs include:

- a. Vee-shaped channels are generally used where the quantity of water is relatively small, such as roadside ditches. The V-shaped cross section is desirable because of difficulty stabilizing the bottom, where velocities may be high. A grass or sod lining will suffice where velocities are low or rock or riprap lining may be necessary in higher velocities.
- b. Parabolic grass channels are preferred and often used where larger flows are expected and sufficient space is available. The shape is pleasing and may best fit site conditions. Riprap should be used where higher velocities are expected and where some dissipation of energy (velocity) is desired. Combinations of grass with riprap centers or turf reinforcement mat centers are useful where there is a continuous low flow in the channel.
- c. Trapezoidal grass channels are used where runoff volumes are large and slope is low so that velocities are non-erosive to vegetated linings. Trapezoidal channels generally have concrete or riprap lined center for low flow.
 - (1) Grass-lined channels must not be subject to sedimentation from disturbed areas.
 - (2) An established grass-lined channel resembles natural drainage systems and is usually preferred if design velocities are below 5 ft/sec.
 - (3) Outlets should function with a minimum of erosion. See Appendix A – 5000 Energy Dissipator BMP.
 - (4) Channels with design velocities greater than 2 ft/sec. will require that turf reinforcement mats, erosion control blankets, fiberglass roving or straw and netting be installed at the time of seeding to provide stability until the vegetation is fully

established. It may also be necessary to divert water from the channel until vegetation is established or to line the channel with sod.

- (5) Whenever design velocities exceed 4 ft/sec. a permanent turf reinforcement mat or rock lining will be necessary.
- (6) Sediment traps may be needed at channel inlets and outlets to prevent sedimentation.

3. Additional Design Criteria:

- a. Capacity: Sufficient to convey 100 year – 24 hour storm.
- b. Velocity: The allowable design velocity for grass-lined channels is based on soil conditions, type of vegetation, and method of establishment. If design velocity of a channel to be vegetated exceeds 2-4 ft./sec. a channel liner is required.
- c. Depth: The design water surface elevation of a channel receiving water from diversions or other tributary channels shall be equal to or less than the design water surface elevation of the diversion or other tributary channel at the point of intersection. The top width of parabolic and vee-shaped, grass-lined channels shall not exceed 30 feet, and the bottom width of trapezoidal, grass-lined channels shall not exceed 15 feet unless multiple or divided waterways, riprap center, or other means are provided to control meandering of low flows.
- d. Cross-section: The channel shape may be parabolic, trapezoidal, or V-shaped, depending on need and site conditions.
- e. Side slopes: Grassed channel side slopes generally are constructed 3:1 or flatter to aid in the establishment of vegetation and for maintenance.
- f. Grade: Generally restricted to slopes 5% or less. Either a uniform or gradually increasing grade is preferred to avoid sedimentation.

D. Log Check Dam (See Appendix A – 5020) – In order to reduce erosion in gullies and other drainage ways, log check dams may be required to be installed as indicated in drawing no. 5020. Logs are to be 4 to 6-inches in diameter which are to be placed vertically into the drainage way soils, adjacent to one another. The purpose of the dams is to slow the flow down the drainage, reduce the centerline slope, thereby reducing the velocity of the water and eventually create a more stable environment and reduce erosion.

E. Riprap (See Appendix A – 5030) – The Developer shall provide designed riprap where necessary to protect against soil erosion. Riprap is a layer(s) of stone or rock designed to protect and stabilize the surface of the soil from erosion from water or wind. Riprap may be used to stabilize cut and fill slopes, channel slopes and bottoms, inlets and outlets for culverts, bridges, slopes drains and shorelines to due wave action. These measures are discussed more thoroughly in Section 3.0 of these standards. The design of the riprap for channels or similar structures will be performed in accordance HEC 14, Design of Roadside Channels with flexible linings.

1. Purpose: To protect the soil surface from erosive forces and/or improve stability of soil slopes that are subject to seepage or have poor soil structure.
2. Conditions Where Practice Applies: Riprap is used for the following applications:
 - a. Cut-and-fill slopes subject to seepage or weathering, particularly where conditions prohibit establishment of vegetation,
 - b. Channel side slopes and bottoms,
 - c. Inlets and outlets for culverts, bridges, slope drains, grade stabilization structures, and storm drains,
 - d. Stream bank and stream grades,

- e. Shorelines subject to wave action.
3. Planning Considerations: Riprap is a versatile, highly erosion-resistant material that can be used effectively in many locations and in a variety of ways to control erosion on construction sites.

Graded Versus Uniform Riprap: Riprap is classed as either graded or uniform. Graded riprap includes a wide mixture of stone sizes. Uniform riprap consists of stones nearly all the same size.

Graded riprap is preferred to uniform riprap in most applications because it forms a dense, flexible cover. Uniform riprap is more open and cannot adjust as effectively to movement of the stones. Graded riprap is also cheaper to install requiring less handwork for installation than uniform riprap, which must be placed in a uniform pattern. Uniform riprap may give a more pleasing appearance.

Riprap sizes are designated by either the mean diameter or the weight of the stones. The diameter specification is often misleading since the stones are usually angular. However, common practice is to specify stone size by the diameter of an equivalent size of spherical stone. Table 1 lists some typical stones by weight, spherical diameter, and the corresponding rectangular dimensions. These stone sizes are based upon an assumed specific weight of 165 lbs/ft³ (2600 kg/m³).

Table 1

Weight (lbs.)	Spherical Dia. (ft.)	Length (ft.)	Width/Height (ft.)
50	0.6	1.4	0.5
100	1.1	1.8	0.5
150	1.3	2.0	0.7
300	1.6	2.6	0.9
500	1.9	3.0	1.0
1000	2.2	3.7	1.3
2000	2.8	5.4	1.8
4000	3.6	6.0	2.0

A method commonly used for specifying the range of stone sizes in graded riprap is to designate a diameter for which some percentage, by weight, will be smaller. For example "d₈₅" specifies a mixture of stones in which 85% of the stone by weight would be smaller than the diameter specified. Most designs are based on "d₅₀", size stones.

When considering riprap for surface stabilization, it is important to anticipate visual impacts, including weed control, hazards from snakes and other animals, danger of slides and hazards

to areas below steep riprap slopes, damage and possible slides from children moving stones, and general safety.

Proper slope selection and surface preparation are essential for successful long term functioning of riprap. Adequate compaction of fill areas and proper use of filter blankets or aggregate foundation is necessary.

Sequence of Construction: Schedule disturbance of areas that require riprap protection so the placement of riprap can follow immediately after grading. When riprap is used for outlet protection, place the riprap before, or in conjunction with the installation of the structure so that it is in place before the first runoff event.

4. Design Criteria:

- a. Gradation: Riprap should be a well-graded mixture with fifty (50%) percent by weight larger than the specified design size. The diameter of the largest stone size in such a mixture should be 1.5 times the d_{50} size with smaller sizes grading down to 1-inch.
- b. Size: The designer should determine the riprap size that will be stable for site conditions. Having determined the design stone size, the designer should then select the size or sizes that equal or exceed riprap gradation commercially available in the area. For more design criteria see references; Association of Bay Area Governments, Manual of Standards for Erosion and Sediment Control Measures; HEC 11 – Use of Riprap for Bank Protection.
- c. Thickness: Construction techniques, dimensions of the area to be protected, size and gradation of the riprap, the frequency and duration of flow, difficulty and cost of maintenance, and consequence of failure should be considered when determining the thickness of riprap linings. The minimum thickness should be 1.5 times the maximum stone diameter, but in no case less than 6 inches.
- d. Quality of stone: Stone for riprap may consist of fieldstone or quarry stone. The stone should be hard, angular, of such quality that it will not break down on exposure to water or weathering, and suitable in all other respects for the purpose intended. The specific gravity of the individual stones should be at least 2.5.
- e. Size of Stone: The sizes of stone used for riprap protection are determined by purpose and specific site conditions.
- f. Slope Stabilization: Riprap stone for slope stabilization not subject to flowing water or wave action should be sized for stability for the proposed grade. The gradient of the slope to be stabilized should be less than the natural angle of repose of the stone selected. Riprap used for surface stabilization of slopes does not add significant resistance to sliding or slope failure and should not be considered a retaining wall. The inherent stability of the soil must be satisfactory before riprap is used for surface stabilization. Slopes approaching 1.5:1 may require special stability analysis.
- g. Outlet protection: Design criteria for sizing stone and determining the dimensions of riprap pads at channel or conduit outlets are presented in: USDA, SCS Field Design Manual; Manual of Standards for Erosion and Sediment Control Measures-Association of Bay Area Governments and other engineering design manuals.
- h. Filter Blanket: A filter blanket is a layer of material placed between the riprap and the underlying soil to prevent soil movement into or through the riprap.

A suitable filter may consist of a well-graded gravel or sand-gravel layer or a synthetic filter fabric manufactured for this purpose. The design of a gravel filter blanket is based on the ratio of particle size in the overlying filter material to that of the base material in

accordance with the criteria below. The designed gravel filter blanket may consist of several layers of increasingly large particles from sand to erosion control stone.

A gravel filter blanket should have the following relationship for a stable design:

$$\frac{d_{15} \text{ filter}}{d_{85} \text{ base}} \leq 5$$

$$5 \leq \frac{d_{15} \text{ filter}}{d_{15} \text{ base}} \leq 40$$

$$\frac{d_{50} \text{ filter}}{d_{50} \text{ base}} \leq 40$$

In these relationships, filter refers to the overlying material and base refers to the underlying material. These relationships must hold between the filter material and the base material (soil foundation) and between the riprap and the filter. More than one layer of filter material may be needed. Each layer of filter material should be at least 6 inches thick.

A synthetic filter fabric may be used with or in place of gravel filters. The following particle size relationships should exist:

- (1) Filter fabric covering a base with granular particles containing fifty (50%) percent or less (by weight) of fine particles (less than U.S. Standard Sieve No. 200):

$$\frac{d_{85} \text{ base (mm)}}{EOS * \text{filter fabric}} > 1$$

- total open area of filter should not exceed 36%

- (2) Filter fabric covering other soils:

- EOS is no larger than U.S. standard sieve no. 70
 - total open area of filter should not exceed 10%
- *EOS - Equivalent Opening Size compared to a U.S. standard sieve size.

No filter fabric should have less than 4% open area or an EOS less than U.S. Standard Sieve No. 100. The permeability of the fabric must be greater than that of the soil. The fabric may be made of woven or nonwoven monofilament yarns and should meet the following minimum requirements:

- (1) Thickness 20-60 mils,
- (2) Grab strength 90-120 lbs,
- (3) Conform to ASTM D-1682 or ASTM D-177.

Filter blankets should always be provided where seepage is significant or where flow velocity and duration of flow or turbulence may cause the underlying soil particles to move through the riprap.

F. Rock-Lined Channel (See Appendix A – 5040)

1. Purpose: To convey concentrated surface runoff without erosion.
2. Conditions Where Practice Applies: This practice applies where design flow exceeds 2 ft./sec such that channel lining is required, but conditions are not suitable for vegetative protection. Specific conditions include:
 - a. All roadside ditches or drainage channels greater than two (2%) percent and located in highly erodable soils that have a low maximum permissible velocity.
 - b. The channel design velocity exceeds that allowable for a grass-lined channel.
 - c. The channel will continue to down-cut without protection because it is adjusting to increased flow or a new base line (outlet elevation).
3. Design Criteria:
 - a. Capacity: peak runoff from 100-year storm.
 - b. Side slopes: 2:1 or flatter.
 - c. Stone size: $d = 2$ inch minimum. Use engineering design procedures for sizing riprap for large or critical drainage channels. See reference material, Association of Bay Area Governments, North Carolina Erosion and Sediment Control Planning and Design Manual, or for the design of stable channels.
 - d. Riprap thickness: $T = 1.5$ times the stone diameter or as shown on the plans; 6 inch thick minimum.
 - e. Foundation: Extra-strength filter fabric or an aggregate filter layer, if required.
 - f. Use a foundation for decomposed granite sands or other highly erodable soils.
 - g. Channel cross section should conform as shown on plans for design high flow.
 - h. Outlet must be stable.

G. Straw Bale Sediment Barrier Check Dam (See Appendix A – 5055)

1. Purpose: Straw bale sediment barriers are intended to intercept and detain small amounts of sediment. These barriers are suited for small channel flow situations; however, they may require significant maintenance to ensure their function. Areas where straw bale barriers could apply include:
 - a. The drainage area is 1 acre or less;
 - b. The maximum slope gradient for the swale above the barrier is 2:1;
 - c. The maximum slope length above the barrier is 100 ft.;
 - d. The flow is less than 2 ft³/sec. flow.
2. Design Considerations: The straw bales are either wire-bound or nylon string tied. Wire-bound bales may deteriorate rapidly if the wire is placed in contact with the soil. Straw bales have a useful life of less than 6 months; however the life is extended when used with filter fabric. If used, the filter fabric should cover the bales, be enveloped in the rock at the spillway in order to better filter out fine soil particles, and extend beyond the spillway to act as an energy dissipater.

Design considerations should include the following:

- a. Drainage area;
- b. Runoff velocities;
- c. Secure installation;
- d. Compatibility with existing topography;
- e. Spillways or energy dissipators;

- f. Use of extraneous materials such as rocks, and/or filter fabric;
- g. Accessibility for maintenance, repairs, and cleaning.

H. Straw Bale Dike (See Appendix A – 5060)

1. Purpose: A straw bale dike intercepts and detains small amounts of sediment transported by sheet type runoff. The dikes detain sediment by ponding water and allowing sediment to settle out. Straw bale dikes also slow runoff velocities, thus reducing sheet and rill erosion. Straw bale dikes are also useful for erosion and sediment control around the perimeter of a construction site. Straw bale dikes may be used where the following conditions apply:
 - a. The placement area is not a slope nor likely to receive concentrated runoff;
 - b. The maximum slope gradient above the barrier is 2:1;
 - c. The maximum slope length above the barrier is 100 feet;
 - d. The placement area is suitable for ponding of sheet runoff and sedimentation can occur.
2. Design Considerations:
 - a. The bales are to be placed along the slope contour or at the toe of the slope.
 - b. The principal mode of action is to pond water and allow particles to settle. Straw bale dikes are not designed to withstand high heads of water, therefore they should be located where shallow pools can form.
 - c. Straw bale dikes are suitable for sheet flow only.

Straw bales have a useful life of less than 6 months; however, the life is extended when used with filter fabric. When installed straw bale dikes must be trenched in and appropriately butted and anchored. Loose straw debris must be cleaned up on a regular basis.

I. Temporary Diversion Dike (See Appendix A – 5065)

1. Purposes:
 - a. To divert storm runoff from upslope drainage areas away from unprotected disturbed areas and slopes to a stabilized outlet.
 - b. To divert sediment-laden runoff from a disturbed area to a sediment-trapping facility such as a sediment trap or sediment basin.
 - c. The upslope dike can improve working conditions at the construction site and prevent erosion. The downslope dike assures that sediment-laden runoff will not leave the site without treatment.
2. Planning Considerations:
 - a. It is very important that a temporary diversion dike be stabilized immediately following installation with temporary or permanent vegetation to prevent erosion of the dike itself. The gradient must have a positive grade to assure drainage, but if the gradient is too great, precautions must be taken to prevent erosion due to high velocity channel flow behind the dike.
 - b. This practice can use material available on the site and can usually be constructed with equipment needed for site grading. Stabilizing the dike with vegetation can extend the useful life of the practice. Diversion dikes are sometimes preferable to silt fence because they are more durable, less expensive, and require much less maintenance when constructed properly. When used with sediment trap or sediment basin they become a logical choice for a control measure once the control limits of the silt fence or straw bale barrier have been exceeded.

- c. Temporary diversion dikes are often used as a perimeter control in association with a sediment trap or a sediment basin, or a series of sediment-trapping facilities, on moderate to large construction sites. If installed properly and in the first phase of grading, maintenance costs are very low.

3. Design Considerations:

- a. Drainage Area: 5 acres or less
- b. Velocity: maximum permissible velocity
- c. Recommended Dike Design:

side slope:	2:1 or flatter
width:	2 foot (top width)
height:	1.5 feet
Freeboard:	0.5 feet

d. Channel Design:

shape:	parabolic or trapezoidal recommended
side slope:	2:1 or flatter
Stabilization:	vegetation or riprap

- e. Grade: The channel behind the dike shall have a positive grade to a stabilized outlet. If the channel slope is less than or equal to two (2%) percent, no stabilization is required. If the slope is greater than two (2%) percent, the channel shall be stabilized.
- f. Outlet: Divert sediment-laden water into a temporary sediment trap or sediment basin. Runoff from undisturbed areas should empty into an outlet protection unless well stabilized natural outlets exist.

2.12 STORM DRAINAGE SYSTEM

- A. General – The storm drain and flood control system is more specifically discussed in the Storm Drainage and Flood Control Design and Construction Standards. The following information is very general in nature and the Developer in designing and constructing these facilities shall use the above-mentioned standards.

- 1. Master Plan Compliance – Developers shall be familiar with the City's current Master Drainage Plan and other storm drainage and flood control reports and master plans. The current storm water master plan as of the date of the writing of these standards is the "Master Drainage Plan" dated December 2003 and prepared by Bowen Collins and Associates. Developer shall contact the City's Engineering Department for information regarding these reports prior to beginning design of these types of facilities.

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2. Design Criteria - Developers shall use the design criteria specified in the City's current Storm Drainage and Flood Control Design and Construction Standards. These standards are available from the City's Engineering Department.
- B. Retention/Detention Basins – The Developer shall design and include regional (master planned) and on-site retention/detention basins as part of the project. The design of regional and on-site retention/detention basins shall be performed in accordance with the City's current Storm Drainage and Flood Control Design and Construction Standards, Master Drainage Plan and other pertinent master plans and studies. The design will also fulfill the requirements of Phase II of the UPDES. These measures are discussed more thoroughly in Section 3.11 of these standards.
- C. Storm Drain System – The Developer shall design and include master planned and local storm drainage pipeline and other appurtenances as part of the project. The design of storm drainage facilities, including pipelines, shall be performed in accordance with the City's current Storm Drainage and Flood Control Design and Construction Standards, Master Drainage Plan and other pertinent master plans and studies. These measures are discussed more thoroughly in Section 3.12 of these standards.
- D. Storm Drain Sediment Protection
1. Drop Inlet Sediment Barriers (See Appendix A – 5300 and 5330)
 - a. Purpose: Drop Inlet sediment barriers are intended to prevent sediment from entering the storm drains during construction operations. This practice allows early use of the storm drain system and is applicable for the phased construction schedule of a wet weather plan. Sediment-laden runoff is ponded before entering the storm drain, thus allowing some sediment to fall out of suspension.
 - b. Design Considerations: A straw bale drop inlet sediment barrier can be used where the inlet is intended to drain a relatively flat disturbed area (slopes less than 5%) in which runoff velocity is low; less than 0.5 ft³/sec. Barriers of this type should not be placed around inlets receiving concentrated flows such as those along major streets or highways. This practice must not be used near the edge of fill material and must not divert water over cuts or fills.

The contributing drainage area should be one acre maximum. The ponding area shall be relatively flat (less than 1%) with sediment storage of 35 yds³ per disturbed acre. As an optional design, the straw bales may be omitted and the entire structure made of gravel and stone, see Appendix A – 5300 and 5330. A structure made entirely of stone is commonly called a "gravel doughnut." The top elevation of the sediment structure must be at least 6 inches lower than the surrounding ground elevation downslope from the inlet. It is important that all storm flows pass over the structure and into the storm drain, and not past the structure. Temporary diking below the structure may be necessary to prevent bypass flow. Material may be excavated from inside the sediment pool for this purpose.
 2. Continuous Berm (See Appendix A – 5305)
 - a. Purpose: A continuous berm is used to divert and intercept sheet type runoff. Continuous berms are useful for erosion and sediment control around the perimeter of a construction site. The berms can be used to detain and pond sediment-laden storm water and allow the sediment to settle out. The continuous berms may be constructed as filter berms; with

aggregate and permeable filter fabric to facilitate the accumulation of sediment and the drainage of storm water.

- b. Conditions Where Practice Applies:
 - (1) Whenever storm water runoff must be temporarily diverted to protect disturbed areas or sediment must be retained on site during construction.
 - (2) Continuous berms can be used in conjunction with or instead of silt fence and straw bale dike for perimeter type sediment control. .
 - (3) Continuous berms, for sediment control, may be used where:
 - (4) sheet and rill flows would occur;
 - (5) the area drains to the barrier 1 acre or less;
 - (6) the maximum slope gradient above the barrier is 2:1;
 - (7) and the slope length above the barrier is 100 feet maximum.
- c. Design Considerations:
 - (1) Continuous berms require a Continuous Berm Machine (CBM). The CBM is a material feeding (hopper) and fabric-rolling system that creates the continuous berm by 'wrapping' geosynthetic material around sand, aggregate, or soil.
 - (2) Trenching is not necessary. Continuous berms should be applied to relatively smooth surfaces to form a tight seal between barrier and the ground.
 - (3) Staking is not necessary since the density of the berm is approximately 100 lbs/ft³. The fabric is flexible so the barrier can stretch and curve and allow the berm to conform tightly to ground surface irregularities.
 - (4) The CBM requires a source of filler materials, either sand, aggregate or local soils. When used in conjunction with a transit mixer discharging sand and/or aggregates it is possible to produce berm at a rate of approximately 50 ft/min. Using local soils can reduce that rate by 2/3.

Continuous berms can be used to pond water and allow sediment to settle out. Continuous berms can be constructed as filter berms, with aggregate and permeable geosynthetic materials intended to facilitate its drainage of the ponded water. Segments of the continuous berm may be filled with aggregate to produce "drainage chambers" and/or drainage pipes with or without risers may be used with the berms.

- 3. Curb Inlet and Drop Inlet Sediment Barriers (See Appendix A – 5315, 5320, 5325 and 5330)
 - a. Purpose: Curb inlet and drop inlet sediment barriers are intended to reduce the sediment discharged into storm drains by ponding the runoff and allowing the sediment to settle out. The structures allow for overflow from high runoff events and the gravel allows the ponds to dewater rapidly.
 - b. Design Considerations: The gravel filled sandbag curb inlet and block and gravel sediment barrier can be used at curb inlets on gently sloping, paved streets where:
 - (1) water can pond and allow sediment to separate out of suspension; and
 - (2) runoff is relatively low, less than 0.5 ft³/sec.

Once the small catchment areas behind the sandbags or block and gravel fill with sediment, future sediment-laden runoff will enter the storm drain without being desilted. Therefore, sediment must be removed from these structures during or after each storm. Additional storage can be obtained by constructing a series of sandbag barriers along the gutter so that each barrier traps small amounts of sediment.

2.13 STREAMBANK EROSION PROTECTION

A. General – Protection of channels used in storm water transmission is an important feature in the transmission of storm water flows from their place or origin to either a sedimentation basin, storm water detention basin, or other storm water facility. Since the storm water flows are concentrated in these channels, special care must be taken to ensure that sufficient protection is provided within the channel cross-section to eliminate erosion. Any work performed in streams under the jurisdiction of the Corp of Army Engineers (COE) are to meet their requirements. The following information is to be considered when designing facilities associated with storm water channels.

B. Coir Roll and Coir Mats (See Appendix A – 5400)

1. Purpose: Coir rolls and coir mats are commonly used for stream bank stabilization and shoreline protection. These bioengineering components provide immediate erosion control while also providing a stable medium to support the growth and development of plants. The coir (coconut fiber) material is natural, long lasting, and has high tensile strength. The fiber material can replace commonly used structural components such as rocks, riprap or logs. The coir rolls and mats can then be planted with appropriate vegetation. The fiber rolls and mats accumulate sediment while the plants grow and the plants roots develop. Eventually the coir material biodegrades and the cohesive strength of the root systems and flexible nature of the plants become the primary stabilizing element.
2. Conditions Where Practice Applies: Soil bioengineering techniques utilizing coir rolls and coir mats are generally appropriate for:
 - a. Stream bank stabilization;
 - b. Shoreline stabilization;
 - c. Wetland mitigation or restoration; and
 - d. Other riparian areas where immediate erosion control is needed while also creating hospitable conditions for plant establishments.

Where perennial flows of water occur, coir rolls are generally placed offshore to break waves or applied at the toe of stream bank as a type of soft armor. Coir rolls provide a substrate for plant growth and facilitate sedimentation behind the roll by capturing sediment, mineral and organic materials.

3. Design Considerations: Bioengineering techniques utilizing coir rolls mats and vegetation should be considered as an alternative to stone revetments or other structural measures. Bioengineering techniques address aesthetic and ecological concerns by encouraging vegetation and wildlife habitat. Bioengineering techniques rely on plants and structures to function together in mutually reinforcing and complimentary rolls. With coir rolls and coir mats, the high tensile strength coconut fibers, fiber netting and the wooden stakes used to anchor the material all comprise the structural components of the system.

Coir rolls, coir netting and coir mats also have high moisture retention properties and will generally last from 4-12 years. However, coir fiber's strength, longevity and ability to hold moisture depend on the type, density and grade of coir material chosen.

Traditional processing of coconut fibers result in several different grades of coir. During processing, the initially separated fiber is called mattress fiber coir, which is very short, thin and flimsy. The next grade of coir separated from the husk is called omat fiber coir. Once the mattress and omat fiber coir are separated, the remaining coir is called bristle fiber coir. Bristle fiber coir is longer, thicker, heavier and stronger compared to the other types.

Coir rolls are commonly available in 12-inch, 16-inch, and 20-inch diameters. The density of the coir logs and coir mats depends on the type of fibers used in construction and how tightly the fibers are compacted. Tensile strength, unit weight, open area, thickness and coir type are important properties to consider when woven coir blankets, and coir netting or coir rolls are specified. For instance, high density coir rolls, 9 lbs/ft³, might be more appropriate for high wave or high stream energy situations when low density rolls, 6 lbs/ft³, would be perfectly acceptable for wetland mitigation. Use light density coir if plant establishment is the only goal. Use high-density coir if protection from high wave or high stream energy, longevity and plant establishment is the project goals.

C. Gabions (See Appendix A – 5400)

1. Purpose: To protect stream banks from the erosive forces of moving water. Rock-filled gabions can be used to armor the bed and/or banks of channels or used to divert flow away from eroding channel sections.
2. Conditions Where Practice Applies: Rock-filled or vegetated rock gabions are applicable to stream bank sections which are subject to excessive erosion due to increased flows or disturbance during construction. This practice is applicable where flow velocities exceed 6 ft/sec. and where vegetative stream bank protection alone is not sufficient. Gabions can be used to construct deflectors or groins intended to divert flow away from eroding stream bank sections. Gabions are also used to construct retaining walls and grade control structures.
 - a. Gabion Mattresses, also referred to as Reno mattresses or revet mattresses are not as thick as standard gabions, usually 0.5, .75, 1-foot. Gabion mattresses are used to line channels, armor stream banks and slopes, and used with gabions for grade control structures (spillways or aprons).

Gabions and gabion mattresses are often preferable to rock riprap alone. For any given hydraulic condition, the gabion or gabion mattress revetment thickness is one third (1/3) of an equivalent riprap design.

Gabions and gabion mattresses are flexible and free draining thus allowing some soil settling. They can be used in unstable streambeds and stream banks. Gabions can provide an important component to a 'bioengineering' solution for stream bank or slope erosion because they allow the growth and establishment of natural vegetation.

Gabions containers are generally fabricated from a double-twist, hexagonal mesh of heavily zinc coated wire. Some gabions use welded wire. As an option the wire can be coated with PVC. Wire diameter is 0.086 inches for the double twisted gabion mattress and 0.106-0.120-inches for the double twisted gabion. The welded wire gabion use wire diameters of 0.120-inches or greater.

The rectangular gabion is divided into cells with diaphragms of equal capacity. The compartments add strength and assure that the full material remains evenly distributed. Gabions and gabion mattresses come in various sizes. Choose the dimensions of the gabions or combination of gabions to meet the design requirement site conditions.

Table 1. Typical gabion sizes

Letter code	length ft	width ft	depth ft	# of cells	Capacity in CY
A	6	3	3	1	2
B	9	3	3	2	3
C	12	3	3	3	4
D	6	3	1.5	1	1
E	9	3	1.5	2	1.5
F	12	3	1.5	3	2
G	6	3	1	1	0.666
H	9	3	1	2	1
I	12	3	1	3	1.333
T	9	6	.75	3	2.0
U	12	6	.75	4	1.33
Q	9	6	.5	3	1.33
S	9	6	.5	2	1.0

The mesh opening for gabions is typically or nominally 3.25 x 4.5 inches (TYPE 8 x 10). Some gabion mattresses have mesh openings of approximately 2.5 x 3.25 inches (TYPE 6 x 8). Both styles perform hydraulically equivalent.

3. Site Considerations: All of the general stream bank stabilization considerations are to be followed. The following are specific considerations for gabion structures.
Gabion walls are appropriate where:
 - a. The vertical integrity of a soil bank needs a higher tensile strength to reduce sloughing of the stream bank.
 - b. There is moderate to excessive sub-surface water movements that may be creating erosion and damage other types of non-permeable structures.
 - c. An excessively steep stream bank must be stabilized and vegetative or extreme mechanical means of stabilization (i.e., pulling back bank) are not feasible due to site conditions.
 - d. Where slope must be modified while heavy machinery is unavailable to the site.
 - e. Fill must be disposed of along an eroding stream bank (fill can be placed behind gabion to modify slope).
 - f. A retaining or toe wall is needed to stabilize the slope.
 - g. Rock riprap is an appropriate practice but the available or desired rock size (smaller) is not sufficient alone to resist the expected shear stress exerted on the revetment.

4. Types of Gabion Structures:

- a. Gabion Wall - a gabion wall is basically a gravity wall, which relies on their own weight and frictional resistance to resist sliding and overturning from lateral earth pressure.
- b. Vegetated Rock Gabion - a rock-filled gabion earth-retaining structure, which has live branches, placed between each consecutive layer of rock-filled baskets. The live branches will take root inside the gabion and into the soil behind the structure. The vegetation will consolidate the structures and bind it to the slope.
- c. Gabion Deflector - deflector or groins project into the streams and divert flows away from eroding stream bank sections.
- d. Gabion Aprons - rock filled gabions or gabions mattress used as outlet protection, energy dissipators or spillways. These semi-flexible gabions are designed to settle without fracture and adhere to the ground if scour occurs.
- e. Grade Control - drop structures or weirs. Gabion baskets and mattresses can be combined to construct check dams or weirs.
- f. Channel Lining - gabion mattresses can be used to line channels. The lining thickness depends on many factors such as the type of rock, design flow velocity, sediment and bedload, and channel gradient.

D. Structural Stream Bank Stabilization (See Appendix A – 5410)

1. Purpose: To protect stream banks from the erosive forces of moving water, where vegetative or bioengineered methods are insufficient or infeasible.
2. Conditions Where Practice Applies: Applicable to stream bank sections, which are subject to excessive erosion due to increased flows or disturbance during construction. Generally applicable where flow velocities exceed 6 ft/sec. or where vegetative stream bank protection is inappropriate.
3. Planning Consideration:
 - a. Stream channel erosion problems vary widely in type and scale and there is no one measure that works in all cases. Stabilization structures should be planned and designed by an engineer with experience in this field.
 - b. The purpose of this specification is merely to point out some of the practices, which are available, and to establish some broad guidelines for their selection and design.
 - c. Before selecting a structural stabilization technique, the designer should carefully evaluate the possibility of using vegetative stabilization alone or in conjunction with structural measures, to achieve the desired protection. Vegetative techniques are, generally, less costly and more compatible with natural stream characteristics.
4. Design Criteria: Since each channel segment requiring protection is unique, measures for structural stream bank protection should be installed according to a plan based on specific site conditions. Develop designs according to the following principles:
 - a. Make protective measures compatible with other channel modifications planned or being carried out in other channel reaches.
 - b. Use the minimum design velocity of the peak discharge of the 10-year storm. Structural measures must be effective for this design flow and must be capable of withstanding greater flows without serious damage. Riprap, gabions or other suitable materials should be used to stabilize the stream banks to the 10-year flood level or the top, whichever is lower.

- c. Ensure that the channel bottom is stable or stabilized by structural means before installing any permanent bank protection.
- d. Ensure that stream bank protection extends between stabilized or controlled points along the stream.
- e. Do not change channel alignment without a complete evaluation of the anticipated effect on the rest of the stream channel, especially downstream.
- f. Give special attention to maintaining and improving habitat for fish and wildlife.

The upper portion of the bank should be covered with topsoil suitable for growing grasses, shrubs, and trees.

2.14 MISCELLANEOUS EROSION/SEDIMENT CONTROL BEST MANAGEMENT PRACTICES

A. General – By the use of sediment control on the project, the Developer/Builder needs to acknowledge the following

- 1. Maintenance of the sediment controls will be performed on a weekly basis or as directed by the City.
- 2. Regrading will occur on a regular basis as necessary to eliminate concentrated flows.
- 3. Sediment Control Inspections forms are to be filled out on a weekly basis and provided to the City. Sediment controls contained herein, cover the period of time of first land disturbance through and including final stabilization of the soil by vegetation, concrete, pavement or other City approved material. Failure to maintain sediment controls or to submit completed inspection forms will be the basis for a Work Stop being placed on the project and a Class C Misdemeanor issued. The sediment controls discussed herein are required on all projects without exception, other approved sediment controls are discussed in section 3.
- 4. Mud tracking – Each construction site is required to have facilities and practices in place which eliminate the tracking of mud from the construction site onto City roadways. This shall mean that each construction site shall have in place, at least one construction entrance equipped with wash-down equipment to wash off vehicles and their tires so that mud is not tracked onto City streets.

B. Construction Entrances (See Appendix A – 5105) – A pad of crushed stone, aggregate, and gravel located where the construction traffic enters or leaves a construction site. The purpose of the construction entrance is to reduce the potential for vehicles tracking sediment, dirt or debris from the construction site onto City streets. In the event of a storm, water event the stone or gravel will act as a check dam retention structure to control flows. It is the intent of this requirement that the adjacent paved surfaces will remain free of materials tracked off of the site. The developer is required to maintain clean streets at all times.

At any point of ingress or egress at a construction site, where adjacent traveled way is paved, a stabilized construction entrance will be installed. The following shall be taken into account in design of such an entrance:

- 1. Native soils will not be allowed as part of construction of the construction entrance.
- 2. The construction entrance shall not extend more than 3-feet into the paved area.

3. 2 to 3-inch course aggregate shall be used.
4. The course aggregate shall be placed to a sufficient depth to protect the street, sidewalk and curbing but shall not be less than 8-inches in depth.
5. The construction entrance is to extend a minimum of 50-feet behind the curb and gutter.
6. Geotextile fabric shall be used for entrances.
7. All ingress and egress to the construction site is limited to the use of this entrance unless otherwise approved. More than one entrance is allowed, however, the perimeter protection shall not deteriorate.

At a point of ingress or egress at a construction site, where the area is unapproved, the following conditions will apply:

1. Clear, grub and grade the area to provide a slope of 2-percent, minimum.
2. Compact the subgrade as required.
3. Place a designed geotextile separation fabric as part of the construction entrance.
4. Place coarse aggregate, 2 to 3-inches in size to a depth of 8-inches minimum.

The Developer is responsible for maintaining the construction entrance as follows:

1. Inspect the entrance daily for loss of gravel and/or sediment buildup.
2. Inspect adjacent roads daily for gravel or sediment deposits.
3. Clean areas by sweeping or shoveling not by washing down the area with water.
4. Repair the entrance and replace gravel as required to maintain entrance in good working order.
5. Expand entrance area as required to accommodate traffic, prevent damage to concrete structures and avoid sediment being washed away in a storm water event.

The construction entrance shall be removed once the project has received final inspection approval and the front of the lot has been landscaped to the approval of the erosion control specialist.

The Engineer shall design the work covered under subsection 2.5 to meet the following technical specification section:

1. Section 02276 – Stabilized Construction Entrance
- C. Sedimentation Basins (See Appendix A – 5110) – The need for sediment basins shall be identified through the preparation of a scour and sediment transport study to be prepared for projects which discharge their storm waters into a natural runoff channel or stream. The study shall be prepared by a registered civil engineer experienced in sediment transport and scour analysis and shall be approved by the City prior to the Developer retaining the consultant. An outline of the report shall be submitted to the City for approval prior to initiating the study. The draft of the report shall be submitted to the City for review and comment and the City's comments shall be incorporated into the report prior to finalizing the report. The final report shall indicate recommendations to eliminate/reduce scour and sediment transport in the existing natural discharge channel and shall also identify the size, location and proposed generalized design of any sedimentation basins needed for the project to include.
1. Energy dissipaters designed with the design procedure as shown in HEC 14.
 2. The sedimentation basin stabilized with vegetation and the mulch protection as required by the City's Effective Planting Plan.
 3. All materials used within the sedimentation basin shall be capable of allowing vegetative growth in around or through the structure. Concrete energy dissipaters are discouraged.

4. Temporary irrigation system if vegetation is planted outside the native planting window.
5. If the basin is also used as a detention basin or has a flow outlet demonstrate the flow path length is sufficient enough to have sediment drop.
6. Complies with the UPDES Phase II requirements.

The preliminary and final design of the sedimentation basin shall be reviewed and approved by the City prior to proceeding.

- D. Concrete Structures – The design of concrete structures related to grading, erosion and sedimentation control and revegetation shall be performed by a registered civil engineer. The developer's engineer shall submit a comparison of structures indicating concrete structures are the only stable structures to use. The design shall take into account the requirements of Section 3.9 of these standards
- Q. Limits of Disturbance (LOD) Control – The Developer shall design the project to provide for LOD control. LOD is considered to be a minimum protection when erosion control methods are not used. These measures are discussed more thoroughly in Section 3.5 of these standards.

2.15 VEGETATION AND REVEGATATION

- A. General – The purpose of this effort is to establish native and other appropriate plant species on disturbed areas, which will assist in the stabilizing of these disturbed areas, and reduce the possibility of erosion. Other support efforts associated with vegetation and revegetation will include seedbed preparation, topsoil, appropriate mulch protection, energy dissipaters and other areas which will assist in allowing cut and fill slopes and other disturbed areas in being revegetated.
- B. Planting and Irrigation of Cut and Fill Slopes - All cut and fill slopes greater than three (3') feet in height shall be planted and irrigated with a sprinkler system in accordance with the provisions of this chapter.
1. The land disturbance permit holder, or his authorized representatives, shall be responsible for installing all landscaping in accordance with an approved landscape planting plan, for a sprinkler system, and for maintaining all cut and fill slopes. The installation of the landscaping and of the required sprinkler system shall be complete within six (6) months after the date of the termination of the grading. Deviations from the requirements of this section may be permitted in exceptional circumstances or where unavoidable hardship would result from a strict application of these requirements when a waiver has first been obtained from the Planning Commission. A separate bond or cash deposit shall be posted with the City Engineer to guarantee such landscaping, sprinkler system, and the maintenance thereof, and such bond or cash deposit, or portions thereof, shall not be released until the landscaping has been established for at least one hundred, twenty (120) days after planting and permanent responsibility for the landscape maintenance has been established.
 2. Landscaping planting plan. A landscaping planting plan shall be prepared and submitted for approval by the City Engineer and the Community Development Director prior to obtaining a land disturbance permit. A soil test shall be made to determine the plant materials which are suitable for the slopes, and the plant materials utilized on the slopes shall be compatible with the soils report and in accordance with the approved planting schedule or as required by a condition of a site plan or final plat map. There shall be a variety of ground covers, trees, and

shrubs incorporated into the landscaping plan and utilizing plants from the "Approved Planting Schedule" set forth in subsection (d) of this section. Other plant materials may be substituted for the "Approved Planting Schedule" if submitted and recommended by a registered landscape architect and approved by the City Engineer.

3. Irrigation plan. An irrigation plan for the sprinkler system to be installed on all cut and fill slopes shall be submitted to and approved by the City Engineer prior to the issuance of the land disturbance permit.
4. Approved planting schedule. All plants required by the provisions of this section shall select from Section 2.15.C. Vegetation and Revegetation Development Standards and 2.15.D. Effective Planting Plan of these standards.

C. Vegetation and Revegetation Development Standards

1. Native vegetation shall be removed only when absolutely necessary; e.g. for the construction of buildings, roads and fill areas, as approved by the City Planning Commission. When removal of vegetation is required see Tree Removal Application Standard and information contained herein:

LIMITS OF DISTURBANCE TABLE	
Area	Maximum Limits of Disturbance
Roads	The catch line of road, plus two feet.
Buildings	The foot print of the building plus 10 ft. (total 5ft in each direction)
Fill areas	The toe of slope plus 2 ft.
Cut Slopes	Top of slope

- a. The Developer or Contractor shall provide a barrier of protection at the limits of disturbance to prevent additional areas from being disturbed.
2. Revegetation of areas within the area of disturbance will be as required within 3 weeks of reaching final grade. Temporary irrigation will be required during the initial establishment of the vegetation unless waved by the Erosion Control Specialist. Temporary irrigation is defined as aboveground water dispersion system. The Developer shall remove the temporary irrigation system after approval of the Cit Engineer.
3. The Developer shall submit the proposed seed mix to the City and provide the following for each bag of seed used 30 day before starting the revegetation.
 - a. Labeling and identifying the contents of the seed mixture by scientific and common name).
 - b. Quantity of seed as a function of pure live seed (PLS).
PLS = purity x germination.
 - c. Date of the germination or tetrazolium tests
 - d. The date of analysis shown on each bag shall be within nine months of the time of use.
 - e. The City reserves the right to request a sample of the seed mixture for the purpose of analysis and testing. The Developer shall pay for said testing.

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4. Seedlings and shrubs are to be indigenous to the area being revegetated. The seedlings and shrubs should:
 - a. Be from a reputable dealer
 - b. Identified with scientific and common name
 - c. Temporary irrigation, as defined above, shall be required during the initial establishment of the seedlings or vegetation.
 5. All seeds, seedlings, shrubs and trees shall be protected with a mulch material that has been designed for site-specific conditions. The mulch material shall meet the following criteria:
 - a. The City's Effective Planting Plan will be used in determining mulch protection required for the seed.
 - b. Test results from an independent testing agency (i.e. TTI, UWRL) will be submitted to the City, indicating that the mulch material proposed is appropriate for the specific conditions of the site, including that the mulch material is compatible with the proposed seed mix.
 - c. Submit to the Engineering Department, acceptable results from the Universal Soil Loss Calculations (USLE) or the Revised Universal Soil Loss Calculations (RUSLE), indicating that the soil loss does not exceed 15 times the baseline calculated soil loss. This analysis is to be performed by one of the following individuals; soil conservationist, agronomist, certified professional erosion and sediment control specialist.
 - d. The mulch material application guidelines that indicate site specific conditions.
 6. The revegetation work shall be performed by persons or firms, having expertise in revegetation of similar site-specific site conditions on the proposed revegetation site. The revegetation contractors, erosion control specialist and landscape architects are acceptable providing they can demonstrate their expertise in revegetation of similar site-specific conditions.
 7. At the request of the Developer and/or at the end of the warranty period, which is three years, of the revegetation bond, the City will perform an inspection to determine if the vegetation has been established enough to prevent future erosion. The technical procedure in determining if the vegetation has been established enough to stabilize the soil against either rill or gully erosion is the quadrant frame method or the step transect method. Both methods suffice in comparing plant cover, species richness and acceptable soil loss and shall be covered on revegetated area and adjacent undisturbed and/or native site. Either method will be performed at several randomly selected locations. A reclaimed herbaceous natural plant community having 80% of the cover and species abundance of adjacent undisturbed perennial vegetation will be deemed successful.
 8. Revegetation Bond and Revegetation Agreement: A revegetation bond shall be established in accordance with Resolution No. _____. A fully executed revegetation agreement shall accompany the bond.
- D. Effective Planting Plan – To satisfy the revegetation requirements of the City ordinances and the International Building Code, IBC, this effective planting plan has been compiled. The proper and recommended installation of the material state herein, is a requirement to satisfy the revegetation bond release periods.

1. Temporary Seeding – Subdivisions and other developments may benefit from temporary seeding. The intent of this seeding is to temporarily control dust, control weeds, and reduce the possibility of erosion on vacant lots until permanent-stabilizing measures can be implemented. Care should be taken to use a seed mixture that will not compete with establishing permanent seeding. Temporary seeding requires the same irrigation requirements and mulch protection requirements, as does permanent seeding. The use of temporary seeding does not satisfy the requirements of the Revegetation Bond and used in areas with slopes less than 5 H.: 1 H. Seed suppliers should be contacted for the most current seed available before specifying the seed mix, the seed mix should use these seeds within the seed mix:
 - a. Sterile Annual Ryegrass
 - b. Rye, winter or spring
 - c. Barley, spring
 - d. Oats, spring
 - e. Wheat, winter or spring
 - f. Slender Wheatgrass
2. Slopes – Erosion is reduced by the root zone matrix of grasses, therefore the use of grasses is one of the essential elements for the requirements to satisfy the revegetation bond release requirements.

The use of wildflowers are aesthetically pleasing and is encouraged by the City, however, the wildflower portion of the seed mix should be minor. The use of shrub or tree seedling may be required based on the native condition of the land prior to disturbance.

The seed mixture applied to the slopes should be at approximately 40 lbs. per acre with upland dry seed mix. The following grasses should be included the seed mix specified:

Common Name	Scientific Name
Sodar Streambank Wheatgrass	Agropyron, riparium
Nezpar Indian Ricegrass	Oryzopsis hymenoides
Western Wheatgrass	Agropyron smithi
Blue Bunch Wheatgrass	Agropyron spicatum

3. Seed/Seedling – The vegetation community in the native areas of the City has several shrub species along with native grass and flowers. Prior to any land disturbance a field inventory of the native vegetation community, including cover estimates, is to be submitted to the City for review. This inventory will establish the replace species and percentage of cover on the project, this is to ensure the revegetation of area to pre-disturbance conditions, the cost of the seedlings is to be included in the revegetation bond.
4. Hillside Regions – Seed/Seedlings to be planted shall be primarily perennial natives. The vegetation inventory will determine actual specie types. The listed seedlings should be among the mixture of seedlings used.

Common Name	Scientific Name
Squawbush	Rhus trilobata
Wyoming Sagebush	Artemisia tridentata wyomingensis
Gambel Oak	Quercus gambelli
Antelopebrush	Purshia tridentata
Rabbitbrush	Chrysothamnus nauseosus
Winterfat	Eorotia lanata
Mountain Big Sagebrush	Artemisia tridentate

5. Wetland and Riparian Areas – To ensure protection the native habitat, filtration of water and bank protection from erosion. A plant inventory will determine the existing specie and coverage of wetland vegetation and will be the basis to determining the revegetation specie. In areas containing the Russian Black Olive tree the developer will substitute the Russian Black Olive tree with an acceptable native woody plant. The City and Corp of Army Engineers will determine the acceptability of the replacement seedlings.
6. Channels, Swales, Toe Ditches, Inceptor Ditches and Concentrated Flows – The flow characteristics of channels, interceptor ditches or toe ditches used in urban storm drainage may require the use of a turf reinforced mat. A qualified professional shall design and specify the appropriate matting based on Federal Highway Administration requirements. The following grasses should be used in the seed mixes and applied at a minimum rate of 30 lbs./acre:

Common Name	Scientific Name
Ephraim Crested Wheatgrass	Agropyrona cristation
Sodar Streambank Wheatgrass	Agropyrona riparium
Western Wheatgrass	Agropyrona smithii
Covar Sheep Fescue	Festucia ovina
Perennial Ryegrass	Lolium perenne

7. Mulch Protection – The mulch is to provide a biomass that will promote germination, protect against erosion, and provide moisture during the dry seasons, for at least two years to three years depending on the elevation of the land disturbance.

Area Elevation	Years
Valley and Foothills	Two years
Mountains above the 5,200 foot Elevation	Three years

8. Materials and Methods

Slope (Horz:Vert.)	Acceptable Products or Methods	Anchors ^b (per sq.yd.)
40:1 to 10:1	Hydro mulch and seeding ^a Drill seeding with native soil cover ^a Land Imprinting ^a Straw Crimping ^{a,b}	N/A
10:1 to 3:1	Mechanically Anchored Straw ^{a,b} Manufactured straw or excelsior blanket with netting one side ^c Land Imprinting ^{a,e}	^c per manufacturer's recommendations

3:1 to 2:1	Manufactured straw/coconut mat, straw mats with netting on both sides, Wood excelsior blanket with netting on both sides ^c	d As per manufacturer's recommendations

Notes:

- a. A temporary irrigation system will be required for the early days of germination.
- b. To be used only in a wind protected area, as approved by the City.
- c. Slope length not to exceed 50 feet unless manufacturer can demonstrate by the R.U.S.L.E. or other appropriate the material BMP will work. Empirical information will not be acceptable.
- d. This is a minimum standard only. Anchors are to keep the matting in direct contact with the soil. Additional staples may be required at the direction of the City.
- e. The soil to be at optimum moisture within the top six inches of soil. Optimum moisture to be determined by geotechnical report.

9. Irrigation – The developer/builder is responsible for providing reasonable amount of moisture to promote growing conditions of the revegetation project. The City recommends temporary irrigation to be used a minimum of 60 days year round. However, the City requires temporary irrigation to be used for a minimum of 60 days between May 1 and October 15.

- E. Erosion Control / Revegetation Plan – The Developer is responsible for preparing a revegetation plan for the project which identifies seedbed preparation, erosion control BMP to be used, temporary seeding efforts, permanent seeding, mulching, inlet sediment barriers and other items related to revegetation and erosion control.

The revegetation plan shall include the following:

1. A field evaluation of the existing vegetation to include herbaceous plant cover, overall species abundance, and plant litter.
2. An evaluation of noxious or prohibited restricted weeds.
3. A list of target native perennial species to be included in the seed mixture.
4. Preliminary soils information based on published soil surveys.
5. Routine soil sample to evaluate fertility requirements for reclaimed areas.
6. A follow-up vegetation inventory during the second growing season on reclaimed land to evaluate the successful establishment of target perennial vegetation.
7. A final vegetation inventory prior to bond release evaluating vegetative cover and species abundance to ensure 80% establishment of adjacent undisturbed areas. Final bond release evaluation shall not be preformed nor will be acceptable until a minimum of three (3) growing seasons has elapsed.

The Engineer shall design the work covered under subsection 2.5 to meet the following technical specification section:

1. Section 02902 – Revegetation Plan
Also in Section 4 or these Standards

- E. Permanent Seeding – The Developer is to provide for the design and installation of permanent seeding and related items for the project. This practice will establish perennial and permanent plantings for a site within 21 days of final grade being reached. These measures are discussed more thoroughly in Section 3.13 of these standards.

SECTION 3.0

MATERIALS

3.1 GENERAL REQUIREMENTS

This section discusses the materials involved in grading, erosion, sedimentation control and revegetation efforts and associated construction activities. Design and construction related to storm drainage facilities is subject to the design and construction standard for that specific type of facility. Separate design and construction standards are available from the City's Engineering Department for culinary water, sewer, secondary water road and bridge construction and storm drainage and flood control facilities. This standard is in addition to previously mentioned standards, in the event a conflict arises the more restrictive standard will govern. The materials selected have been chosen for their strength, durability and ease of maintenance. All materials, unless specifically approved otherwise, shall be new and unused.

Where applicable, American Public Works Association (APWA), American Society of Testing Materials (ASTM), American Association of State Highway Transportation Officials (AASHTO) or other standards have been referenced and it shall be the responsibility of the developer/engineer /contractor to be familiar with those standards to insure compliance. This standard will govern in the event of a conflict. Titles corresponding to the specific numbers are given in the reference section of the standards.

In some instances, particular manufacturers and product names have been mentioned as being approved. Other products may also meet the requirements, but must be first approved in writing by the Engineering Department. Two factors that are considered by the Engineering Department and the City Engineer in products as approved:

1. Products performance of the Texas Transportation Institute (TTI), Manufacturer's Literature or Utah Water Research Lab.
2. The calculation results of the USLE or RUSLE on a site specific design.

Manufacturer's literature not based on results from an independent testing facility will not be considered. Manufacturers will be required to submit the complete report from the independent testing facility to the Engineering Department for a complete review on alternate products.

If at any time the Engineering Department believes that the use of a specific product must either be halted or changed, the City Engineer has the authority to make the change providing the decision is based upon an engineering, performance or maintenance evaluation. A copy of all technical specifications is contained in Appendix B.

3.2 TESTING AND FINAL ACCEPTABILITY OF MATERIAL

The Engineering Department will require such tests and certifications as deemed necessary to show that the specified materials have been employed. Notwithstanding prior factory or yard inspections, the City Engineer will have the right to reject any damaged or defective materials found on the job and order its removal from the site. Further information on testing is contained in Section 9.0 – Testing, of this manual.

3.3 TOPSOIL

- A. General – Topsoil shall be stripped, stockpiled, or live hauled in accordance with the requirements of these standards and the Contract Documents. The Contractor shall, where possible, keep the height and size of topsoil piles to a minimum. Topsoil is to be used only to stockpile and replace for revegetation, excess handling of the topsoil should be avoided. Stockpiles are not to exceed 25 feet in height and the amount of time the topsoil piles kept in a stockpile is also to be kept to a minimum. The intent of topsoil stockpiling is to retain the soil structure, preserve pore space essential for microorganisms and provide an environment that will retain the soil fertility to promote the restoration of native seeds indigenous to the area.

Stockpiles are to be setback at least 100-ft away from native undisturbed areas and live bodies of waters, including seasonal drainage channels. The developer may propose BMP to prevent the stockpile from eroding from wind or water. The intent of the topsoil setbacks is to preserve native vegetation, preserve drainage channels and satisfy the UPDES regulations

The Developer may also propose other methods and locations of stockpiling topsoil for review and approval by the City. Satisfying the intent of stockpiling topsoil and the setbacks indicated herein, for reviewing any proposed stockpile location.

The Engineer shall design the work covered under subsection 2.6 to meet the following technical specification section:

1. Section 02925 – Topsoil

3.4 EROSION CONTROL

- A. General – Interim measures could be used in the areas that have been graded and left exposed and not brought to final grade within 21 days of initial disturbance. The measures discussed below include the use of mulch, organic tackifiers and temporary seeding for interior slope stabilization.
1. Interior Slope Stabilization, Mulch – The placement of material to stabilize the soil against the forces of wind and water as an interim measure could include tackifiers, sediment controls, temporary seeding, wood mulches, water, manufactured mulch blankets made from excelsior or straw.

Interim soil stabilization, measures are to be applied to the soil from the day of initial disturbance until the soil has received approved erosion control and revegetation measures as per Resolution _____, Revegetation Bond.

Site-specific conditions will determine the recommended seed mix. Check with the project's Development guidelines, City of West Jordan, local seed suppliers or County Extension Service for recommended mixes for site-specific conditions.

The Effective Planting Plan will determine the actual mulch material used to protect the seed. Provisions for temporary irrigation is required throughout the year.

The revegetation project approval will be based on the Revegetation Bond reductions procedures as outlined in Resolution _____. It is the responsibility of the developer to select, install, irrigate and maintain the project in such a manner as to qualify for the bond reductions.

2. Slope Stabilization, Temporary Seeding – Temporary seeding means the growing of a short-term perennial or annual cover (plants) on a disturbed construction site that is disturbed and the use of temporary seeding is to control erosion from wind or water. The use of temporary seeding is recommended for areas that have been disturbed and requires stabilizations and the City deems it not appropriate for a revegetation bonds. An example of this would be a residential subdivision that has been massed graded and the City agrees with the developer, residential home construction will invalidate the revegetation bond.

Temporary seeding is subject to the same seed protection requirements as outlined in the effective planting plan. This practice is to use fast growing grasses whose root system hold down the soils so they are less apt to be carried offsite by water or wind. Another advantage of temporary seeding is it reduces the problems associated with mud and dust from bare soil during construction.

Whereas temporary seeding requires temporary irrigation and the same mulch protection as permanent seeding, it could be more cost effective to evaluate chemical stabilizers.

The Engineer shall design the work covered under Section 2.0 and Appendix B to meet the following technical specification section:

1. Section 02271 – Erosion Control

3.5 LIMITS OF DISTURBANCE (LOD)

- A. General – Limits of disturbance (LOD) barriers are to be placed, reviewed and approved in writing by the Engineering Department prior to any land disturbance. Approved minimum barrier are described below.

1. Fabric: Design for site specific conditions
2. Posts: 2 x 2, 6.0-ft long to be approved by the Engineering Department.
3. Wire Mesh: 14 gage min. with 6 inch minimum openings
4. Wire Stables: 1-inch long, hog rings or wire ties are acceptable when approved by the City Engineer.
5. Straw Bales: Not acceptable
6. Pre-manufactured barriers are acceptable when approved in writing by the Engineering Department.
7. Straw wattles

The LOD boundary control is to be installed by placing posts on 6-foot centers with a minimum 2-foot of bury and 3-feet exposed above grade. The Contractor is to excavate the anchor trench on the uphill side of the posts. The wire mesh shall be secured to posts on the up-hill side of the posts from the bottom of the trench to the top of the posts. The Contractor is to install the fabric as required to encase trench and drape over top of fence by 1-foot minimum. The fabric is to be secured to the posts and wire mesh a minimum of every 6-inches vertically and one foot horizontally. The Contractor is to then backfill the trench over the geotextile fabric to anchor it in

place.

The Contractor is to maintain the fence by inspecting it after each rainfall and/or during a heavy or prolonged rainfall or as required by the Erosion Control Specialist. The Contractor shall make adjustments or repairs to the fence to prevent runoff from bypassing the ends of the fence, or by under cutting the trench in which the fabric has been installed. When LOD barrier also functions as a sediment control BMP, the Contractor is to remove the accumulated sediment before it reaches $\frac{1}{2}$ the height of fence. The LOD barrier will be reported on the erosion control and sediment control inspection as required by the City.

The site boundary control may be removed after construction has received its final inspection approval or as approved by the Engineering Department.

The Engineer shall design the work covered under subsection 2.3 to meet the following technical specification section:

1. Section 02279 – Silt Fences

3.6 EROSION CONTROL

- A. General – Permanent erosion control measures are those, which will be constructed to provide for long-term (2-5 year) protection of soils on the project. These differ from sediment control BMP. These measures include the following:

1. Mulch – When used with out vegetation, mulch is a temporary erosion control practice where materials such as grass, woodchips, wood fibers, straw, or gravel are placed on the soil surface. When used without biodegradable netting these materials act independently and are also very erode able. Therefore, the depth of mulch criteria is as indicated in the chart. The LS factor in the USLE or the RULSE dictate when the slope length increase so does the depth of the mulch. The advantages of using mulch are:
 - a. Mulch slows the water down, thus increasing the time of concentration for storm water calculations.
 - b. Provides protection for the germination and survival rate of seeds and seedlings.
 - c. When used with a biodegradable netting a matt effect can be accomplished.

MULCH APPLICATION RATES			
Type of Mulch	Mulch Rate (tons/acre)	Land Slope (percent)	Slope Length Limit (feet)
Straw	1.0	1-5	200

	1.0	6-10	100
	1.5	1-5	300
	1.5	6-10	150
	2.0	1-5	400
	2.0	6-10	200
	2.0	11-15	150
	2.0	16-20	100
	2.0	21-25	75
	2.0	26-33	50
	2.0	34-50	35

MULCH APPLICATION RATES			
Type of Mulch	Mulch Rate (tons)	Land Slope (%)	Slope length limit (feet)
Crushed Stone 1/4 to 1 1/2 in.	135	< 16	200
	135	16-20	150
	135	21-33	100
	135	34-50	75
	240	<21	300
	240	21-33	200
	240	34-50	150
Wood Chips	7	< 16	75
	7	16-20	50
	12	<16	150
	12	16-20	100
	12	21-33	75
	25	< 16	200
	25	16-20	150
	25	21-33	100
	25	34-50	75

*Note: Slope length limit specified is the length of slope for which the mulch rate specified is effective slope length. Mulch is to be anchored by the use of a photodegradable extruded plastic netting and stakes to anchored mulch to ground or with an appropriate tackifier.

2. Hydro Mulch – May be used when specified by the Effective Planting Plan. The Contractor shall follow written recommendation of the Hydro-seeder and the hydro-mulch recommendations are to be on site at all times and available to the Engineering Department at all times. The recommendations shall address the following:
 - a. Type of soil on slope to be protected
 - b. Percentage of slope
 - c. Application rate
 - d. Maximum wind speed
3. Tackifiers – Tackifiers are defined as being chemical stabilization practices, often referred to as a chemical mulch, soil binder, soil palliative. Chemical stabilization can be used as an

alternative stabilization process in areas where temporary seeding practices are used as identified by the effective Planting Plan. Asphaltic tackifiers are not allowed. The application rates and procedures recommended by the manufacturer of a chemical stabilization product shall be followed to prevent the products from forming ponds and from creating large areas where moisture cannot get through.

4. Blankets - Manufactured blankets have made the process of mulching convenient and cost effective for the developer or builder. Commonly referred to as erosion control blankets, mulch blankets or soil retention blankets, their function is the same.
 - a. To provide a convenient and inexpensive method of providing protection to the soil against erosion.
 - b. Provide a growing environment for the revegetation process from germination to established growth.

Due to the wide range of products, erosion and vegetation characteristics the blankets are allowed to be installed when the following conditions are met:

- a. Blankets are used within the parameters of manufacturer recommendations.
- b. Produces a site specific staking or stapling pattern.
- c. Produces acceptable soil loss results based on the Revised Universal Soil Loss Equation for their blanket.
- d. The seed supplier's written recommendation that this is the protection they recommend for the vegetation that is proposed on the site.
- e. The LS factor is satisfied when used on slopes greater than 50 feet.

The Engineer shall design the work covered under subsection 2.5 to meet the following technical specification section:

1. Section 02272 – Fabric, Erosion Control Mats and Geotextiles

5. Straw Mulch - Straw mulch is anchored or punched in by using a tracked construction vehicle. Straw mulch is to be applied at a rate of 2 ½ tons per acre.

The Engineer shall design the work covered under subsection 2.5 and Appendix B to meet the following technical specification section:

1. Section 02935 – Crimped Straw

3.7 RETAINING WALLS

- A. General – Where insufficient space is available for construction of a complete slope or where obstacles are in the way, retaining walls may need to be constructed to retain the earth and limit the amount of erosion, which might be experienced. If the wall is 48-inches or greater, the wall is governed by the International Building Code (IBC). Such wall will need to be designed by a licensed civil engineer, registered in the State of Utah.

The Engineer shall design the work covered under subsection 2.5 to meet the following technical specification section:

1. Section 02277 – Segmental Block Retaining Wall
2. Section 04220 – Concrete Unit Masonry

3.8 LANDSCAPE IRRIGATION SYSTEM

- A. General – In cases where soil erosion control measures are selected by the Developer to meet his project needs, a landscape irrigation system will need to be designed and constructed. The design of such systems shall be done by a licensed landscape architect, registered in the State of Utah and shall be reviewed and approved by the City prior to construction.

The Engineer shall design the work covered under subsection 2.15 and Appendix B to meet the following technical specification section:

1. Section 02811 – Landscape Irrigation System

3.9 CONCRETE STRUCTURES

- A. General – The design of concrete structures related to grading, erosion and sedimentation control and revegetation shall be performed by a registered civil engineer. The design shall take into account the following technical specifications. Preliminary design and final design shall be reviewed and approved by the City prior to finalizing the projects for construction.

The Engineer shall design the work covered under subsection 2.5 and Appendix B to meet the following technical specification section:

1. Section 03100 A – Concrete Formwork
2. Section 03102 – General Concrete Construction
3. Section 03200 – Reinforcement Steel
4. Section 03300 – Cast-in-Place Concrete
5. Section 03303 – General Concrete
6. Section 03304 – Minor Concrete

3.10 RIPRAP

- A. General – Riprap is a layer of stone or rock designed to protect and stabilize the surface of the soil from erosion from water or wind. Riprap may be use to stabilize cut and fill slopes, channel slopes and bottoms, inlets and outlets for culverts, bridges, slopes drains and shorelines to due wave action. The thickness of the riprap for slope protection shall be in accordance of section 3.6 Erosion Control.

Riprap is classified as either graded or uniform. Graded riprap includes a wide range of stone or rock sizes. Uniform riprap consists of stone or rocks approximately the same size. Graded riprap is preferred since it provides a dense, flexible cover. Riprap sizes are designed by either the mean diameter or the weight of the stones.

Proper slope selection and surface preparation are essential for successful long-term functioning riprap. Adequate compaction of fill areas and proper use of filter blankets are necessary

The Engineer shall design the work covered under subsection 2.5 and Appendix B to meet the following technical specification section:

1. Section 02275 – Riprap

3.11 RETENTION/DETENSION BASINS

- A. General – The design of regional and on-site retention/detention basins shall be performed in accordance with the City's current Storm Drainage and Flood Control Design and Construction Standards, Master Drainage Plan and other pertinent master plans and studies.

The Engineer shall design the work covered under subsection 2.5 and Appendix B to meet the following technical specification section:

1. Section 02292 – Dam Embankment Construction
2. Section 02274 – Clay Liner
3. Section 02710 – Toe Drain
4. Section 11232 – Slide/Stop Gates
5. Section 00000 - Low Flow Pipe

3.12 STORM DRAIN SYSTEM

- A. General – The design of storm drainage facilities, including pipelines, shall be performed in accordance with the City's current Storm Drainage and Flood Control Design and Construction Standards, master storm water management plan and other pertinent master plans and studies.

The Engineer shall design the work covered under subsection 2.5 and Appendix B to meet the following technical specification section:

1. Section 02712 – Storm Drainage System
2. Section 02750 – Storm Drainage System Testing
3. Section 02606 – Manholes
4. Section 02617 – Reinforced Concrete Pipe
5. Section 02618 – Reinforced Concrete Pressure Pipe
6. Section 11231 – Flap Gates

3.13 PERMANENT SEEDING

- A. General - This practice will establish perennial and permanent seeding for a site where development is complete or will have no further disturbance. This practice is for an area that has been brought to final grade within 21 days of initial disturbance and satisfies one of the conditions of the revegetation bond as stated in Resolution _____.

1. Installation Specifications
 - a. Install berms or swells to prevent concentrated flows from adjacent properties.
 - b. Prepare seed bed should be granular, loose, uniform grades to 2-4 inches in depth.
 - c. Surface Roughing if the rainfall causes the soil surface to become sealed or crusted, loosen it just prior to seeding by disking, harrowing, raking or other suitable methods.
 - d. Apply fertilizer as required by existing soil evaluations.

- e. Mulch: The Contractor will obtain a written statement and recommendations from the seed supplier or other knowledgeable entity, comparing the types of vegetation and the type of mulch being used. The seed supplier written statement will specifically address the analysis of the denseness of the blanket with growing characteristics of the proposed seed, i.e. as the seed germinates, the broadleaf plant will cause tenting due to the denseness of the mulch.
2. Seed Mix - The following seeds will be included in the proposed seed mix.

Sodar Streambank Wheatgrass

Agropyron, riparium

This a native sod grass of the Northern Great Plains plant growth region and the western intermountain area. It tolerates drought and spreads rapidly to form a good ground cover. It appears early and resembles thick spike wheatgrass. It is used widely as a low-growing, low maintenance cover. This is useful for roadside seeding, recreation areas, disturbed areas, and other sites where a low maintenance turf is desired.

Nezpar, Indian Ricegrass

Oryzopsis hymenoides

This grass is dense tufted perennial with upright stems. It is widely distributed over the west where it is one of the most drought-enduring native range grasses. It grows on semi deserts, sand dunes, sandy plains, canyons, hillsides, foothills, exposed ridges, and dry, sandy, rocky, or granulated shale sites. It is one of the first species to become established on disturbed sandy sites. This species has excellent seedling vigor and is easily established. Birds, especially mourning dove and pheasant, and small rodents relish the plump nutritious seeds.

This is an important bunch grass of the intermountain region. However, the seed is generally available in limited quantities.

The Engineer shall design the work covered under subsection 2.5 and Appendix B to meet the following technical specification section:

1. Section 02933 – Seeding

SECTION 4.0

PLAN PREPARATION

4.1 GENERAL

The Engineering Department has established procedures, which must be followed in the preparation of engineering drawings and other plans. Deviations from these requirements, unless specifically authorized, will be cause for rejection by the Engineering Department. All engineers preparing plans should have in their possession a complete set of these Standards. All work shall be in ink on mylar sheets and digital copies of this work will be provided to the Engineering Department upon completion of the project. All projects constructed in the City will conform to these Standards.

The engineer has a distinct responsibility to follow the progress of the work and to submit change orders to the drawings and to incorporate "as-built" information on the drawings.

It should be understood that the responsibility for accuracy and completeness of the drawings rests with the developer's engineer. By signing the drawings, the City Engineer attests to the fact that they have been reviewed by the City and that the Planning Commission has authorized construction. By signing the drawings the City Engineer does not replace the professional liability of the professional engineer who prepared the drawings. The professional engineer who has prepared the studies, design, and drawings associated with this work is to sign and stamp these documents as required by State law.

4.2 PLAN PREPARATION RESPONSIBILITY

Refer to subsection 1-1 and 2.1.B. Design Professionals Qualifications for this information.

4.3 SHEET SIZE AND MARGINS

Overall dimensions of each sheet are 24x36-inches. Margins are to be 2-inches on left, all others ½-inch.

4.4 SIGNATURE BLOCKS

All sheets of the drawings shall have a approved signature blocks. The approval blocks shall be signed before any construction occurs. Any changes to the plans after initial approval shall be shown as revisions and are required to be approved by the City Engineer.

4.5 COVER SHEET

This shall be the first sheet in the set and shall contain:

- A. Index Map. An index map with an overall plan at a scale of one inch = 300 feet showing general layout of work, named streets, subdivision boundaries, lot boundaries and numbers, a sheet index and other pertinent information. Care must be exercised to make sure scale and orientation are correct since these index maps are used in the City's geographical information system for other purposes.

- B. Vicinity Map. A vicinity map with a scale of one inch = 1,000 feet showing subdivision boundary, streets, adjacent subdivisions, major streets outside of subdivision boundaries and the location of the bench mark.
- C. Bench Marks. All bench marks used in the project shall be graphically shown on this sheet and the elevations, descriptions, locations, etc., spelled out as illustrated below:

B.M. No. _____ Elev _____ F.B. _____ Page _____

Type of Marker _____

Location _____

All elevations used in preparation of standard plans shall be based on Salt Lake County Surveyor's Office information.

- D. General Notes. The general notes shall be shown on the cover sheet and need not be shown on the other sheets. The general notes shall include a note requiring compliance with these standards and 5 day notice prior to a preconstruction meeting and before beginning construction (see Section 4.11). Land disturbance notes are to appear on the grading plan. In some instances the land disturbance general notes may appear on a separate sheet. In these instances the grading plan will reference the general notes with lettering not less than 18 points and the sheets will have similar and consecutive numbering, starting with "G" i.e. For general notes refer to Sheet G-1 of G-4
- E. As-built Materials List - On the cover sheet shall be a block to be used for as-built information. It shall be as follows:

MATERIAL LIST

<u>Item</u>	<u>Supplier and/or Manufacturer</u>	<u>Model/ Type No.</u>	<u>No.</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Prior to submittal of as-built drawings, the developer's engineer shall complete the pertinent information.

"As-built" certification is also required. The wording shall be as follows:

"AS-BUILT" CERTIFICATE

I hereby certify that the work shown on Drawing Number _____ Sheet _____ through _____ inclusive, marked "as-built" has been constructed in conformance with lines and grades as shown on said plans and referred specifications.

Registered Civil Engineer

RCE No.

Date

- G. City Engineer's Certification for Approval to Construct. Appropriate designation for City Engineer approval to construct, located above title block (number and date to be completed by the Engineering Department).

"Approved for Construction. _____ Date _____
City Engineer

4.6 GRADING AND SEDIMENT CONTROL PLAN

- A. General – Grading plans are to be submitted for review, prior to disturbance of land or vegetation. The City will issue a letter to proceed when the plans conform to the specifications herein. Specifications herein are to be considered minimum. During the review process the City could require additional information prior to issuing the letter to proceed.

The minimum submittal will consist of:

1. A plan review of the site.
 2. Two sections through the grading project on the X and Y axis with details as required.
 3. The dust control plan as required by the State of Utah, Department of Environmental Quality, Division of Air Quality is to be submitted as a separate drawings meeting the state's requirements.
 4. A wet weather plan is required showing additional BMPs that will mitigate the affects of the wet weather on/to adjacent facilities. The intent is to keep streets, storm drains, and existing waterways free of sediment.
 5. Detail sheets contain the proposed BMPs on the site. The details are to provide specific and detailed installation instructions to the Contractor to install said BMPs. The general description per manufacturer recommendations is not adequate or acceptable. The BMPs selection is to be flexible and addressed as the project proceeds and site conditions change.
- B. Plan View – Show and identify the following:
1. The layout of the subdivision including streets, lot line easement lines, drainage channels, and under ground drainage systems. The layout is to be seen as a background (50%).
 2. Existing contours including topographic features including but not limited to existing drainage channels, roads, and structures. Contours to be labeled with numeric elevations on a maximum ten-foot intervals and shown as dashed lines. The City Engineer may change the required interval based on the slope of the property.
 3. Finished contours of all proposed topographic features. Finished contours are to be more distinct than existing elevations. Contours to be labeled with numeric elevations on ten-foot intervals and shown as solid lines. The City Engineer may change the required interval based on the slope of the property.

4. Show area Limits of disturbance (LOD).
5. Indicated LOD barrier material, i.e. concrete Jersey barrier or silt fence.
6. Show construction phasing limits.
7. Show timetable construction phasing. Chart form is acceptable.

Example:

Phase	Start	Finish
1	May 15, 2000	September 2000
2	August 22, 2000	December 2000
3	March 1, 2001	September 2002

8. Identify areas in which the majority of the lot has been created with fill dirt.
9. Topsoil storage area(s), containment, and erosion control methods.
10. Retaining walls
11. Sediment BMPs satisfying the intent of retaining soil on the site and out of the streets, existing waterways, storm drain, including dust control 24 hours and seven days per week. Identify type and location of sediment control BMPs in two locations.
 - a. The plan view
 - b. In a chart on the same sheet as the plan view

Example:

Sediment Control BMP	Identification	Location of BMP	Site Condition
Silt Fence	SF-1	South side of property	Bottom of slope
Construction Entrance	CE-1	North end of property	Adjacent

12. Show locations and direction of flows of existing and proposed swales, water courses, canals, ditches, springs, wells, culverts, storm drains, and storm water facilities. BMP are to be shown in the plan view and in chart form.
13. Show existing and proposed easements and ownership of said easements on residential lots.
14. Show location of any designated flood plains and/or wetland boundaries.
15. Show the staging area and BMP to control chemical and fuel spills.
16. Provide a minimum of two sections through property, one through the x-axis and one through the y-axis. Additional sections are required when:
 - a. Cuts or fills over six feet.
 - b. Identify locations of sensitive areas, i.e. wetlands or natural drainage courses that will be affected by the proposed grading.
17. Identify the dust control to be used 24 hours a day, seven days per week.
18. Location of concrete vehicle wash out area.
19. The calculation of amount of soil is being moved. This calculation is inclusive of imported, exported, or material used to balance the site. If the soil is being moved, dug, excavated, imported or exported, the calculation should reflect the same.
20. The existing and finish grades expressed in percent to be shown in the respective areas. Existing or finished grades over 30% will be distinctively shaded.

21. Survey Section indicators shown with corresponding sheet numbers.
22. General Notes to appear on Grading Plan.
 - a. Contractor should perform earthwork in accordance with the City of West Jordan Land Disturbance Ordinance, the City's Standard Specifications, City of West Jordan Land Disturbance Design and Construction Standards, erosion, sediment, revegetation requirements, and the dust control plan as required by the State of Utah, Department of Environmental Quality, Division of Air Quality.
 - b. The Contractor will perform earthwork in accordance with technical specifications outlined in the Land Disturbance Design and Construction Standards and the recommended earthwork specifications found in the report of geotechnical engineer, and the geotechnical investigation dated [REDACTED]. In the event there is a conflict between the documents mentioned herein and City of West Jordan's erosion and sediment control requirements or the dust control plan as required by the State of Utah Department of Environmental Quality, Division of Air Quality, City of West Jordan's requirements and the State requirements will control.
 - c. The sequence of construction is to be followed.
 - d. Sedimentation BMPs shown on the erosion control and sediment control plans to be installed within the same working day the land disturbance occurs.
 - e. Dust control BMPs are to be on site and implemented as soon as land disturbance occurs. The dust control as required by the State of Utah air quality plan is to be submitted with the grading plan as a separate drawing.
 - f. All areas to be revegetated are to receive revegetation BMPs within 21 days of disturbance.
 - g. If the existing grade is different from what is shown on this grading plan, stop work and contact the City of West Jordan, Engineering Department. Work is to remain stopped until the City's Engineering Department provides a written notice to resume work.
 - h. The project owner is responsible for maintaining the streets, storm drains, and channels, ditches and swales free from debris, soil, mud, or other material that would cause a public safety concern, violate the City's UPDES permit, state or federal laws, or prevent the facility from operating.
 - i. All concrete trucks are to use the designated washout area(s). Failure to comply will result in a work stop and the offender could be guilty of a Class C misdemeanor.
 - j. L.O.D. barriers are to be in place and maintained until written notification is received from the Engineering Department. The owner is responsible for maintaining L.O.D. barriers.
 - k. If disturbance occurs outside the L.O.D. work will stop and remain stopped until the written response is received from the City.
 - l. The owner is to be responsible for additional grading information as required throughout the remainder of the project.

C. Grading Plan Sections

1. Sections to be drawn to the scales indicated see Section 4.7. The profile to be displayed on an X and Y grid background.
2. Section to show existing grades, finished grade, property lines and drainage features.

4.7 EROSION CONTROL AND REVEGETATION PLAN

- A. General - An erosion control plan is required for all land disturbances including but not limited to pioneering roads, residential subdivisions, commercial projects/subdivisions, temporary and permanent construction, roads and utilities.

The erosion control plan must be prepared and approved before final approval and before construction begins. The erosion control plan shall be submitted with the grading plan as required by local ordinances or be prepared as part of the storm water pollution prevention plan (SWPPP).

If the grading permit allows work to be done during the wet weather season, the permit may require a wet weather operating and erosion control plan. This plan must be approved prior to the commencement of any work and include all necessary temporary and permanent erosion control measures, including those to be followed should the work stop at any time during the wet weather season.

If the site or portion of the site is planned to be idle for more than 45-days, then vegetative stabilization must be accomplished within 7-days. The wet weather plan must include a plan for the immediate (within 24-hours of the first forecast of a storm front) installation of emergency erosion control measures.

- B. Guidelines for Erosion Control Plans - The plan will consist of three parts:

1. A narrative, containing:
 - a. A brief description of the proposed land-disturbing activities, existing site conditions, and adjacent areas (such as creeks and buildings) that might be affected by the proposed clearing and grading;
 - b. A description of critical areas on the site - areas that have a potential for serious erosion problems, including the name, location and aerial extent of moderate and highly erodible soils and slopes on the project site;
 - c. The date grading will begin and the expected date of stabilization;
 - d. A brief description of the measures that will be used to control erosion and sedimentation on the site;
 - e. When these measures will be implemented;
 - f. A description of an inspection and maintenance program, with provisions for frequency of inspection, reseeding, repair and reconstruction of damaged structures, cleanout and disposal of trapped sediment, duration of maintenance program, and final disposition of the measures when site work is complete.
2. A map showing:
 - a. Existing site contours at an interval and scale sufficient for distinguishing runoff patterns before and after disturbance;
 - b. Final contours;
 - c. A legend, if necessary;
 - d. Limits of clearing and grading;
 - e. Existing vegetation, such as grassy areas or vegetative buffers, that may reduce erosion or off-site sedimentation;
 - f. Critical areas within or near the project site, such as streams, lakes, wetlands, or the aerial extent of erodible soils;

- g. The location and types of erosion and sediment control measures, including vegetative treatment used.
- 3. Plan details, including:
 - a. Detailed drawings of erosion and sediment control structures and measures, showing dimensions, materials, and other important details;
 - b. Design criteria and calculations such as design particle size for sediment basins and peak discharge for channel design and outlets;
 - c. Seeding or vegetative specifications;
 - d. Inspection and maintenance notes.
 - e. Specification for surface roughing.

The narrative and details should be placed on the erosion control plan map if possible.

- C. Plan Check - The following items provide a general approach and guidelines that a review agency or plan checker might find useful:
- 1. Responsibility: It is not the responsibility of the plan reviewer to ensure that the plan is appropriate for the level of work suggested by the proposed project. The reviewer can only ensure that the plan meets the minimum standards set by the reviewing agency and its authorizing ordinance.
 - 2. Communications: Encourage informal communications between the plan reviewer and the plan preparer. This will enable the reviewer to make informal suggestions that may save the developer money and the preparer time, and it may result in a better, more effective plan. It will also enable the preparer to explain and justify the plan.
 - 3. Incomplete Plans: Do not review seriously incomplete plans. Send them back with a request for the missing information.
 - 4. Required Information: Make sure all the required information has been submitted. A checklist can be used by both plan reviewers and plan preparers, however, checklists can encourage laziness. Having everything checked off does not necessarily mean that everything is in order.
 - 5. Plan Concept: The concept should be examined first, starting with the general and moving to the specific. Does the plan make sense?
 - 6. Schedule: Examine the construction schedule. Will grading be completed before the wet weather season or before the summer thunderstorm months? When will storm drainage facilities, paving, and utilities be installed in reference to the wet weather season? If grading will take place during months when there is a high probability of heavy rains, what extra precautions will be taken to protect against erosion, sedimentation, and changing drainage patterns (Is a wet weather plan necessary)?
 - 7. Minimize Disturbance: Does the plan show areas that are not to be disturbed? If possible, native vegetation should be retained and stream buffer areas should be designated on the plan and flagged in the field. A well-conceived erosion control plan will minimize erosion by attempting to minimize disturbance and retain natural vegetation. A phased approach to development can assure that the extent and timing of grading does not exceed the contractors ability to perform erosion and sediment control.
 - 8. Site Drainage: Make sure you understand where all drainage comes from on and above the site, where it goes, and how it traverses the site. For large sites, require or prepare a drainage area map. If drainage patterns are unclear, ask for clarification.
 - 9. Sediment Basins and Traps: Locate all sediment basins and traps and define their tributary areas.
 - 10. Erosion Control: Check the method used to prevent erosion. Hydraulic seeding and mulching may adequately stabilize some areas, but other areas, because of their proximity to sensitive

features such as watercourses, or their steepness and erosive soil, may need far more intensive revegetation efforts. On steep and critical slopes, a reliable backup system for hydraulic planting, such as punched straw, bonded fiber matrix, or erosion control blankets is strongly recommended.

11. Channels and Outlets: Examine all drainageways where concentrated flows will occur. Be sure adequate erosion protection is provided both along channels and at channel and pipe outlets. Check the sources of runoff to be sure that all the runoff comes from undisturbed or stabilized areas or has been desilted by sediment basins or other sediment retention devices.
12. Miscellaneous: Look for haul roads, stockpile areas, and borrow areas. They are often overlooked and can have a substantial effect on drainage patterns. Have construction or access roads been surfaced with rock, as a minimum treatment, before the rainy season? Look at all points of vehicle access to the site and be sure mud and soil will not be tracked onto paved streets and that sediment-laden runoff will not escape from the site at these points. Pay particular attention to watercourses and their protection.
13. Plan Details: Once the plan concept has been shown to be adequate, check the details to be sure the concept is adequately described in the plans.
14. Structural Details: Be sure that sufficiently detailed drawings of each structure (sediment basin, dike, ditch, silt fence, etc.) are included so there is no doubt about location, dimensions, or method of construction.
15. Calculations: Determine if calculations have been submitted to support the capacity and structural integrity of all structures. Were the calculations made correctly? Non-engineered structures, such as straw bale barriers, do not generally need hydrologic calculations, however, supporting information such as drainage area and peak flow should be available if requested.
16. Vegetation: Review seed, fertilizer, and mulch specifications. Check quantities and methods of application to be sure they are appropriate and consistent with local guidelines. Are there stipulations so that ineffective revegetation and/or damage can be remedied immediately?
17. Maintenance: Be sure that general maintenance requirements and, where necessary, specific maintenance criteria, such as the frequency of sediment basin cleaning, are included. Are there stockpiles of spare materials (filter fabric, straw bales, stakes, gravel, etc.) to repair damaged control measures? Routine maintenance inspections should be part of the plans.
18. Contingencies: The plan must provide for unforeseen field conditions, scheduling delays, and other situations that may affect the assumed conditions. For example, straw mulch may need to be installed as an emergency measure during severe summer thunderstorms, or sediment basins may need to be cleaned more frequently.
19. Technical Review: Where applicable, the erosion and sediment control plan should be reviewed by the soils, certified professional in erosion and sediment control (CPESC), or geotechnical consultant for the project.
20. Signature: Where applicable, the erosion and sediment control plan should be signed by the preparer who shall be a qualified professional.

4.8 GRAPHIC SCALES AND NORTH ARROW

All plan and profile sheets shall contain:

- A. A graphic scale, horizontal as well as vertical, illustrated such that a true representation is produced when the plans are reduced in size, and they shall be as follows:

Horizontal 1 inch = 40 feet

Vertical 1 inch = 10 feet *

*Double scale drawings (i.e., 1 inch = 8 feet) may only be submitted where the predominant slope of the existing ground surface or any one sheet exceeds 15 percent. In such cases, the words "Double Scale" shall be boldly shown.

- B. A north arrow oriented toward the top or to the right only, or as approved. Generally, north shall be oriented towards the top or right hand side of the sheet.

4.9 PROCEDURE FOR APPROVAL

Approval for improvement plans consists of two phases. Each phase consists of a series of requirements, which must be met before final acceptance.

- A. Requirements for authorization of construction (see Section 5 of these Standards).
B. Requirements for final acceptance (see Section 11 of these Standards).

4.10 PLAN CHECKING LIST

The following list is intended as a guideline to assist the preparer; it is not represented to be a complete list of requirements.

Check List Plan Checking and Project Requirements Grading

Cover Sheet.

Standard size, title block, signature block. Revision and engineer's block
Key and vicinity map
Include lot numbers and lot lines. Sheet index
Adjacent subdivisions and street layout
Bench mark
Design and as-built certificates
General notes
Blue stake alert note.
Engineer's stamp and expiration date

General Design

Conform to master plans
Check for right of way and easements
Compliance with other utility company requirements
Check for existing irrigation canals
Check for compliance with City's surveying monumentation

Grading and Sediment Control Plan Submittal

A plan view of the site
Screened background layout of project
Existing contours (screened)
Finished contours shown and labeled
L.O.D. shown, material identified and labeled
Indicate construction phase lines

- Time table chart of phasing
- Areas with fills over four feet
- Topsoil storage areas shown and identified
- Sediment BMP shown on plan view sheet and in chart
- Existing drainage features
- Existing wetlands identified
- Show staging area and provide details
- Two sections through the grading project on the x and y axis details
- Dust control plan on separate sheet
- Wet weather plan using BMP
- Concrete washout area

Plan & Profile Sheets

- Graphic scales
- North arrows
- Roadway stationing left to right
- Elevations of centerline of roadway, curb and gutter on each side
- Proper burial
- Curve data if there are curves
- Street, curb dimensions, street names
- Lot boundaries
- Easements including line bearings
- Angle points - show deflection angle right or left moving up station

Administrative Before Construction of Main(s)

- Cost estimate
- Inspection and engineering review fee. Bonds and insurance.
- SWPP & Notice of Intent

Administrative During or After Construction to Main(s)

- Change Order Fee
- Meter installation requests

Check List **Plan Checking and Project Requirements** **Erosion, Revegetation and Sedimentation**

The following checklist is provided to help the plan preparer and reviewer make sure that all the necessary elements of an comprehensive plan have been addressed.

Narrative

Project description: A brief description of the nature and purpose of the land-disturbing activity and the amount of grading involved.

Existing site conditions: A description of the existing topography, vegetation, and drainage.

Adjacent areas: A description of neighboring areas, such as streams, lakes, residential areas, and roads that might be affected by the land disturbance.

Soils: A brief description of the soils on the site including erodibility and particle size distribution (texture).

Critical areas: A description of areas within the developed site that have potential for serious erosion or sediment problems.

Erosion and sediment control measures: A description of the methods that will be used to control erosion and sediment on the site. Temporary erosion control, and temporary sediment control measures. Who will be responsible for implementation? Financial guarantees may be required to assure proper implementation

Permanent stabilization: A brief description of how the site will be stabilized after construction is completed.

Maintenance: A schedule of regular inspections and repairs of erosion and sediment control structures, and the person responsible for maintenance.

Maps

The following information should appear on one or more maps:

Existing contours: Existing elevation contours of the site at an interval sufficient to determine drainage patterns.

Preliminary and final contours: Proposed changes in the existing elevation contours for each stage of grading.

Soils: Boundaries of the different soil types within the proposed development.

Existing vegetation: Locations of trees, shrubs, grass, and unique vegetation.

North arrow

Vicinity Map

Critical areas: Areas within or near the proposed development with potential for serious erosion or sediment problems.

Existing and final drainage patterns: A map showing the dividing lines and the direction of flow for the different drainage areas before and after development, and how well off-site water passes through the site without contamination.

Limits of clearing and grading: A line showing the areas to be disturbed, and proposed buffer strips.

Erosion and sediment control measures: Locations, names, and dimensions of the proposed temporary and permanent erosion and sediment control measures.

Storm drainage system: Location of permanent storm drain inlets, pipes, outlets, and other permanent drainage facilities (swales, waterways, etc.), and sizes of pipes and channels.

Details

Detailed drawings: Enlarged, dimensioned, and typical drawings of Best Management Practices such as erosion control blankets, energy dissipators, grass-lined channels, and sediment barriers.

Seeding and mulching specifications: Seeding dates, seeding and mulching rates in pounds per acre, and application procedures.

Maintenance program: Inspection schedule, spare materials needed, stockpile locations, and instructions for sediment removal and disposal and for repair of damaged structures.

Master Plans – Check master plans to ensure compliance of project with the City's most current master plan(s).

Calculations

Calculations and assumptions: Data for design storm used to size pipes and channels and sediment basins and traps, design particle size for sediment trap efficiencies, basin discharge rates, size and strength characteristics for filter fabric, wire mesh, fence posts, etc., and other calculations necessary to support drainage, erosion, and sediment control systems.

Attachments: The erosion control plan should accompany the grading plan.

4.11 STANDARD LANGUAGE FOR DEDICATION OF FACILITIES TO CITY

Please refer to the Road and Bridge Design and Construction Standards for the approved language for these items.

4.12 STANDARD NOTES

The standard notes shown on the following page(s) should be included on the cover sheet as applicable. They are subject to change to suit the needs of the Engineering Department.

GENERAL GRADING NOTES

1. Contractor shall notify City of West Jordan Engineering Department at (801) 569-5051 five business days prior to commencing construction so that a preconstruction meeting can be scheduled.
2. All construction shall conform to City of West Jordan's Land Disturbance Design and Construction Standards as adopted and amended.
3. The contractor shall contact Blue Stakes (801.532-5000) for marking of existing utilities prior to performing any excavation. Call for underground locating two working days prior to any excavation.
4. Contractor shall perform earthwork in accordance with City of West Jordan Standard Specifications, Land Disturbance Design and Construction Standards and the recommended earthwork specifications found in the report of geotechnical investigation dated _____, 20____ by _____.
5. The existing topography shown on these plans is based on aerial topographic mapping performed by _____ for _____ dated _____, 20 ____.
6. The Owner shall provide an erosion control plan and obtain all permits required by the City of West Jordan, Salt Lake County, and the State of Utah for erosion control. The Contractor shall be solely responsible to provide all temporary erosion control and maintenance, and shall provide erosion and sediment control forms to the City. For additional erosion control information, see 'Erosion Control/Revegetation Plan' sheets. See section 4.7.
7. Subsurface investigations have been conducted at the site of the work. Copies of the soils report may be obtained at the office of _____. Soils

investigations were conducted for design purposes only and the data shown in the reports are for subsurface conditions found at the time of the investigation. The Owner and Engineer disclaim responsibility for the interpretation by the Contractor of data, such as projection or soil bearing values and profiles, soil stability and the presence, level and extent of underground water for subsurface conditions during construction operations.

4. CAUTION: Only City of West Jordan Infrastructure Maintenance and Operations Department personnel are to operate any valves on the culinary water system.

GENERAL EROSION, REVEGETATION AND SEDIMENTATION NOTES

1. Contractor shall notify City of West Jordan Engineering Department at (801) 569-5051 five days prior to commencing construction so that a preconstruction meeting can be scheduled.
2. All construction shall conform to City of West Jordan's Land Disturbance Ordinance and Land Disturbance Design & Construction Standards as adopted and amended.
3. The contractor shall contact Blue Stakes (801.532-5000) for marking of existing utilities prior to performing any excavation. Call for underground locating two working days prior to any excavation.

SECTION 5.0

FEES, CHARGES AND REQUIREMENTS FOR AUTHORIZATION OF CONSTRUCTION

5.1 GENERAL

The authority for fees/charges is generally established in the City of West Jordan Municipal Code, Title 2 – Administration, Chapter 7 - Finance. Specific fee/charge amounts are adopted by City Council Resolution and are generally updated by resolution on a yearly basis. All fee/charge amounts are adopted following the conducting of public hearings by the City Council as required by law. Copies of the current documents are available from the City Records Office and/or are contained in the City’s “Development Processing Manual”, which can be obtained from the City’s Community Development Department.

5.2 SUBMITTAL OF PRINTS (PLAN CHECK)

The Developer is responsible for submitting two sets of the prints of the proposed roadway improvements and one copy of the final subdivision plat, where appropriate to the Engineering Department. Plans illustrating an incomplete design and drafting detail may not meet minimum standards and may be just cause for a rejection of the first plan check. The developer or developer's engineer shall submit preliminary plans completed in accordance with these standards. The developer and the developer's engineer should be aware that most projects involve several plan check/ submittals before the drawings are deemed to be in satisfactory condition.

5.3 LAND DISTURBANCE PERMIT APPLICATION FEE

Land disturbance activities, which require a Land Disturbance permit as defined in Title 81 - Land Disturbance Ordinance are required to file and pay the fee associated with this permit.

5.4 SPECIAL PROVISIONS

If there are unusual conditions which would require substantial deviation from the City’s Land Disturbance Design and Construction Standards, particularly with respect to other sensitive lands, such deviations are to be submitted in writing prior to preliminary plat review and/or development project approval, or in any case prior to submittal of the first plan check.

5.5 EASEMENTS

Any easements necessary must have deeds submitted for checking at this time or must be shown on the subdivision plat before recordation

5.6 AGREEMENTS, BONDS, AND INSURANCE CERTIFICATES

City staff will provide the developer with the proper forms and developer shall submit the following:

- A. Insurance Policy Certificates. Insurance certificate with limits as stated in the “Agreement”. Attention is particularly called to the City’s requirements concerning submittal of an “Accord”

form. The insurance certificate shall include general liability, auto liability and worker's compensation insurance in amounts as required by the Engineering Department or City Attorney. The City, its officers, employees and agents, shall be named as additional insureds. The notice of cancellation period must be no less than 60 days. Any reference in the cancellation clause to "endeavor to" or "but failure to mail such notice shall impose no obligation or liability of any kind upon the company" must be deleted. Also, the words "This certificate is issued as a matter of information only and confers no rights on the certificate holder" must be deleted. If disclaimers cannot be deleted from the Accord form, then a signed warranty letter must be attached to the certificate.

- B. City's Accord Form. The City reserves the right to request that the City's Accord form be utilized.
- C. Performance Bond. Security is required to pay for stabilization of the site should work be abandoned or stopped before construction is completed. The Engineering Department and City Attorney's office will determine the amount and form of the security and of the form approved by the City Attorney's office. When an agency of the State, federal, or local government provides at least 20-percent of the financing for the project, an instrument of credit from that agency is acceptable.
1. Form – The security can be one of the following:
 - a. Bond by a duly authorized corporate surety, or
 - b. Letter of credit
 2. Amount – The amount of security shall be the full cost of erosion and sedimentation control measures for the project. The estimate of this cost shall be prepared by the developer, and reviewed and approved by the Engineering Department. The City reserves the right to change the estimated amount required.
 3. Release – The security will be released upon issuance of a certificate of completion or upon voluntary relinquishment of the permit, provided provisions of the Land Disturbance Ordinance have been complied with and no administrative or legal action against such security has commenced.
- D. Payment Bond. A Payment Bond (Labor and Materials) in triplicate and notarized, equivalent to the estimated cost based upon the City's most current Resolution.

5.7 APPROVAL FOR CONSTRUCTION

Upon receipt of all documents, bonds, fees and checking for all documents, bonds and fees, the staff shall prepare a memorandum to the City's Community Development Department indicating the Engineering Department's concerns have been addressed and the project is ready for City Council or Planning Commission action, from an Engineering Department perspective.

Complete details of Engineering Department requirements for approval of projects is contained in the City's "Development Processing Manual", which is available from the City's Engineering Department. This manual details the various engineering and other requirements necessary to obtain various approvals for a variety of types of development.

Prior to approval by the Planning Commission, the developer/developer's engineer will submit four (4) sets of final drawings (blue line prints) to the Engineering Department to be stamped "Approved for Construction", once the Planning Commission approves the project. The Engineering Department will

sign the original plans only after approval by the Planning Commission, and will notify the developer's engineer that the plans are signed and available. These prints will be stamped "Approved for Construction" on each sheet and one set will be returned to the developer, which must be kept by the contractor on the project site at all times. The other three sets will be distributed to: one (1) to the Engineering inspector, one (1) to the City's project engineer, and one (1) to the permanent Engineering Department file. No work is permitted which is not shown on these approved plans, except minor field changes approved by the Engineering inspector, until a change order has been processed by the Engineering Department and new "Approved for Construction" sheet(s) is (are) issued. The original drawings will be returned to the developer's engineer until they are "as-built", at which time the originals become the City's property.

No construction is to occur before the plans are signed and before the proper five day Engineering Department notification has been given. This notification will allow time for a preconstruction meeting with all interested parties.

The Engineering Department and the developer have a direct relationship via the documents outlined above. Therefore, to the extent possible, correspondence and verbal communication are to be between these parties rather than between the Engineering Department and the contractor or subcontractors where the developer is excluded. In some instances, when the developer or his representative is not available, a work stop order could be placed on the project until the developer; makes himself available.

5.8 SPECIAL CHARGES

If there are items requiring special approval, the Engineering Department may require deposition of funds or agreements for funds in the future, to provide for operation and maintenance of an extended revegetation plan i.e., the planting of seedlings in a deep fill area. Review of this work by the Engineering Department will be charged per Councilmanic Resolution.

SECTION 6.0

CONSTRUCTION STAKING

6.1 GENERAL REQUIREMENTS

Construction staking is the responsibility of the developer, his engineer or contractor. When the term 'construction staking' is used, it should be remembered that it encompasses construction roadway, pioneering roads, limits of disturbance, which may not involve any staking, such as survey flagging to be used in heavy vegetated areas. Stakes or marks will be set at no greater interval than 50-feet on straight alignments, in 30-percent and greater slope areas, staking or flagging will be based on the principle of line-of-site as required by the Engineering Department.

The actual installation of construction stakes or flagging is to be preformed to minimize the disturbance of vegetation, existing grade and other sensitive geological and environmental features.

The information contained on the construction stake shall clearly indicated station, station description, existing grade, finished grade, amount of cut or fill, offsets, and setbacks.

6.2 PRESERVATION OF STAKES

Construction stakes or construction markings shall be carefully preserved by the contractor until after the staking or flagging can be reviewed and approved by the City. If two or more consecutive stakes are knocked out during construction, new stakes shall be set at the contractor's expense.

6.3 "AS-BUILT DRAWINGS"

The stationing and staking adjustments due to field conditions should be shown on as built drawings.

SECTION 7.0

CONSTRUCTION

7.1 GENERAL REQUIREMENTS

This section describes the use of materials and workmanship to be employed in any land disturbance including but not limited to residential building sites, commercial site, parks, subdivisions, as well as City projects. The developer/ engineer shall prepare such general and special specifications as are necessary to define the nature and location of the work, contractual arrangements, payment for work and any other matters concerning the owner or his contractor; these items are not discussed within the standards presented here.

- A. Use of this Section - The construction section is intended to highlight the features of construction, which are deemed to be most significant. In any construction activity, when there is a conflict between the recommendations of the manufacturer of a product, and the specifications herein and/or county, state or federal regulations the more stringent, should apply.

Finally, Section 3.0 of these Standards contains material descriptions and the developer/contractor should use that section along with this section and the respective plates as a reference. Section 9.0 describes testing procedures and requirements.

- B. Quality of Materials - Materials and equipment to be incorporated into the work shall be new and meet quality control standards of the manufacturer, no seconds allowed on the project. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used. When construction bids are received directly by the City such bids shall show the proposed pipe material and the manufacturer's name, if more than one type is allowed.

The Contractor shall have at the job site certified copies of factory or laboratory test reports showing the strength characteristics of any materials used in the work. For all reinforced concrete work, the contractor shall furnish in advance of pouring concrete and, if requested, the mix design and calculated concrete strength as prepared by the concrete supplier.

- C. Substitutions - Where articles or materials are specified by brand or trade name, alternate materials or articles equal to those specified may be approved provided the request for approval is in writing accompanied by supporting data, in ample time to permit investigations without delaying the work, based on the following:

1. The alternate product documentation performance typical of the site-specific design parameters. Documentation of similar products will not be accepted. The intent is to have the design parameters be the controlling factors in specifying a product. It is the sole responsibility of the manufacturer to work with the design engineer and/or to determine the design parameters.
2. On projects that the City has a financial interest, all alternate product submittals shall include a value engineering cost analysis.

Unless substitutions have received prior to approval, no deviation from the Standards will be allowed.

- D. Quality of Workmanship - All work will be done by persons experienced in the specific work, under competent supervision and in a first class manner to the City's complete satisfaction. When work is being done directly for the City, the contractor in the proposal shall name each subcontractor and no substitutions will be permitted without prior approval.

E. Defective Work

Site Work - Any defective materials or workmanship, which shall become evident within one year after field acceptance of completed work shall be replaced or repaired without cost to the City. Refusal of the contractor to correct defective work, which is clearly his responsibility, will be considered just cause for exclusion from performing future work for the City. Such exclusion does not impair the City's right to bring legal action to correct the deficiencies as well as to withhold release/exoneration of cash/letter of credit bond and payment bond.

Sediment Controls – Any defective materials or workmanship, which shall become evident, is to be replaced or repaired without cost to the City immediately. Refusal of the contractor to correct defective work, which is clearly his responsibility, will be considered just cause for exclusion from performing future work for and/or in the City. Such exclusion does not impair the City's right to bring legal action to correct the deficiencies as well as to withhold release/exoneration of cash/letter of credit bond and payment bond.

Revegetation – Defective work shall be governed by the prescheduled release dates of the revegetation bond as described in Resolution 97-73. All damage resulting from the contractor's refusal to repair the defective work will be the sole responsibility of the contractor of the owner.

- F. City Inspection, Field Acceptance and Guarantee Period - The developer's engineer is responsible for the daily inspections and submitting inspection forms, compaction data and other City required information. The developer's engineer is to notify the Engineering Department a minimum of 24 hours before final inspection is requested. The Engineering Department has the responsibility to respond in a timely manner, which is considered fair and responsible, but within five working days or request.

The Engineering Department is responsible for all final acceptance inspections of all grading, sediment control, erosion control and revegetation work. All such work shall be available for City observations and comments at all times. It will be the contractor's responsibility to provide a working day's notice to the Engineering Department prior to the start of any work. Scheduling a preconstruction meeting requires a minimum of five working days. Failure to provide proper notification may delay the preconstruction meeting and the starting date of the project since the Engineering Department may not be able to inspect the work and cannot accept any work for which a preconstruction meeting and/or inspection has not been arranged. It must be emphasized that the primary responsibility for compliance with all City requirements and standards rests with the developer. Any acceptance of a portion of the work by a construction inspector does not relieve the developer of this basic responsibility.

Field acceptance is made by the inspector; however, the 18-month guarantee period for all work shall begin as of City Engineer acceptance. The acceptance of any revegetation work will be subject to Resolution 97-73. As mentioned in Section 7.I.E., any defective site work or grading work discovered during this period shall be repaired or replaced but a new 18-month period will

not begin for the corrected work. Any defective work on a revegetation project or area will be subject to provisions or Resolution 97-73.

All holiday or weekend inspection will be subject to additional charges as detailed in the City's standard rates for such work.

- G. Public Relations - The contractor shall conduct its affairs in a manner that will lessen the disturbance to residents in the vicinity of the work. In this regard, standard working hours as specified in the Municipal shall be observed unless prior approval is received, which also includes City observed holidays. The job site shall be maintained in a condition, which shall bring no discredit to the City or its personnel, and all affected private improvements shall be restored to at least their original condition. Saturday work may be provided for only by approval of the Engineering Department and the contractor will be responsible for payment of all overtime and other charges associated with having City staff available for inspection and other coordination. Special care must be taken in regards to school zones, including sidewalks. These zones must be maintained open at all times and any alterations to existing shall be coordinated with the School District and the City's Engineering Department.

7.2 CONSTRUCTION SEQUENCE – EROSION /SEDIMENT CONTROL

- A. This portion of the document is to familiarize the permit holder/contractors and subcontractors with the general erosion/sediment controls required of all projects. Site-specific requirements contained on the City approved construction plan are in addition to these requirements. These requirements are as follows:
1. Read and follow the sequence of construction shown on the approved plans. Any modifications must be obtained from the Engineering Department prior to deviating from the sequence of construction.
 2. The limits of disturbance must be field marked prior to any land disturbance.
 3. Within a working day of disturbance, the erosion/sediment control measures must have been installed.
 4. Provisions to control dust are to be on site and operational prior to any land disturbance and are to meet the State's permit requirements. The State's dust control permit is to be available at the construction trailer at the site.
 5. An erosion/sediment control preconstruction meeting is required prior to any land disturbance.
 6. At the erosion/sediment control preconstruction meeting, a review of the area of disturbance and the proposed vegetation removal will be reviewed and approved by the Engineering Department.
 7. The permit holder must obtain written approval from the Engineering Department, certifying that the limits of disturbance, dust control measures and tree protection are correctly marked and installed or ready to implement prior to commencing any clearing.
 8. Erosion/sedimentation control best management practices will remain in good working order through the entire project and until all disturbed soil has been stabilized to prevent erosion. Written approval must be obtained by the Engineering Department certifying all disturbed areas.
 9. All disturbed areas will be reestablished as per these standards within 21 days of reaching the final grade.

10. Erosion/sedimentation control facilities require mandatory, periodic inspections throughout the construction and until all disturbed areas have been stabilized.
11. Erosion/sedimentation control facilities require regular, frequent inspection of not less than seven days or within 24 hours of a storm event or a snowmelt. Inspection will be documented by submitted the required information contained in the erosion and sediment control plan. Failure to fill out and submit said inspection forms to the Engineering Department would result in the issuance of a work stop order. Work stop order will not be released unless a special erosion and sediment control meeting is held.
12. Keep streets clean at all times. Written permission by the Engineering Department is required prior to washing streets.
13. A copy of these erosion/sediment control notes is to be posted at the site at all times. Failure to post said notes might result in a work stop order.

7.3 PERMITS

The following permits may be required of the contractor:

- A. Excavation Permit – Where construction will encroach into the public right-of-way or easements, the contractor shall obtain all necessary excavation permits. Within City of West Jordan right-of-way, the permit is secured from the General Services Department. Within the County areas, a similar permit is required from the County. State roads require a permit from UDOT. Particular attention is called to Section 7.15 and the appropriate standard drawings.
- B. Explosives Permit – Where the contractor anticipates the use of explosives in conjunction with the water construction, a blasting permit shall be first obtained from the City County and State agencies, and all nearby property owners shall be notified. These permits are discretionary and may not be given for a particular circumstance.
- C. Land Disturbance Permit – The Contractor is responsible for obtaining a land disturbance permit from the Engineering Department and paying the applicable fees. The Developer shall prepare the necessary grading plans and drawings and submit the necessary reports from a registered geotechnical engineer prior to the permit being issued.
- D. Dust Control Permit – The contractor is responsible for obtaining a Dust Control Permit from the Department of Environmental Quality Division of Air Quality and paying the applicable fees. The developer shall prepare the necessary Dust Control Permit and necessary drawings and submit the necessary plan and reports from an erosion control specialist prior to the permit being issued. The developer is hereby notified that the possession of a 404 permit does not constitute compliance until all details and BMP's have been reviewed by the City.
- E. Storm Water Pollution Prevention Permit (SWPP) - The contractor is responsible for obtaining a SWPP Permit from the Department of Environmental Quality Division of Water Quality and paying the applicable fees.
- F. Salt Lake County Development and Construction Permit - The Developer is to obtain and submit this permit to the City if the subdivision is within 100 feet of a critical flood area as defined by Salt Lake County. If the project is not within 100 feet of a critical flood area as defined by Salt Lake County, the Developer is to submit a letter from Salt Lake County to the City so indicating.

- G. Corps of Army Engineer 404 Permit – The contractor is responsible for obtaining a grading permit from the Corp of Army Engineer or the Natural Resource Conservation Service and paying the applicable fees. The developer shall prepare the necessary plans, drawings, and reports. That will specify detail all erosion control, sediment control, revegetation and urban drainage BMP and submit said items to the City from a qualified professional in their respective field, prior to the permit being issued. The developer is here by notified that the possession of 404 permit does not constitute compliance until all details and BMP have been reviewed by the City.
- H. Utah Department of Transportation (UDOT) Access Permit – The developer/contractor is responsible for obtaining a UDOT access permit for any work, which will require a connection to a UDOT owned and maintained roadway.
- I. Utah Department of Transportation (UDOT) Encroachment Permit - The developer/contractor is responsible for obtaining a UDOT encroachment permit for any work, which will impact UDOT, owned property.
- J. Canal Company Discharge Permit – The discharge of any surface water to an irrigation canal will require that the developer/contractor obtain a storm water discharge permit from that canal company.
- K. Other Permits - Other permits may also be required by other agencies, which must be applied for and obtained by the developer or his contractor. Certain permits are also required as part of the development conditioning process which must be provided prior to beginning construction of the project. Please refer to the City's 'Development Processing Manual' for additional information.

7.4 INSPECTION

A. General Excavating and Grading Requirements

1. Supervision. The land disturbance permit holder shall provide sufficient supervisory control during the grading operations to insure compliance with the approved plans and with the provisions of this Code. The land disturbance permit holder shall avail himself of geological and/or soils engineering services to implement the supervisory control of the land disturbance permit holder's registered civil engineer. The engineering geologist and/or soils engineer shall be properly qualified, in accordance with the provisions of this chapter, and qualified to perform such services within the City. Periodic reports as required by the City Engineer shall be submitted by the soils engineer and/or engineering geologist.
2. Safety precautions during grading. If, at any stage of work on an excavation or fill, the City Engineer determines by inspection that further work as authorized by an existing land disturbance permit is likely to endanger any property or public way, the City Engineer may require that plans for such affected area be amended to include adequate safety precautions as a condition to allow the work to continue. The City Engineer may cause the work on the affected area to be halted and may require that plans be amended to include adequate safety precautions as a condition to allow the work to continue.

Safety precautions may include, but shall not be limited to, specifying a flatter exposed slope or construction of additional drainage facilities, berms, terracing, compaction, cribbing,

retaining walls or buttress fills, slough walls, desilting basins, check dams, benching, wire mesh and guniting, rock fences, revetments, or diversion walls.

3. Supervised grading. Where necessary, the City Engineer shall require the land disturbance permit holder to employ:
 - a. A registered civil engineer to supervise all grading;
 - b. A soils engineer to provide either constant or continuous soils inspections; and
 - c. An engineering geologist to provide either constant or continuous geological inspections as suit the job.

The employment of such persons shall not be deemed to render unnecessary inspections described in this chapter, except that on any work requiring the continuous supervision and inspection of a registered civil engineer, the inspections required by this section may be delegated to the registered civil engineer by the City Engineer.

If the registered civil engineer, soils engineer, or engineering geologist, fulfilling his responsibility pursuant to the provisions of this section, finds that work is not being done in conformance with the provisions of this chapter or the plans and specifications approved by the City Engineer, the registered civil engineer, soils engineer, or engineering geologist shall immediately notify the person in charge of the grading work, and if the nonconformity is not corrected, the City Engineer shall be notified in writing of the nonconformity and of the corrective measures to be taken. Such notice shall be delivered to the office of the City Engineer within twenty-four (24) hours except in the case of mass grading, which is more than 10,000 cubic yards per day, when the time limit shall be eight (8) hours.

If, for any reason, the services of any of the three (3) professional persons are terminated during the progress of the grading work, such professional person and the land disturbance permit holder shall immediately notify the City Engineer in writing. Such termination may result in temporary delays in the grading operations until satisfactory arrangements are made to assure the City Engineer that competent professional supervision is provided. When the services of one or all three (3) of the professionals of record are terminated, the professional whose services have been terminated shall submit to the City Engineer certification of work performed under his supervision, along with deficiencies to be corrected. The new professional shall submit to the City Engineer a letter of certification that the previous professional's design, reports, and recommendations have been reviewed, that all provisions the City Engineer required as conditions of the land disturbance permit will be complied with during the course of the work, and that he shall review the detailed grading plans and thus assume his responsibility as set forth in this chapter for all future grading on the project. The letters shall be referenced to the approved grading plans prepared by the design civil engineer.

The certification shall state that the job was constructed as indicated by the "as built" plan, that the soils engineer and engineering geologist's reports and certifications have been submitted, that they have provided their services in accordance with good practices, and that all drainage provisions and safety features have been incorporated in the grading of the site.

4. Hillside Overlay District grading. The rules and regulations set forth in this subsection are to apply to all Hillside Overlay District land disturbance in the City, which shall be considered supervised grading.

The land disturbance permit holder shall employ a registered civil engineer to prepare the design of grading plans for all hillside grading. The design civil engineer shall prepare his design in accordance with good planning practices and applicable codes and to the restrictions imposed as determined by detailed studies of the site and materials to be graded. Such studies shall be performed by a soils engineer and an engineering geologist approved by the City Engineer and shall be submitted prior to the issuance of land disturbance permits. The civil engineer shall furnish sufficient supervision during construction to obtain compliance with the plans as approved.

The land disturbance permit holder shall employ a soils engineer and an engineering geologist whose duties shall be to work closely with the civil engineer, to examine surface and subsurface conditions in accordance with the provisions of this Code, and to submit reports thereon. Such reports, in conjunction with the provisions of this chapter, shall form the basis for the design of the grading project. Such reports shall be based upon a detailed topographic base map of the area to be graded and shall include specific conclusions and recommendations for avoidance or correction of all known existing or anticipated geologic hazards and any adverse soil conditions on or affecting the site or contiguous property.

The soils engineer, in addition to his pregrading exploratory work, shall provide inspections during the placement of all compacted fill in accordance with the requirements of this chapter, the approved plans, and good engineering practices. In addition, he shall follow the progress of the job sufficiently close to determine that the recommendations of his pregrading report are followed. If conditions, which require the modification of plans, are encountered during grading, he shall submit a report of his findings and recommendations for a change of plans to the land disturbance permit holder and the civil engineer, the engineering geologist, and the City Engineer. Periodic reports may be required as set forth in subsection (a) of this section.

The engineering geologist, in addition to his pre-grading exploratory work, shall provide inspections during the actual grading process at least as often as determined to be appropriate by the City Engineer. Such grading inspections by the engineering geologist are to determine that the conditions of his pregrading reports are as anticipated. If conditions, which require the modification of plans, are encountered during grading, he shall submit a report of his findings and recommendations to the land disturbance permit holder, the civil engineer, the soils engineer, and the City Engineer. Periodic reports may be required as set forth in subsection (a) of this section.

The soils engineer, at the completion of the grading, shall submit a certified report of compaction tests for all fill located within the limits of the tract and/or off-site grading areas. The soils engineer's final report shall also include a statement that all subdrains were installed, his professional opinion of the suitability of the fill placement area and the ability of the natural materials to support the compacted fill without excessive settlement of the fill or potential damage to structures erected thereon, and a statement to the effect that he has inspected all cuts and fills and that, in his opinion, they meet the design requirements. The report shall be referenced to a dated "as built" plan prepared by the design civil engineer. The engineering geologist, at the completion of grading, shall submit a final geologic report stating that he has maintained the required in-grading inspection, that the recommendations of his pregrading report have been followed, that in his professional opinion all known adverse geologic conditions have been corrected or provided for, that future adverse geologic

conditions are not anticipated, and that all lots or sites are geologically suitable and safe for construction. The report shall include the geologist's certification that he has inspected all cut slopes and sidehill fill placement areas prior to the placement of fill. He shall also certify that all subdrain placement areas were inspected prior to the installation of the subdrains. The report shall be referenced to a dated "as built" plan prepared by the design civil engineer.

Upon completion of the grading, the civil engineer responsible for the design shall submit an "as built" plan to the City Engineer for the approval of all work covered by the land disturbance permit and shall include the following:

- a. The plan shall be one inch equals forty (40') feet scale, unless otherwise approved by the City Engineer, and shall show the locations of streets, pads, slopes, structures, pertinent elevations, original contours and finished elevations, and other pertinent information required to show the as-built condition, and shall be dated.
- b. The plan shall bear the signature of the design civil engineer who shall certify that he has inspected the site, reviewed the plans, and that the work shown and completed is substantially in accordance with his design.
- c. The plan shall also bear the signatures of the soils engineer and the engineering geologist who shall certify that they have reviewed the plans and that the work shown and completed is in accordance with their recommendations.

B. Inspections of Excavations and Fills

1. Requirements. All construction or work for which a land disturbance permit is required shall be subject to inspections by authorized employees of the City, and certain types of work to be determined by the City Engineer shall have either continuous or constant inspection and supervision by a registered civil engineer, and/or other appropriate consultants, soils engineer, and engineering geologist as a condition of the issuance of the land disturbance permit. Prior to issuing a grading certificate, a final inspection shall be made of all construction or work for which a land disturbance permit has been issued.
2. Exposure of work. Whenever any work on which called inspections are required, as specified in this section, is covered or concealed by additional work without having first been inspected, the City Engineer may require, by written notice, that such work be exposed for examination. The work of exposing and recovering shall not entail expense to the City.
3. Notices. The land disturbance permit holder or his agent shall notify the City Engineer twenty-four (24) hours in advance of the time when the grading operation is ready for each of the following inspections:
 - a. Initial inspections. When the land disturbance permit holder is ready to begin work but before any grading or brushing is started;
 - b. Toe inspections. After the natural ground is exposed and prepared to receive fill but prior to the placing of any fill. Approval for placing fill shall not be made until all debris and unsuitable material has been removed from the site to an approved location;
 - c. Subdrain inspections. Inspections shall be required on all subdrains after the installation but prior to the placement of any fill;
 - d. Excavation inspections. After the excavation is started but before the vertical depth of the excavation exceeds ten (10') feet;
 - e. Fill inspections. After the fill emplacement is started but before the combined vertical height of the lift exceeds ten (10') feet;

- f. Drainage device inspections. After the forms, steel reinforcement, and pipe are in place but before any concrete is placed;
 - g. Rough grading. When all the rough grading has been completed. This inspection may be called for at the completion of the rough grading without the necessity of the City Engineer having previously reviewed and approved applicable reports;
 - h. Rough grading certification. A conditional interim certificate may be issued to the City Engineer to allow the issuance of building land disturbance permits. This certificate shall in no way exonerate the applicant from completing the grading;
 - i. Final certification. When all work, including the installation of all drainage structures, other protective devices, the compaction of trench backfill, and planting and slope stabilization, has been completed and the "as built" plan and required reports have been submitted;
 - j. Other inspections. In addition to the called inspections provided by this section, the City Engineer may make any other inspections of any work to ascertain compliance with the provisions of this chapter and other laws; and
 - k. Interrupted grading. When the land disturbance permit holder is ready to resume work, but before any grading or brushing is started, the land disturbance permit holder or his agent shall notify the City Engineer twenty-four (24) hours in advance of the time when the grading operation is ready.
4. Certification. The Developer's engineer shall certify to the Building Official, upon the completion of the grading work, that all grading work has been done in compliance with all approved grading plans and reports and that all applicable Building Code regulations shall be administered by the office of the Building Official thereafter.
5. Issuance of certificates. Upon the final inspection when it is found that the work authorized by the land disturbance permit, including the installation of all drainage structures, has been satisfactorily completed in accordance with the requirements of this chapter, a grading certificate covering such work shall be issued to the land disturbance permit holder by the City Engineer.
6. Final reports. Upon the completion of the work, the City Engineer may require the following reports and information:
- a. A report from a registered civil engineer certifying that all grading, lot drainage, and drainage facilities have been completed in conformance with the approved plans and the provisions of this chapter and that the graded site will support residential or commercial type structures, whichever is applicable;
 - b. A soils engineering report including, but not limited to, certification of the soil bearing capacity, summaries of field and laboratory tests, locations of tests, expansive soil classification lot by lot, and slope tests taken in the fills showing the limits of compacted fill on an "as built" grading plan;
 - c. An engineering geology report by the engineering geologist, based on the final contour map, including specific approval of the grading as affected by geological factors. Where necessary, a revised geologic map, cross sections, and any recommendations necessary shall be included; and
 - d. When "as built" grading plans are required, as determined by the City Engineer, such plans shall be signed by the supervising civil engineer, the soils engineer, and the engineering geologist, when applicable, for their portions of the work.

- C. Additional Inspections or Testing - The City Engineer may require additional inspection and testing by an approved testing when deemed necessary. The testing agency's responsibility may include, but need not be limited to, certification concerning the inspection of cleared areas and benches to receive fill, and determination of the compaction density of fills. Any such additional testing or inspections shall be at the land disturbance permit holder's expense.
- D. Final Inspection - The developer's engineer shall inspect and certify that the site is ready for final inspection and shall request a final inspection of the City Engineer in writing.

The City Engineer is not give final approval until all work has been completed in accordance with the final approved plans and specifications, including, but not limited to, installation of all drainage facilities and their protection devices, all required revegetation, all required erosion and sediment control measures, and an approved post-construction maintenance schedule is established. The acceptability of revegetation stabilization will be determined by the City using the criteria set forth in the Land Disturbance Design and Construction Standards.

- E. Inspection of Individual Lots - The construction of buildings and other structures on individual lots shall not begin until after all improvements required as part of the final plat map or site plan have been completed.

As part of the subdivision improvements' inspections, the Engineering Department will provide inspection for all 'subdivision level' related improvements. This will include all improvements within the City's dedicated right-of-way and receipt of certification that the Grading and Drainage Plan and grading and drainage drawings have been complied with (from the design engineer) and the original erosion control measures are in place as required.

Once the subdivision level improvements are in placed and approved, the Building Division will then become responsible for the project on a lot-by-lot basis and is responsible for the 'Lot Level' designs and inspections. This would include receiving certification from the design engineer that the Grading and Drainage Plan, grading and drainage drawings are still being complied with, that the requirements of the lot's 'site plan' are being complied with which would include such items as locations of driveways, their grades, setbacks of the house, retaining walls, etc.

7.5 TRAFFIC REGULATION

- A. General - The Contractor shall submit a traffic control plan to the City for review and approval. The traffic control plan shall include the times the work shall be ongoing, streets affected, the proposed plan for dealing with traffic as well as a schedule for work to be performed. This work shall be done in accordance with the following technical specification:

1. Section 02010 – Traffic Regulation

7.6 CLEARING AND GRUBBING

- A. General - Clearing and grubbing which consists of removal of objectionable material from the right-of-way and project shall be done with caution such that existing wastewater improvements, adjacent property and trees and shrubbery that are not to be removed shall be protected from injury or damage. In areas of excessive deep organic layer the clearing and grubbing shall be defined as a depth not to exceed 12 inches. The sequence of construction will be followed by the contractor and have the sediment and dust control BMP in place as the clearing and grubbing

proceeds. At no time will the contractor leave the site at the end of the day without providing for sediment and dust controls.

Within public utility easements or rights-of-way, trees, shrubs, fences and all other improvements that have to be removed to permit construction and which are intended for replacement, shall be replaced in kind or size (excluding native trees under 2-inch diameter or native brush) or with approved substitutes unless permission to exclude such replacement is obtained from the owner/agency or granted by the Engineering Department. Replacement trees shall have a minimum diameter caliber, above graft, as recommended by the American Association of Nurserymen, but shall be larger if so required. This work shall be done in accordance with the following technical specification:

1. Section 02112 – Clearing, Grubbing and Stripping
- B. Removal and Disposal of Material – The contractor shall be responsible for leaving the site in a neat and finished appearance, free from debris and/or inflammable material. Debris to be legally transported to a legal disclosed landfill. Under no condition will debris be buried, including vegetation.

7.7 UTILITIES, EXISTING FACILITIES AND CONCRETE REMOVAL

- A. Abandonment - Refer to Section 8.0 regarding abandonment of roadways and/or structures.
- B. Utilities and Existing Facilities - The existing utilities and/or facilities shown on the drawings or the location of which is made known to the contractor prior to excavation, by contacting Blue Stakes 2 working days or as required by the involved utility companies, shall be protected from damage during the excavation and backfilling of trenches and, if damaged, shall be repaired by and at the contractor's expense. Any existing utility or facility not shown on the drawings or the location of which is not shown to the contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the contractor; and adjustment in payment, if any, is subject to negotiation between the contractor and the developer without any City liability, unless it is a City sponsored project.

Whether expressly indicated on the drawings or not, all contractors shall call Blue Stakes prior to any clearing, grubbing, or excavating. Failure to do so shall not relieve the contractor of any liability associated with disturbance/ breakage of existing utilities. This work shall be done in accordance with the following technical specification:

1. Section 02223 – Protecting Existing Underground Utilities

In case it shall be necessary to remove any such utilities, facilities or any portions thereof, the contractor shall notify the Engineering Department and the owner of the structure. The contractor shall not interfere with said utility and/or facility structures until disposition of the obstruction to the work has been determined and/or notice to relocate or remove has been given by the Engineering Department or authorized agent of the owner of the utility and/or facility so affected.

The fact that any underground utility and/or facility is not shown on plans shall not relieve the contractor's responsibility to comply with these standards. It shall be the contractor's

responsibility to ascertain prior to commencing work the existence of any underground utilities or facilities that may be subject to damage by reason of operations performed by the contractor.

- C. Concrete, Masonry or Mortared Construction Removal - At locations shown on plans, portions of existing concrete pavement, curbs, gutters, sidewalks, foundations and other concrete or mortared structures shall be removed to the lines and elevations specified. Concrete structures or objects not shown or noted on the plans shall be removed where necessary and disposed of by the contractor.

Concrete removal operations in connection with the reconstruction of existing structures shall be performed without damage to any portion of the structure that is to remain in place. If damage occurs, the contractor shall repair any such damage at his own expense, to the satisfaction of the Engineering Department. Repair/replacement of any sidewalks, curbs and/or gutters shall be to the satisfaction of the Engineering Department, as appropriate. Where existing reinforcement is to be incorporated in new work, such reinforcement shall be protected from damage and shall be thoroughly cleaned of all adhering material before being embedded in new concrete.

7.8 EXCAVATION AND TRENCHING

- A. General - Trench excavation shall consist of all excavation involved in the grading and construction of water lines, and other utilities and facilities as shown on plans. The contractor shall perform all excavation of every description and of whatever substances encountered, to depths indicated on the drawings or otherwise specified or required. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. The material piles shall also not obstruct existing sidewalks, roadways, or driveways unless approved in writing by the Engineering Department. All excavated materials not required or unsuitable for backfill shall be removed. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water from any source accumulating therein shall be removed by pumping or by other approved methods. Such sheeting and shoring shall be done as may be necessary for the protection of the work and for the safety of personnel.

Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the Engineering Department, the pipe or duct can be safely and properly installed and backfill can be properly tamped in such tunnel sections. If blasting is necessary, the contractor shall notify the City of his blasting schedule and procedures and obtain a blasting permit, and shall observe all reasonable precautions in protecting life and property. This work shall be done in accordance with the following technical specification:

1. Section 02200 - Earthwork
2. Section 02201 – Earthwork (For Roads and Highways Only)
3. Section 02211 - Rough Grading

- B. Excavation - Excavation for water lines shall be made only after pipe and other necessary materials are delivered on the work site. After such delivery, trench excavation shall proceed as rapidly as possible, and the pipe installed and the trench backfilled without undue delay.
- C. Shoring - All shoring for open excavations shall conform to the State of Utah, Department of Industrial Relations, and Division of Industrial Safety "Construction Safety orders (O.S.H.A)."

The contractor shall be responsible for adequately shored and braced excavations so that the earth will not slide, move or settle, and so that all-existing improvements of any kind will be fully protected from damage.

No shoring once installed shall be removed until the trench has been approved for backfill operations. Removal of shoring shall only be accomplished during backfill operations and in such a manner as to prevent any movement of the ground or damage to the pipe or other structures.

The contractor shall obtain and pay for all permits for any excavations over 5 feet (1.5m) in depth into which a person is required to descend or any excavation less than 5 feet (1.5m) in depth in soils where hazardous ground movement may be expected and into which a person is required to descend.

7.9 BACKFILL AND COMPACTION

A. General - There are several distinct zones to be considered in the backfilling procedure as follows:

1. Pipe Zone. This area is from the trench bottom to 12 inches (300 mm) above the pipe. This zone is to be backfilled under the strict jurisdiction of the Engineering Department.
2. Above pipe zone but below pavement subgrade plus the zone including the subgrade and pavement Backfill and compaction in existing streets and in the area above the pipe zone shall be in full accordance with the City excavation permit issued for the specific work, and with the City land development specifications. In both cases, the filling of trenches shall be subject to approval by the City or Engineering inspector who shall have full authority to order compaction tests to demonstrate the actual backfill density.

7.10 CONSTRUCTION WATER

A. General - The developer/contractor shall not take unmetered water from the City's or any other culinary water system. Instead, he or she should sign up at the General Services Department for one or more construction meters after receipt of a deposit amount. The developer/contractor is not to move the construction meters. Charges for construction water are covered by City Council Resolution. The developer/contractor is put on notice that unpaid invoices will result in removal of the construction meter. This work shall be done in accordance with the following technical specification:

1. Section 02161 - Care of Water

7.11 SUBGRADE PREPARATION AND PLACEMENT OF BASE MATERIALS

- A. General – This work shall provide for the preparation of natural, filled, or excavated roadbed material prior to the placement of subbase or base material, pavement, curbs and gutters, driveways, sidewalks, or other roadway structures.
- B. Subgrade Preparation – This work shall be done in accordance with the following technical specification:

1. Section 02227 - Sand-Cement Slurry
 2. Section 02280 - Soil Treatment
 3. Section 02514 - Soil Cement Base
- C. Untreated Base – This work provides for untreated base for pavement, curb, gutter and similar types of improvements that shall be constructed according to their technical specification sections.

7.12 CONCRETE AND MASONRY CONSTRUCTION

- A. General – This work provides for construction of concrete structures, curbs & gutter, sidewalks, cross gutters and driveways connected to grading, erosion, revegetation and sedimentation control projects. This work shall be done in accordance with the following technical specification:
1. Section 03100 - Concrete Formwork
 2. Section 03102 – General Concrete Construction
 3. Section 03200 - Concrete Reinforcement Steel
 4. Section 03300 - Cast-in-Place Concrete
 5. Section 03304 – Minor Concrete
- B. Concrete Structures – Concrete bridges, culverts, catch basins, retaining walls, abutments, piers, footings foundations, and similar structures shall be constructed in conformity with the plans and specifications. Retaining walls are to be inspected by the Developer's engineer with reports being submitted to the City for review.
- C. Concrete Curbs & Gutters, Sidewalks, Cross Gutters, and Driveways – Concrete curbs, walks, gutters cross gutters, alley intersections, access ramps, and driveways shall be constructed of portland cement concrete of the class and other requirements prescribed in the plans and specifications. The finish coat to be applied to curbs shall consist of Class "B" mortar.

7.13 LANDSCAPE AND IRRIGATION SYSTEMS

- A. General – This section shall govern the preparation, planting, and irrigation system construction for landscape areas required by the City.

Existing utilities and improvements not designated for removal shall be protected in place. Unless otherwise provided, walls, curbs, planter boxes, walks, irrigation systems, and similar improvements required by the City shall be constructed following rough grading and before landscaping.

- B. Testing - All work on the irrigation system, including hydrostatic and coverage tests, preliminary operational tests of the automatic control system, and the backfill and densification of trenches, and other excavations shall be performed after topsoil work and before planting. This work shall be done in accordance with the following technical specification:

1. Section 02811 - Landscape Irrigation System

SECTION 8.0

ABANDONMENT

8.1 GENERAL

The developer's engineer shall indicate all existing roadways, water or storm drain lines or structures, which are to be abandoned, on the drawings. In general, abandoned lines, which are in service, will be replaced with a parallel line of equal or larger size, and the engineer shall demonstrate in any case that the abandonment does not adversely affect the operation of the system.

All abandonment of property and abandonment and construction of underground pipelines shall be discussed with the Engineering Department and approved prior to any such work.

8.2 UNDERGROUND UTILITY LINES

Underground utility lines to be abandoned shall be entirely filled by pumping concrete into them. The pump mix shall be a mixture sufficiently workable for the purpose intended and shall be a concrete mix of 200-psi minimum. The engineer shall show on the drawings the approximate number of cubic yards of concrete, which will be required for any particular reach.

8.3 STRUCTURES

Structures associated with lines to be abandoned shall be removed by the contractor/developer and given to the City, if salvageable.

8.4 EASEMENTS OR RIGHT-OF-WAY

All easement and right-of-way abandonments shall be provided for as part of the development processing, not during construction. If it is determined that easements or property must be abandoned during construction, the project will be put on hold until the property issues are resolved to the satisfaction of the City, and/or the Salt Lake County Recorder's office.

SECTION 9.0

TESTING

9.1 GENERAL

This section applies to grading and soils materials testing, erosion control materials and storm drain system materials testing, concrete and other miscellaneous materials tested associated with this standard. The references made here are for general information only and the individual construction specifications need to be referenced for additional details on testing for that specific item. The testing of culinary water, storm drainage facilities, wastewater, parks and trails, and road and bridge facilities are addressed in other design and construction standards.

9.2 CONCRETE TESTING

- A. The following references apply to concrete related items including concrete mix design, testing of aggregates and cement, reinforcing steel, concrete unit masonry, and others:

ACI 214-77	Recommended Practice for Evaluation of Strength Test Results of Concrete.
ACI 301-79	Specifications for Structural Concrete for Buildings.
ACI 304	Specifications for Site Mixed Concrete
ACI 308	Specifications for Curing Concrete
ACI 315-80	Details and Detailing of Concrete Reinforcement.
ACI 318-77	Building Code Requirements for Reinforced Concrete.
ACI 347-78	WRI Manual of Standard Practice for Welded Wire Fabric Recommended Practice for Concrete Formwork.
ASTM A82-79	Specification for Steel Wire, Plain, for Concrete Reinforcement.
ASTM A185-79	Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
ASTM A478	Specification for Precast Reinforced Concrete Manhole Sections
ASTM A615-82	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A775	Test Methods for Epoxy Coatings
ASTM C31-84	Methods of Making and Curing Concrete Test Specimens in the Field.
ASTM C33-84	Specification for Concrete Aggregates.
ASTM C34	Testing of Concrete Specimens
ASTM C39-83b	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C76	Specification for Reinforced Concrete Culvert Storm Drain and Sewer Pipe
ASTM C90	Specifications for Concrete Masonry Units
ASTM C94-83	Specification for Ready-Mixed Concrete.
ASTM C114-83b	Method for Chemical Analysis of Hydraulic Cement.
ASTM C127	Method of Sieve Analysis of Course Aggregate
ASTM C136-84a	Method for Sieve Analysis of Fine and Coarse Aggregate.
ASTM C143-78	Test Method for Slump of Portland Cement Concrete.
ASTM C144	Specifications for Masonry Mortar

ASTM C150-84	Specification for Portland Cement.
ASTM C156-80a	Test Method for Water Retention by Concrete Curing Materials.
ASTM C157-80	Test Method for Length Change of hardened Cement Mortar and Concrete.
ASTM C192-81	Method of Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C207	Specifications for Hydrated Lime
ASTM C231	Specifications for Concrete Mix Air Content
ASTM C260-77	Specification for Air-Entraining Admixtures for Concrete.
ASTM C309	Specifications for Concrete Curing Compound
ASTM C311-85	Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
ASTM C404	Specifications for Concrete Unit Masonry Aggregate
ASTM C443	Specifications for Rubber Gaskets
ASTM C478	Pre-cast Concrete Manholes
ASTM C494-82	Specification for Chemical Admixtures for Concrete.
ASTM C578	Specifications for Rigid Insulation for Concrete
ASTM C615	Specifications for Reinforcing Steel
ASTM C618-85	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
ASTM D173	Specifications for Saturated Cotton Fabric
ASTM D1751-83	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
ASTM D1752	Specifications for Expansion Joint Material
ASTM E119-83	Method for Fire Tests of Building Construction and Materials.
AWS D1.4-79	Structural Welding Code - Reinforcing Steel.
PS 1-74	U.S. Product Standard for Concrete Forms, Class I.

9.3 SOILS TESTING

- A. The following references apply to soils, excavation, grading and recompaction efforts related items . They are as follows:

ASTM D 422-63(1972)	Method for Particle-Size Analysis of Soils.
ASTM D 698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5lb (2.49kg) Rammer and 12-in (304.8 mm) Drop.
ASTM D 1140-54(1971)	Test Method for Amount of Material in Soils Finer than the No. 200 (75 mm) Sieve.
ASTM D 1556-82	Test Method for Density of Soil in Place by the Sand-Cone Method.
ASTM D 1557-78	Test Methods for Moisture-Density Relations of Soils and Soils-Aggregate Mixtures using 10-lb. (4.54 kg.) Rammer and 18-in. (457mm.) Drop.
ASTM D 1663-84	Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
ASTM D 2419-74(1979)	Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

ASTM D 2487-83	Classification of Soils for Engineering Purposes.
ASTM D 2901-82	Test Method of Cement Content of Freshly-mixed Soil Cement.
ASTM D 2922-81	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 4318-84	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

9.4 STORM DRAINAGE SYSTEM TESTING

- A. The following references apply to storm drainage system related items including piping, trench backfill and compaction and storm drainage appurtenances.

AASHTO M 252	Corrugated Polyethylene Drainage Tubing
ASTM C76	(1989) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM D422	Particle-Size Analysis of Soils
ASTM D698	Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.5-kg) Rammer and 12-inch (305 mm) Drop
ASTM D2321	Recommended Practice for Installation of Corrugated Polyethylene Pipe
ASTM D2487	Classification of Soils for Engineering Purposes
ASTM D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	Standard Specifications for Sewer Pipe and Fittings

9.4 MISCELLANEOUS TESTING

- A. The following references apply to miscellaneous item including PVC piping, testing methods for plastic sheeting and film, gaskets, etc.

AWWA M 23	Manual of Water Supply Practices – PVC Pipe – Design and Installation
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers By Impact
ASTM D792	Standard Test Method for Specific Gravity and Density of Plastics by Displacement
ASTM D1004	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1204	Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
ASTM D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastomer
ASTM D1505	Test Method for Density of Plastic by the Density-Gradient Technique
ASTM D1593	Specification for Nonrigid Vinyl Chloride Plastic Sheeting
ASTM D1603	Test Method for Carbon Black in Olefin Plastics

ASTM D1693	Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D2564-80	Test Method for PVC Solvent Cement
ASTM D3015	Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds
ASTM D4437	Practice for Determining Integrity of Field Seams Using Joining Flexible Polymeric Sheet Geomembranes
Federal Specification SS-S-00210	Plastic Sealing Gasket

SECTION 10.0

WORK AREA CLEAN-UP

10.1 FINAL PROJECT CLEAN-UP

During construction the Contractor must take care to not track dirt, mud or other debris from the construction site onto adjacent City streets or private property. Vehicles must be washed down prior to leaving the construction site, if mud is present, an/or the Contractor must employ a sweeper to clean the streets daily. In all cases the contractors are required to adhere to the Engineering inspector requirements. The details, penalties, etc. are contained in the City's Municipal Code.

Once all roadway work has been completed and can be field accepted, the Contractor shall clean the streets, curbs, gutters and nearby affected areas to the satisfaction of the City. All structures including fire hydrants shall be properly painted, where required, and free from dirt, concrete or other spattered materials. Also, the work site will be cleaned of construction debris by the contractor. All private improvements damaged during construction shall be restored to at least the original condition of said improvements including but not limited to trees, shrubs, curbs, gutters, sidewalks, fences, grass, etc. Filled excavations in private property shall be neatly finished in a manner to facilitate natural drainage and eliminate hazards to persons or property. Also, all requirements of the Engineering Department, Community Development Department, and other requirements shall be met. The project shall be left in a final condition that brings no discredit to the City.

SECTION 11.0

REQUIREMENTS FOR FINAL ACCEPTANCE

11.1 GENERAL

"Acceptance" of a project by the City occurs in several stages. In this regard there are several appropriate terms:

"Partial Field Acceptance for Occupancy Clearance Purposes". This may be given when occupancy is requested for certain units with a development project where the entire roadway system is not to a state of completion where it could be termed field accepted. In no event can occupancy clearances be given where satisfactory service cannot be assured. Also, clearance for occupancy does not imply that the City has waived any right to insist on repairs or corrections of punch list items subsequently identified in a final inspection of the entire water system. In all cases the Fire and Police departments shall be provided all-weather access to the project for emergency purposes.

"Field Acceptance". This is the term when the Engineering Inspector and Infrastructure Maintenance and Operations Director (or their representatives) jointly inspect the project and agree that all requirements as shown on the approved drawings and as specified in these Standards have been met.

"Final Acceptance". This is the term when the City Engineer formally accepts the project.

11.2 FIELD ACCEPTANCE

After satisfactory completion of the improvements, the Engineering inspector will provide a field acceptance letter to the City Engineer. However, it shall be the developer's responsibility to initiate action and to supply the required administrative items prior to official City Engineer acceptance of the improvements.

11.3 "AS-BUILT DRAWINGS" ORIGINALS

Original "As-built Drawings" drawings and two sets of blueline prints and mylar prints shall be submitted to the Engineering Department as part of acceptance of the project. The "As-built Drawings" shall reflect the actual improvements made and give the accurate location of all new/or-relocated facilities, horizontally and vertically. The following certificate shall be signed and shall appear on the cover sheet of the project plans:

"As-built Drawings" Certificate

I hereby certify that the work shown on Drawing No. _____, Sheets _____ through _____ marked "As-built Drawings" has been constructed in conformance with lines and grades and requirements as shown on said plans, drawings and referred specifications.

Registered Civil Engineer

R.C.E Number

Date

It should be emphasized that the responsibility for accurate record drawings must involve active participation by the developer's engineer during the project. This also means that facilities shall be surveyed for line and grade once the various improvement, or portion of an improvement is completed. All changes, whether done through the formal change order or revision process or whether done, as a field adjustment should be reflected on the record drawings.

11.4 ITEMIZED COST/ADDITIONAL FEES

A certified and itemized copy of the cost of the facilities offered for dedication shall be submitted to the Engineering Department. Such certification shall consist of copies of the signed contractual agreement with any change orders. If the final cost is found to be more than the originally approved engineer's cost estimate, developer shall pay the City an additional amount of engineering review fee, based on the difference between the estimate and the final cost, and based on the current rates of such fees.

11.5 OTHER ADMINISTRATIVE ITEMS/INCLUDING EASEMENTS

Depending upon the project, there can be other administrative items required before final acceptance. Examples are unpaid invoices, contractual requirements involving easements, etc.

11.6 APPROVAL FOR ACCEPTANCE

When all requirements (field and administrative) have been met, staff will prepare a notice of acceptance of the improvements and exoneration of the performance and labor and material bonds (25-percent of the bonds remains in force until it is fully exonerated; generally this is for the 24-month maintenance and guarantee period). The City of West Jordan Municipal Code contains additional requirements for final acceptance.

Whereas, the normal maintenance and guarantee period is 24-months and the bond retention is 25-percent of the final cost of construction; both of these may be increased if in the opinion of the Engineering Department the normal period and amount are not sufficient.

11.7 STATUS DURING MAINTENANCE AND GUARANTEE PERIOD

The developer/contractor is responsible during the guarantee period for the proper performance and maintenance of the applicable systems. Should City crews have to perform any of this work, the costs for it may be invoiced to the developer/contractor.

11.8 EXONERATION OF SURETY

The City Engineer will normally exonerate seventy-five percent (75%) of the bond upon acceptance. The remaining twenty-five percent (25%) will be retained for the 12-month guarantee period and then released.

**APPENDIX A
STANDARD DRAWINGS**

TABLE OF CONTENTS

STAND. DWG. NO.	<u>DESCRIPTION</u>
	<u>General</u>
1005	Abbreviations and Symbols (Roadways)
1010	Abbreviations and Symbols (Storm Drain, Sewer, Water)
1015	City of West Jordan Map
	<u>Channel Erosion Protection</u>
5000	Energy Dissipator
5005	Erosion Blankets & Turf Reinforcement Mats - Channel Installation
5010	Grass-Lined Channel – Typical Cross Sections
5015	Grass-Lined Channel – Typical Installation
5020	Log Check Dam
5030	Riprap Protection
5035	Rock Check Dam
5040	Rock Lined Channel
5050	Temporary Semi-Pervious Straw Bale Sediment Barrier
5055	Temporary Straw Bale Check Dam
5060	Temporary Straw Bale Dike
5065	Temporary Diversion Dike
	<u>Miscellaneous</u>
5100	Silt Fence
5105	Temporary Gravel Construction Entrance/Exit
5106	Temporary Individual Lot Ramp
5110	Typical Sediment Basin
	<u>Slope Erosion Protection</u>
5200	Brush Layering
5205	Cellular Confinement System for Slope Stabilization
5210	Erosion Blankets & Turf Reinforcement Mats Slope Installation
5215	Grooved or Serrated Slope
5220	Live Staking
5225	Overside Drain
5230	Rolling Dip and Waterbar
5235	Slope Drain
5240	Stepped or Terraced Slope
5245	Straw Anchoring
5250	Biolog Rolls
5255	Surface Roughening
5260	Slope Wattle (Live Fascine)

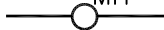
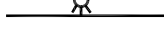
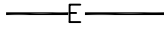
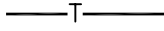
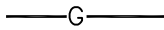
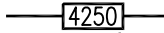
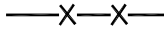
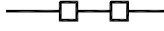
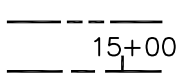
Storm Drain Sediment Protection

5300	Block and Gravel Drop Inlet Sediment Barrier
5305	Continuous Berm
5310	Curb and Gutter Sediment Barrier
5315	Curb Inlet Sediment Barrier (Block & Gravel)
5320	Curb Inlet Sediment Barrier (Sandbags)
5325	Silt Fence Drop Inlet Sediment Barrier
5330	Straw Bale/Gravel Drop Inlet Sediment Barrier

Streambank Erosion Protection

5400	Coir Roll/Coir Matts
5405	Gabions

SYMBOLS



DEFINITIONS

CENTER LINE

CONSTRUCTION CENTER LINE

PROPERTY OR R/W LINE

EASEMENT LINE

MONUMENT LINE

FENCE

CONTOUR LINE (FG)

CONTOUR ELEVATION (FG)

BANK SLOPES

STORM DRAIN LINE

CULINARY WATER LINE

SECONDARY WATER LINE

GAS LINE

TELEPHONE CABLE

ELECTRIC CABLE

SANITARY SEWER LINE

ASPHALT PAVING

FIRE HYDRANT

WATER VALVE

WATER METER

MANHOLE

CATCH BASIN

CLEAN OUT BOX

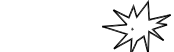
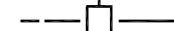
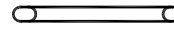
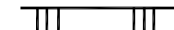
POLE & ANCHOR

STREET LIGHT

UNDISTURBED EARTH

STRUCTURE

SYMBOLS



DEFINITIONS

CURB & GUTTER

SIDEWALK

RAILROAD TRACKS

GUARD RAIL

OPEN DITCH, CANAL

CULVERT

SECTION CORNER

SOIL BORING

MONUMENT

BENCH MARK

SIGN

POWER POLE

TELEPHONE POLE

DECIDUOUS TREE

CONIFEROUS TREE

P.I.

P.C. OR P.T.

PROFILE

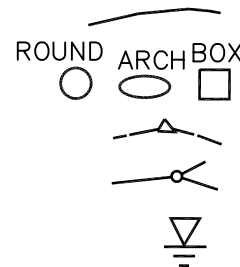
GROUND PROFILE

CULVERT

P.V.I.

P.V.C. OR P.V.T.

GROUNDWATER ELEVATION



City of West Jordan, Utah



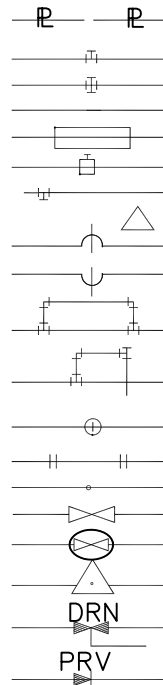
ABBREVIATIONS AND SYMBOLS ROADWAYS

PLAN
1005

ABBREVIATIONS

C.I.P. = CAST IRON PIPE
 D.I.P. = DUCTILE IRON PIPE
 PVC = POLYVINYL CHLORIDE
 MJ = MECHANICAL JOINT
 T.J. = TYTON JOINT
 O.B. = OPEN BELL
 L.B. = LARGE BELL
 WOV = WASH OUT VALVE
 VAL. = VALVE
 HYD. = HYDRANT
 REG. = REGULATOR
 BD. = BEND
 EXT. = EXTEND
 RED. = REDUCER
 FLG. = FLANGED
 ASSY. = ASSEMBLY
 M.W. = MANWAY
 MH = MANHOLE
 SPIG. = SPIGOT
 ADPT. = ADAPTOR
 TBC. = TOP BACK OF CURB
 F.C. = FACE OF CURB
 P.C.C.P. = PRE STRESSED CONCRETE
 CYLINDER PIPE
 C.M.P. CAS. = CORRUGATED METAL PIPE
 CASING
 A.A.V.V. = AUTOMATIC AIR RELEASE
 VALVE
 A.C.A.R.V. = AUTOMATIC COMBINATION
 AIR RELEASE VALVE
 ASPH. = ASPHALT
 A.C. = ASPHALTIC CONCRETE
 CONC. = CONCRETE
 GALV. = GALVINIZED IRON
 COP. = COPPER
 PRV. = PRESSURE REDUCING VALVE
 GV. = GATE VALVE
 BFV. = BUTTERFLY VALVE
 WOV. = WASH OUT VALVE

SYMBOLS



DEFINITIONS

PROPERTY LINES
 (100' MAP, DESIGN DRAWINGS)
 WATER MAIN TEE
 WATER MAIN CROSS
 REDUCER
 REGULATOR
 TAPPING SLEEVE AND VALVE
 PLUG AND CLAMP
 CONCRETE THRUST BLOCK
 PIPE OVER
 PIPE UNDER

BYPASS

RUN-AROUND
 CIRCLED VALVE
 (SYSTEM NORMALLY CLOSED)
 OFFSET OR VERTICAL BENDS
 WASH OUT VALVE
 GATE VALVE
 BUTTERFLY VALVE

AIR RELEASE VALVES
 MANUAL DRAIN VALVE

PRESSURE REDUCING VALVE

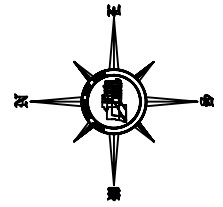
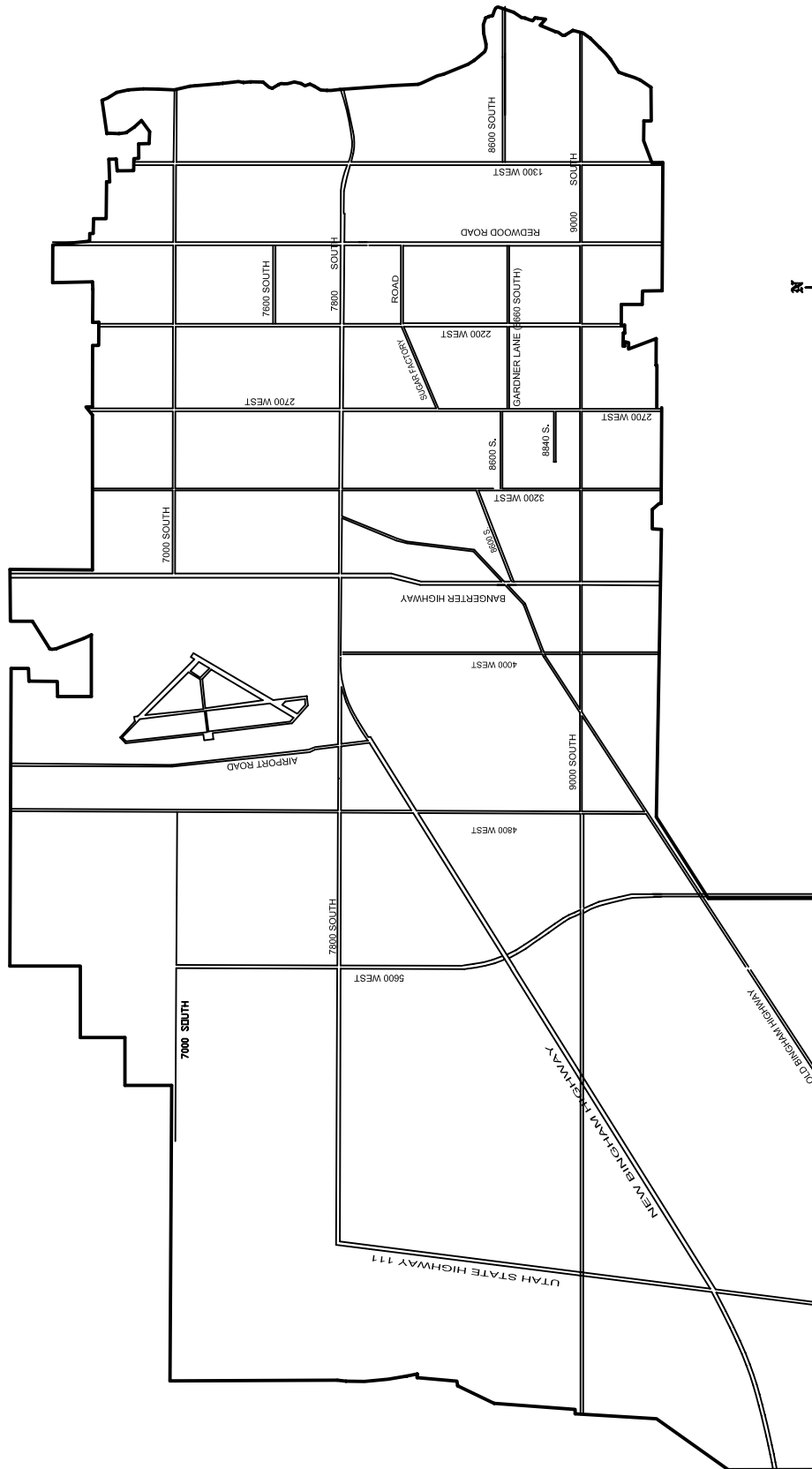
City of West Jordan, Utah



ABBREVIATIONS AND SYMBOLS

STORM DRAIN, SEWER, WATER

PLAN
1010

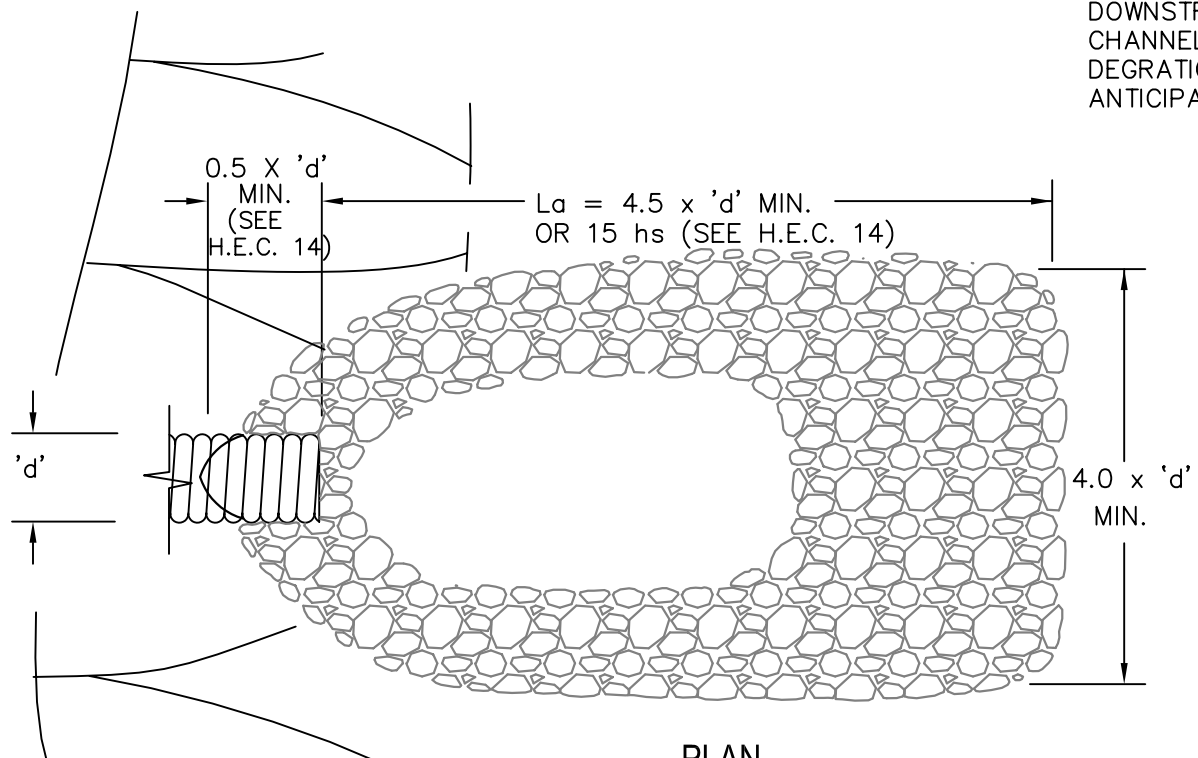
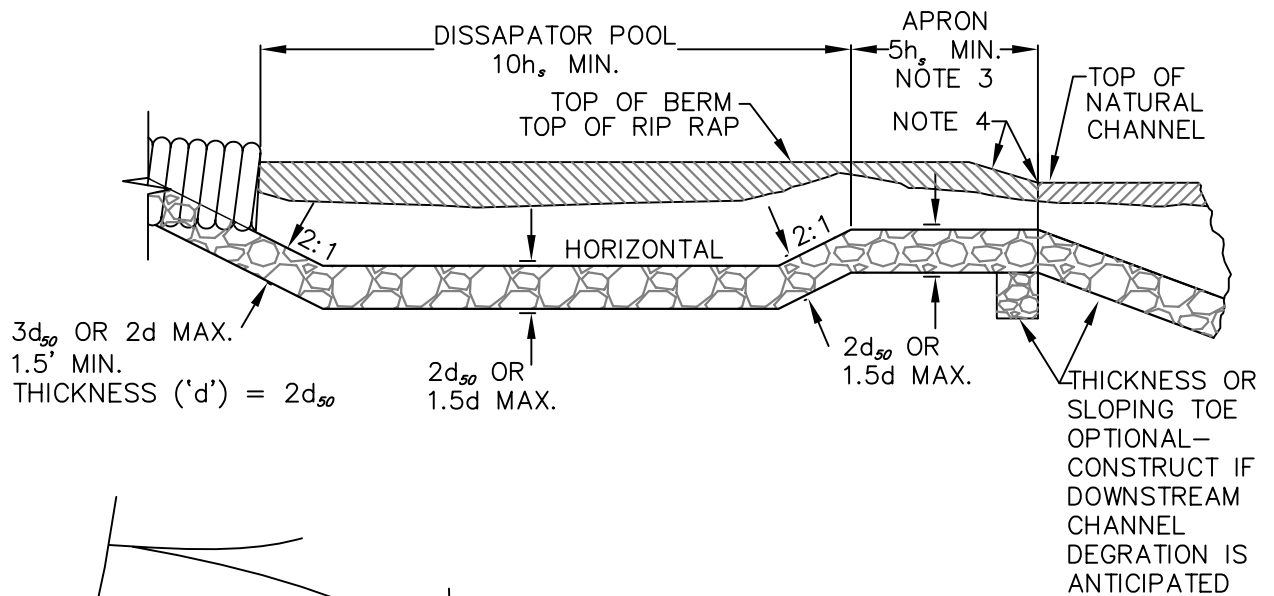


City of West Jordan, Utah



WEST JORDAN CITY MAP

PLAN
1015



PLAN

NOTES:

1. TO BE DESIGNED PER H.E.C. 14
2. ROCK SIZE TO BE DESIGNED PER H.E.C. 11
3. IF EXIT VELOCITY OF BASIN IS SPECIFIED. EXTEND BASIN AS REQUIRED TO OBTAIN SUFFICIENT CROSS-SECTIONAL AREA.
4. WARP BASIN TO CONFORM TO NATURAL STREAM CHANNEL. TOP OF RIPRAP IN FLOOR OF BASIN SHOULD BE AT THE SAME ELEVATION OR LOWER THAN NATURAL CHANNEL BOTTOM.
5. PLACE RIP-RAP BEFORE OR IN CONJUNCTION WITH THE INSTALLATION OF THE STRUCTURE SO THAT IT IS IN PLACE BEFORE THE FIRST RUNOFF EVENT. (AS PER PAGE 2-44)

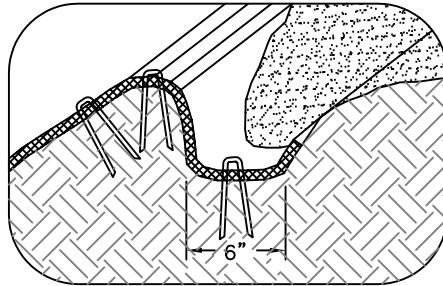
City of West Jordan, Utah



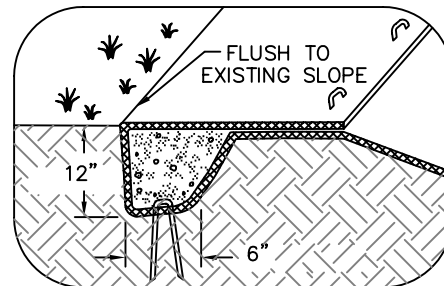
ENERGY DISSIPATOR

PLAN

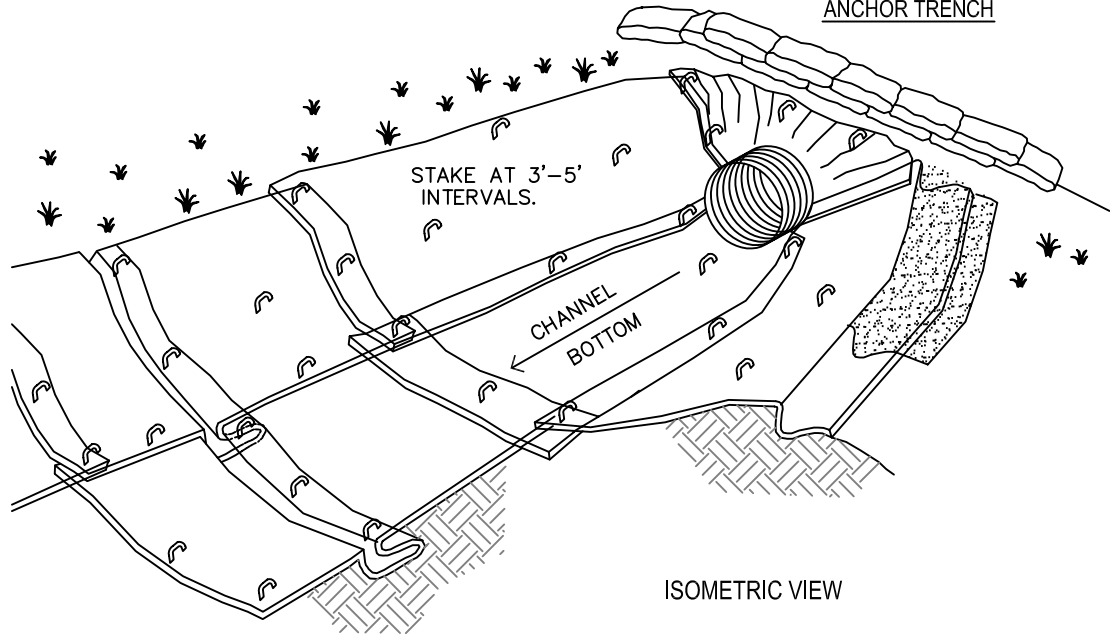
5000



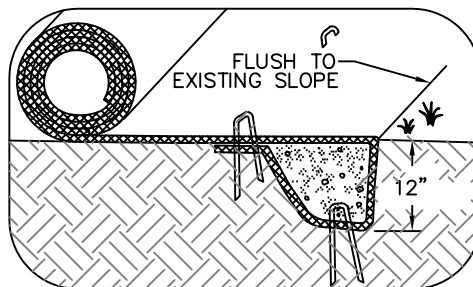
LONGITUDINAL ANCHOR TRENCH



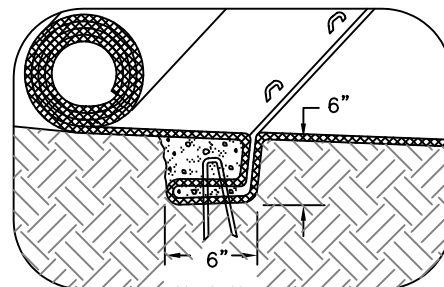
TERMINAL SLOPE AND CHANNEL
ANCHOR TRENCH



ISOMETRIC VIEW



INITIAL CHANNEL ANCHOR TRENCH



INTERMITTENT CHECK SLOT

NOTES:

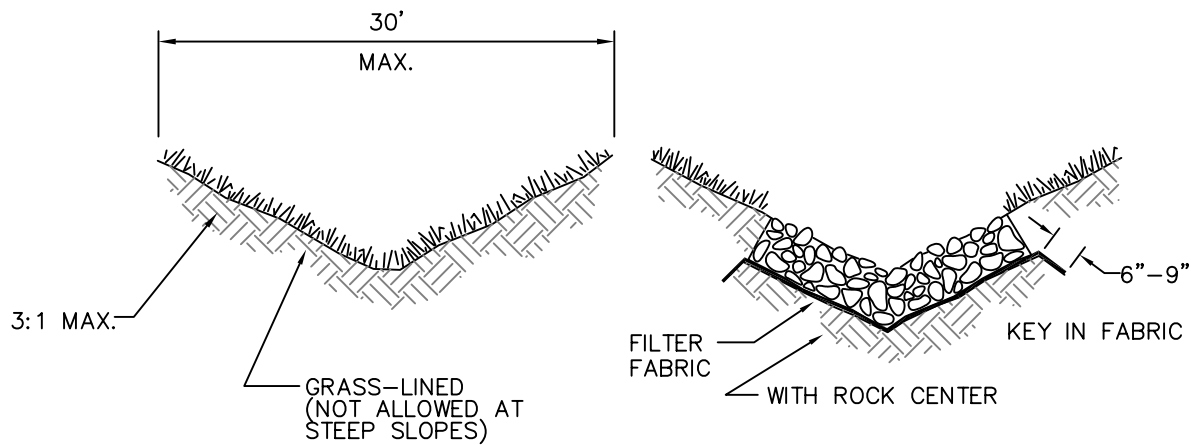
1. CHECK SLOTS TO BE CONSTRUCTED PER MANUFACTURERS SPECIFICATIONS.
2. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

City of West Jordan, Utah

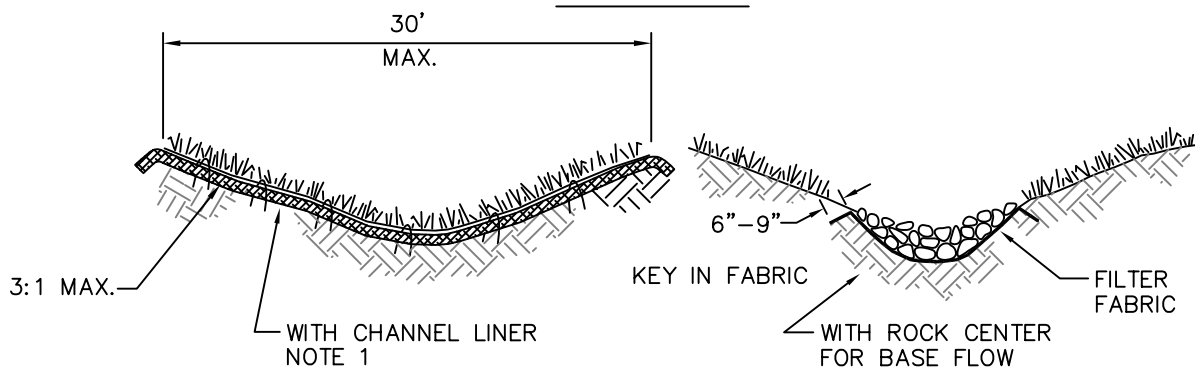


EROSION BLANKETS &
TURF REINFORCEMENT MATS
CHANNEL INSTALLATION

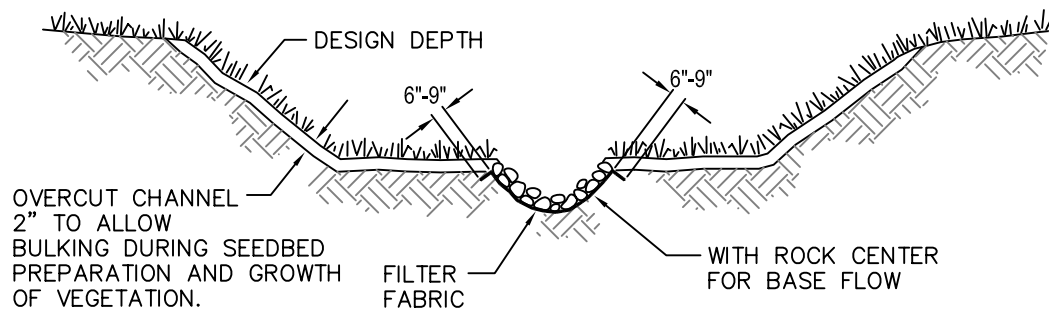
PLAN
5005



TYPICAL V-SHAPED CHANNEL
CROSS-SECTION



TYPICAL PARABOLIC CHANNEL
CROSS-SECTION



TYPICAL TRAPEZOIDAL CHANNEL
CROSS-SECTION

NOTES:

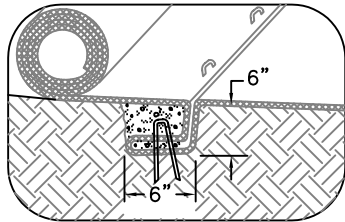
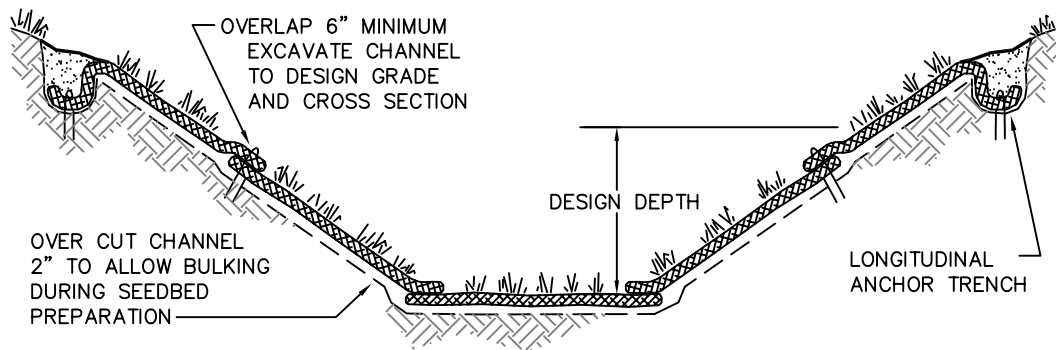
1. TO BE DESIGNED AS PER H.E.C. 15-
FLEXIBLE CHANNEL
2. FABRIC THICKNESS 20-60 MILS.
3. FABRIC GRAB STRENGTH 90-120 LBS
4. FILTER FABRIC TO CONFORM TO ASTM D-1682 OR ASTM D-177

City of West Jordan, Utah



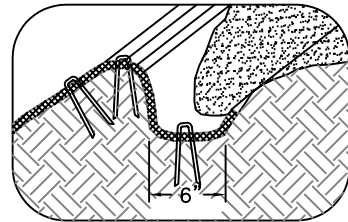
GRASS-LINED CHANNEL
TYPICAL CROSS SECTIONS

PLAN
5010

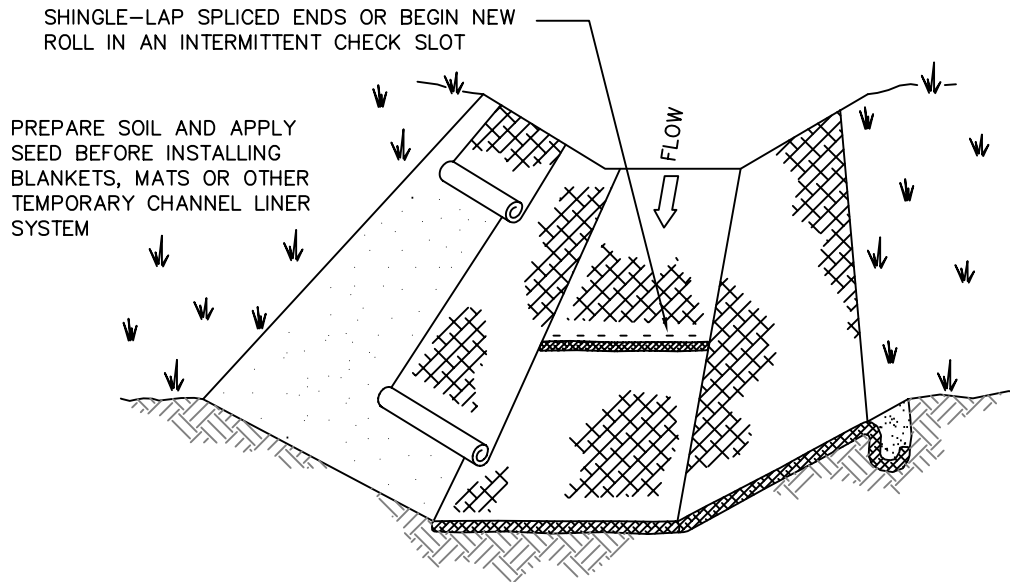


INTERMITTENT CHECK SLOT

TYPICAL INSTALLATION
WITH EROSION CONTROL
BLANKETS OR TURF
REINFORCEMENT MATS



LONGITUDINAL ANCHOR TRENCH



NOT TO SCALE

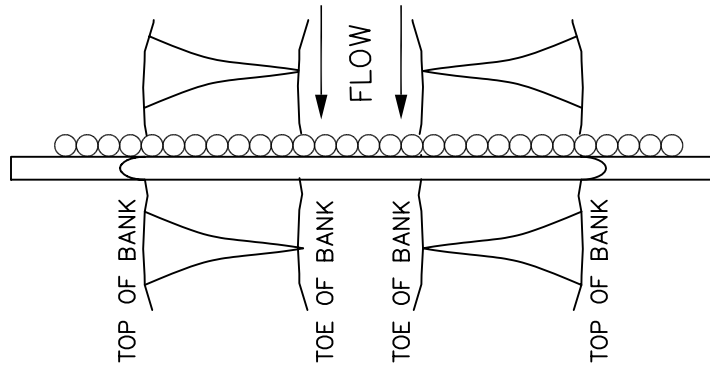
NOTES:
1. TO BE DESIGNED AS PER H.E.C. 15

City of West Jordan, Utah

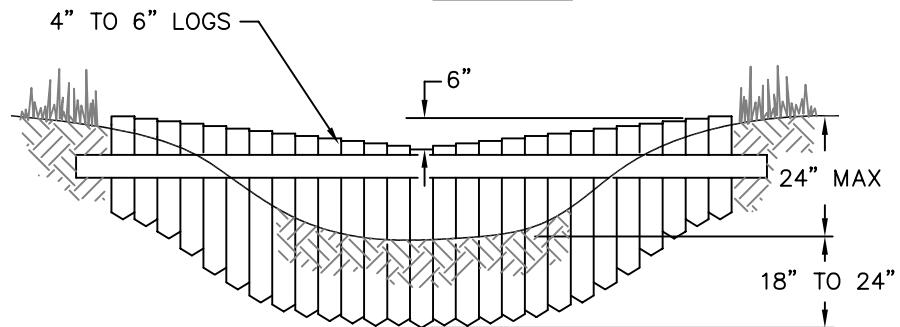


GRASS-LINED CHANNEL
TYPICAL INSTALLATION

PLAN
5015

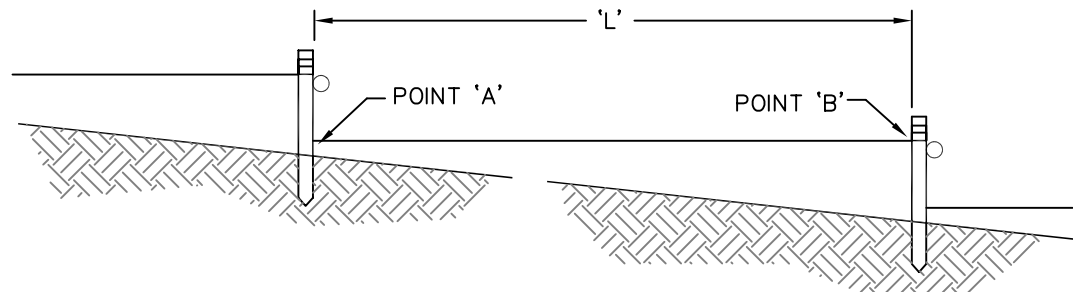


PLAN VIEW



VIEW LOOKING UPSTREAM

'L' = THE DISTANCE SUCH THAT POINTS 'A' AND 'B' ARE OF EQUAL ELEVATION



SPACING BETWEEN CHECK DAMS

NOT TO SCALE

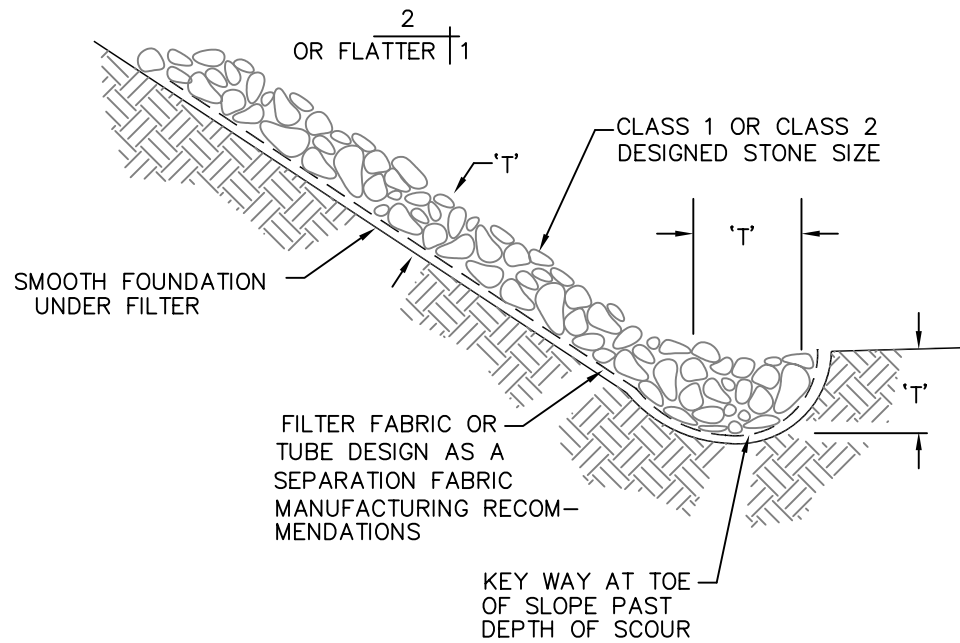
NOTE:
KEY THE ENDS OF THE CHECK DAM
INTO THE CHANNEL BANK. LOGS SHALL
BE PRESSURE TREATED IF GRADE
STABILIZATION STRUCTURE IS INTENDED
TO BE PERMANENT.

City of West Jordan, Utah



LOG CHECK
DAM

PLAN
5020



$$T=2d_{50}$$

TYPICAL SECTION

NOTE:

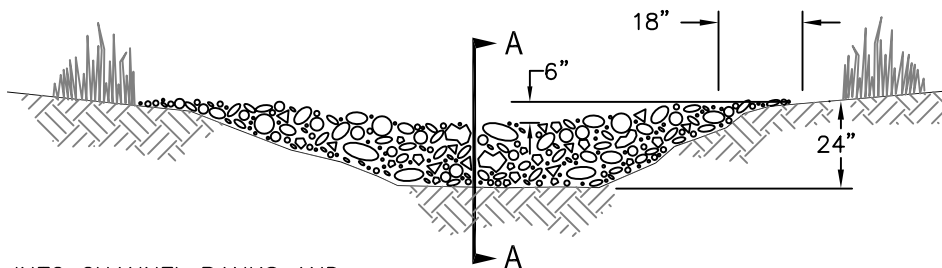
1. TO BE DESIGNED PER H.E.C. 15-
FLEXIBLE CHANNEL
2. ROCK SIZE TO BE DESIGNED PER H.E.C. 11

City of West Jordan, Utah



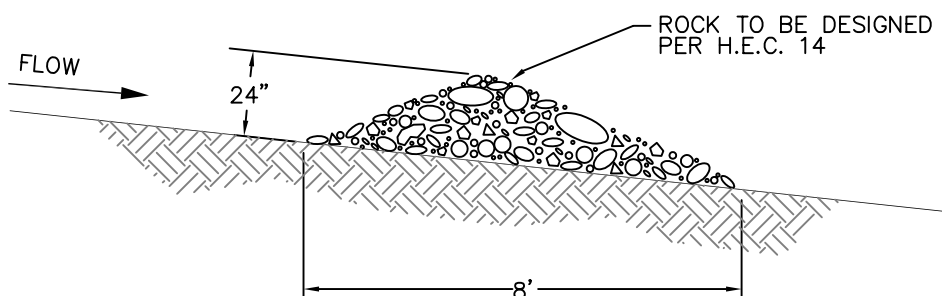
RIP RAP
PROTECTION

PLAN
5030



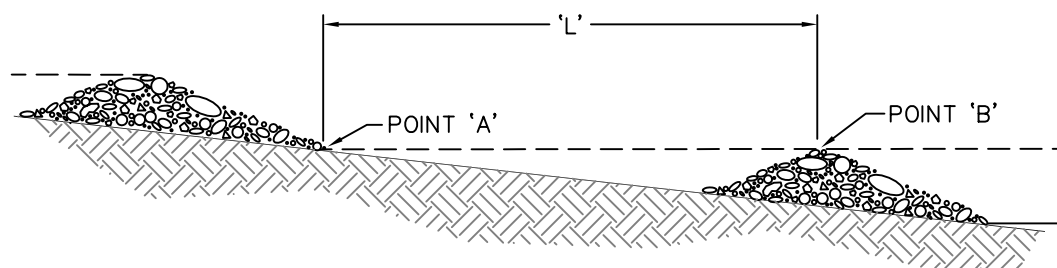
NOTE:
KEY STONE INTO CHANNEL BANKS AND
EXTEND IT BEYOND THE ABUTMENTS A
MINIMUM OF 18" TO PREVENT FLOW
AROUND DAM.

VIEW LOOKING UPSTREAM



SECTION A - A

'L' = THE DISTANCE SUCH THAT POINTS 'A' AND
'B' ARE OF EQUAL ELEVATION.



SPACING BETWEEN CHECK DAMS

NOTES:
1. DESIGN PER H.E.C. 14

NOT TO SCALE

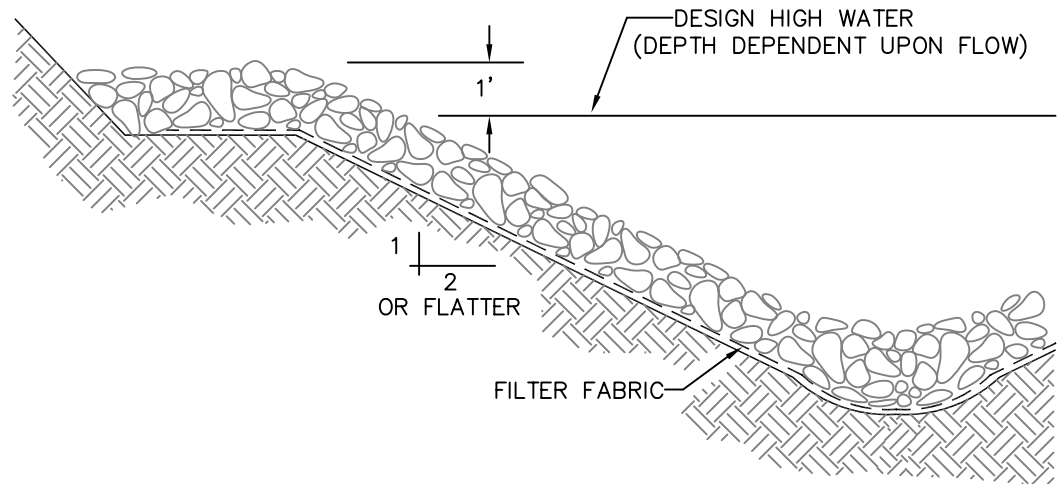
City of West Jordan, Utah



ROCK
CHECK DAM

PLAN
5035

DESIGN HEIGHT (H), WIDTH AND STONE SIZE SHALL
BE DETERMINED BY THE ENGINEER



TYPICAL SECTION

NOTES:

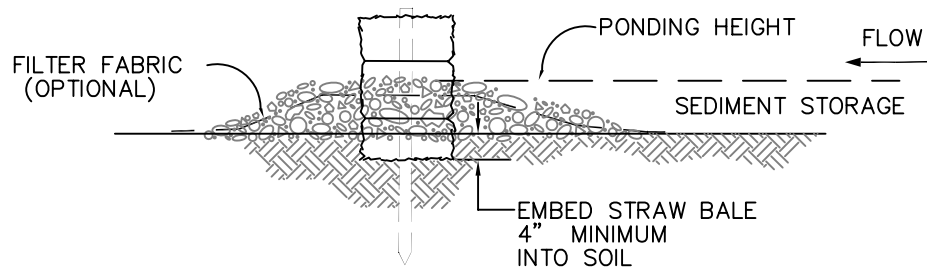
1. ROCK SIZE TO BE DESIGNED PER H.E.C. 11
2. TO BE DESIGNED PER H.E.C. 15—
FLEXIBLE CHANNELS

City of West Jordan, Utah

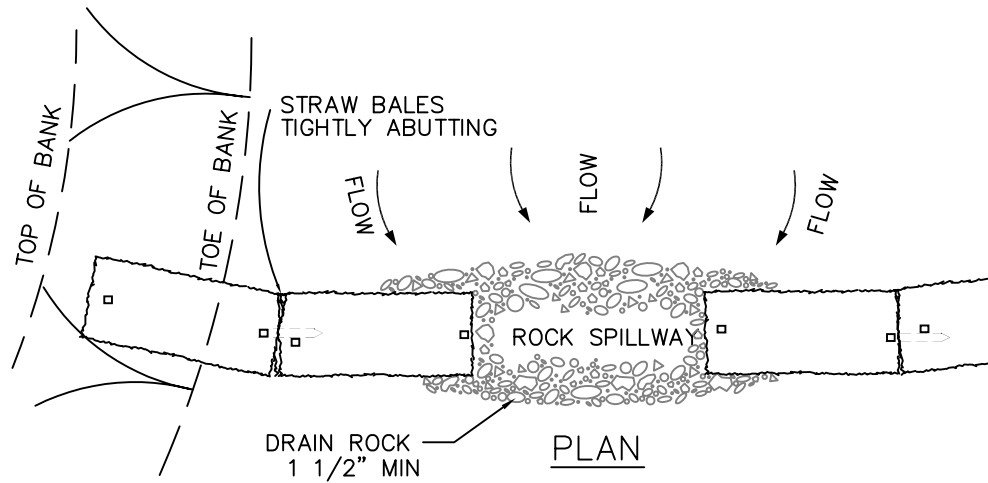


ROCK LINED
CHANNEL

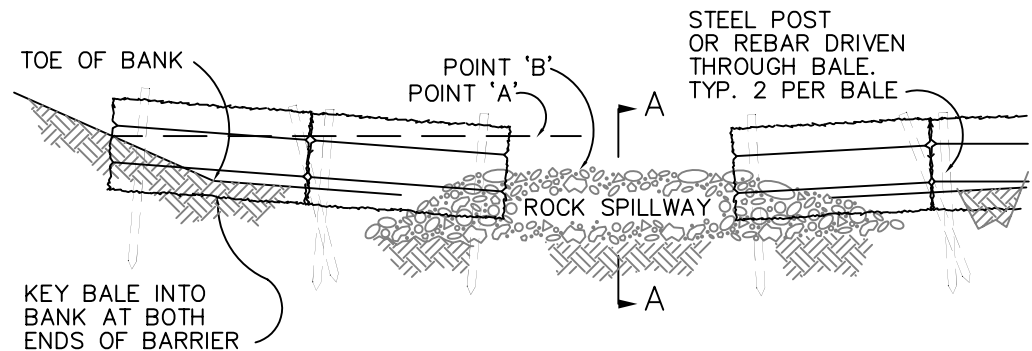
PLAN
5040



SECTION A - A



PLAN



VIEW LOOKING UPSTREAM

NOTES:

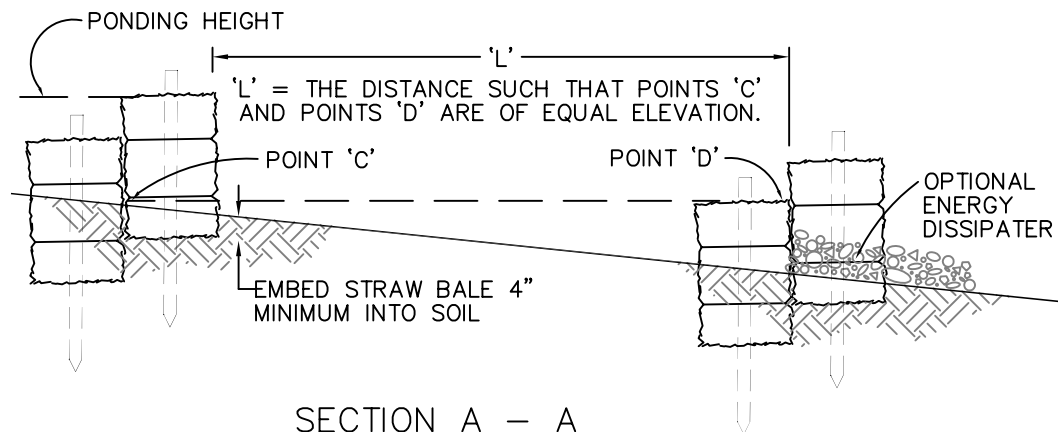
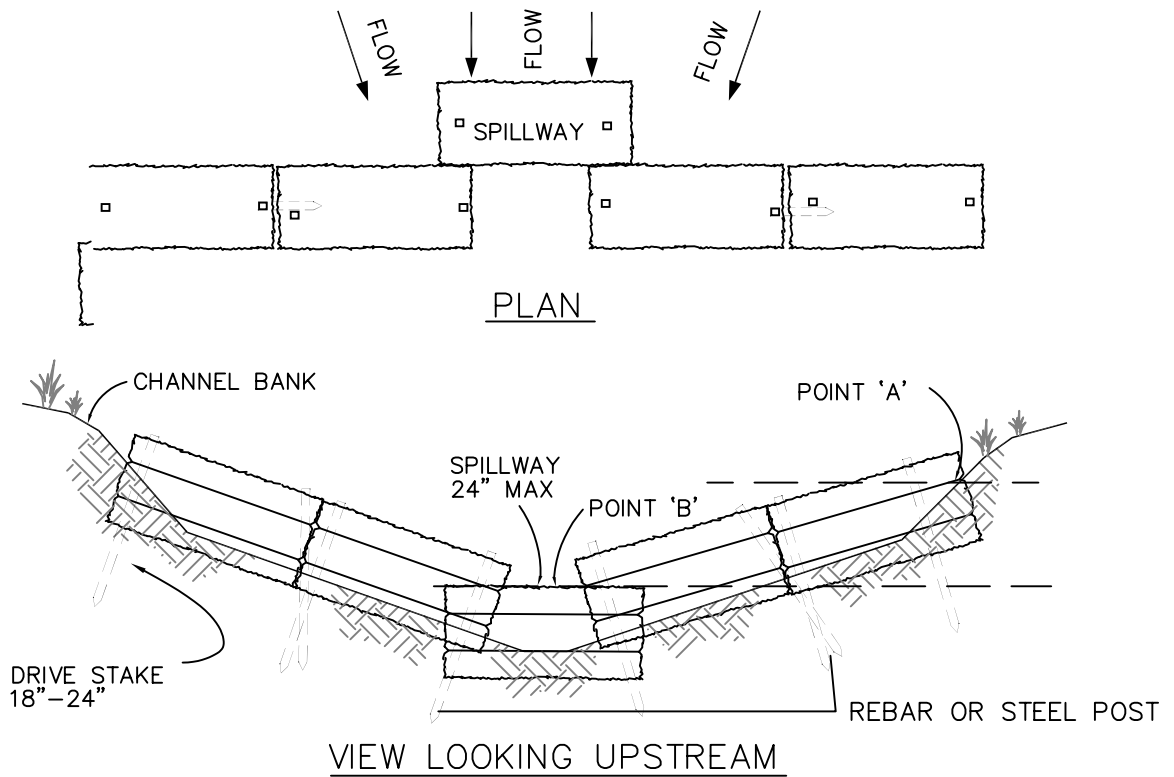
1. PLACE BALES PERPENDICULAR TO FLOW.
2. EMBED THE BALE 4" INTO THE SOIL AND "KEY" THE END BALES INTO THE CHANNEL BANKS TO PREVENT FLOW AROUND THE BALES.
3. BALES PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING.
4. POINT "A" SHALL BE HIGHER THAN POINT "B".
5. SPILLWAY HEIGHT SHALL NOT EXCEED 24" .

City of West Jordan, Utah



TEMPORARY SEMI-PERVIOUS STRAW
BALE SEDIMENT BARRIER

PLAN
5050



NOT TO SCALE

NOTES:

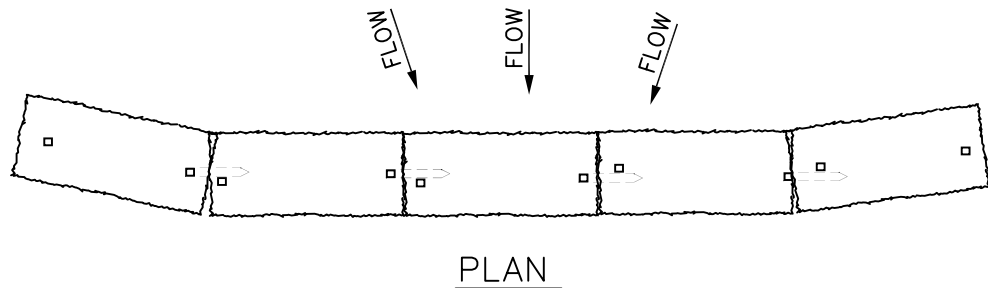
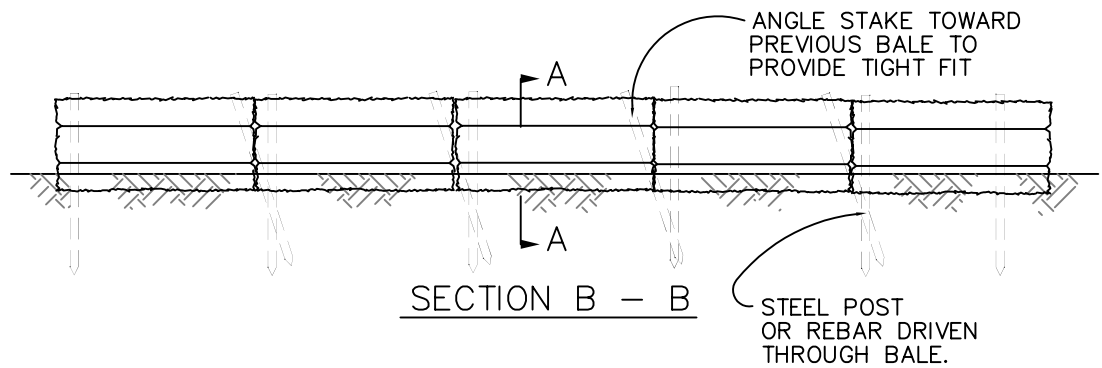
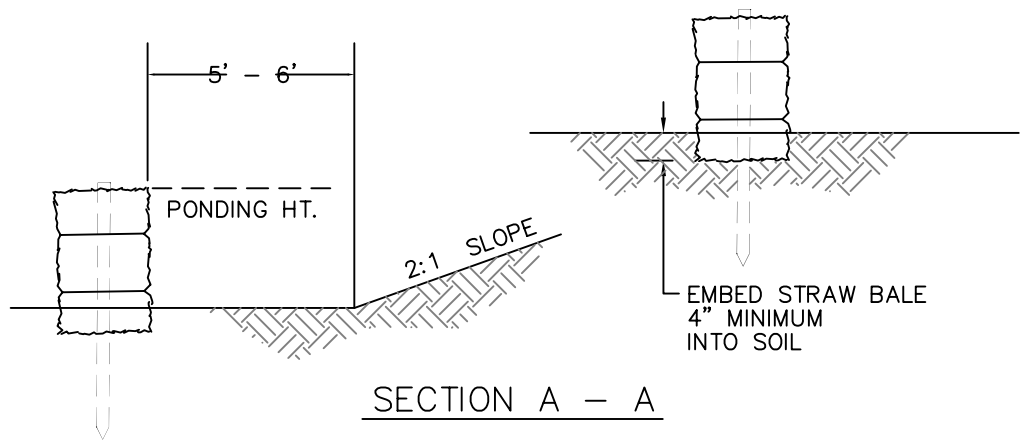
1. EMBED BALES 4" INTO THE SOIL AND 'KEY' BALES INTO THE CHANNEL BANKS.
2. POINT 'A' MUST BE HIGHER THAN POINT 'B'. (SPILLWAY HEIGHT)
3. PLACE BALES PERPENDICULAR TO THE FLOW WITH ENDS TIGHTLY ABUTTING.
4. SPILLWAY HEIGHT SHALL NOT EXCEED 24" .
5. INSPECT AFTER EACH SIGNIFICANT STORM, MAINTAIN AND REPAIR PROMPTLY.

City of West Jordan, Utah



TEMPORARY STRAW BALE
CHECK DAM

PLAN
5055



NOTES:

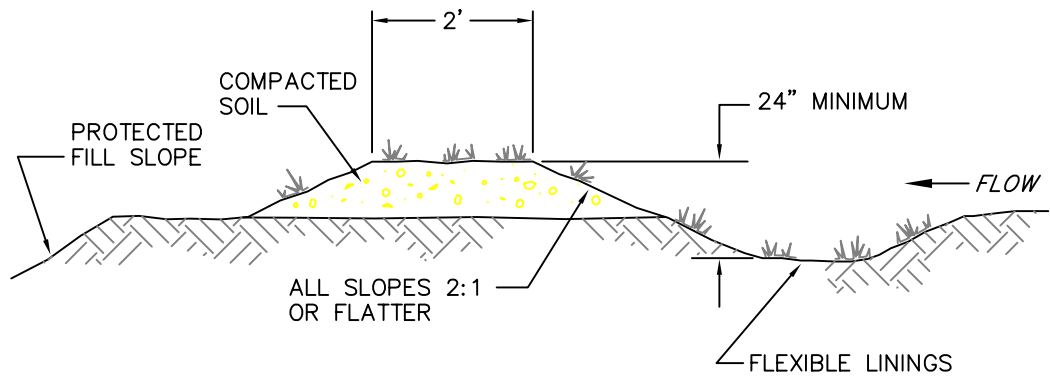
1. THE STRAW BALES SHALL BE PLACED ON SLOPE CONTOUR.
2. BALES TO BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING.
3. KEY IN BALES TO PREVENT EROSION OR FLOW UNDER BALES.

City of West Jordan, Utah

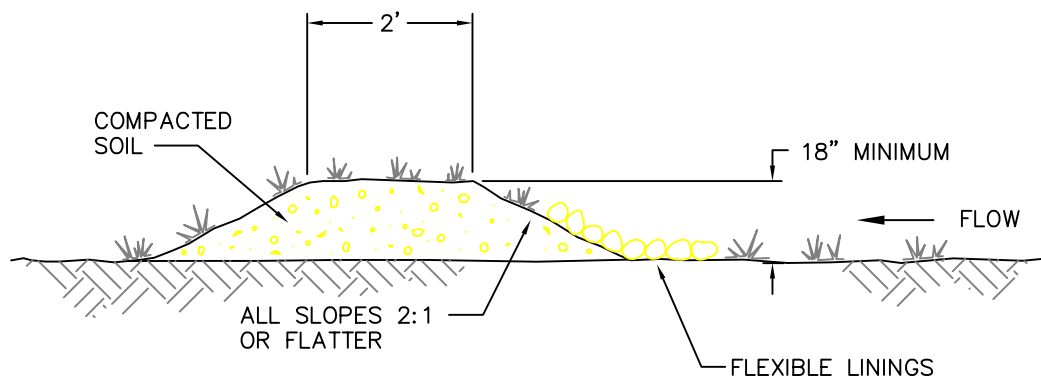


TEMPORARY STRAW BALE
DIKE

PLAN
5060



TYPICAL FILL DIVERSION



TYPICAL TEMPORARY DIVERSION DIKE

NOTES:

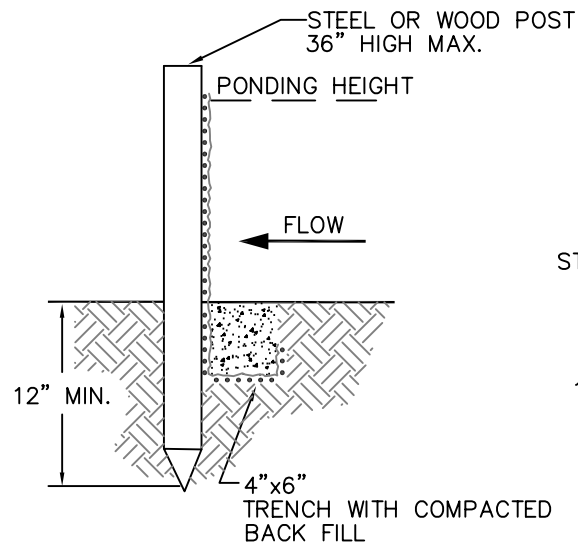
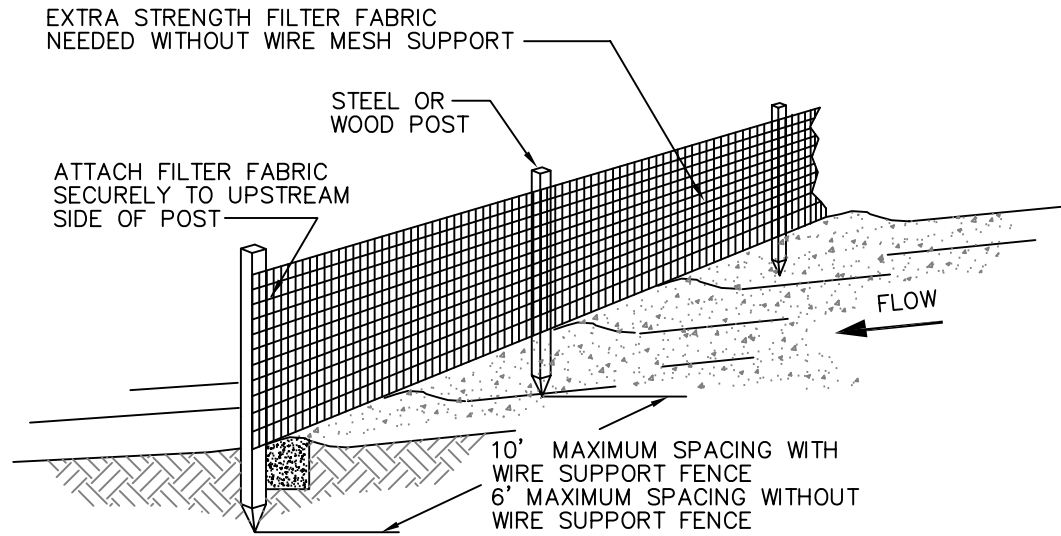
1. THE CHANNEL BEHIND THE DIKE SHALL HAVE POSITIVE GRADE TO A STABILIZED OUTLET.
2. THE DIKE SHALL BE ADEQUATELY COMPACTED TO PREVENT FAILURE.
3. THE DIKE SHALL BE STABILIZED WITH TEMPORARY OR PERMANENT SEEDING OR RIPRAP.

City of West Jordan, Utah

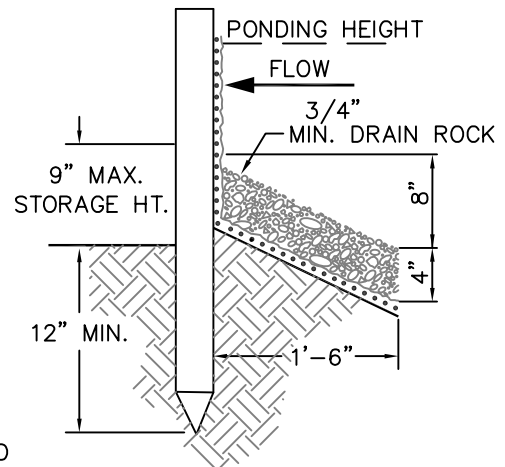


TEMPORARY DIVERSION DIKE

PLAN
5065



TRENCH DETAIL



INSTALLATION WITHOUT TRENCHING

NOTES:

1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" (225mm) MAXIMUM RECOMMENDED STORAGE HEIGHT.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO DESIGNATED STORAGE AREAS.

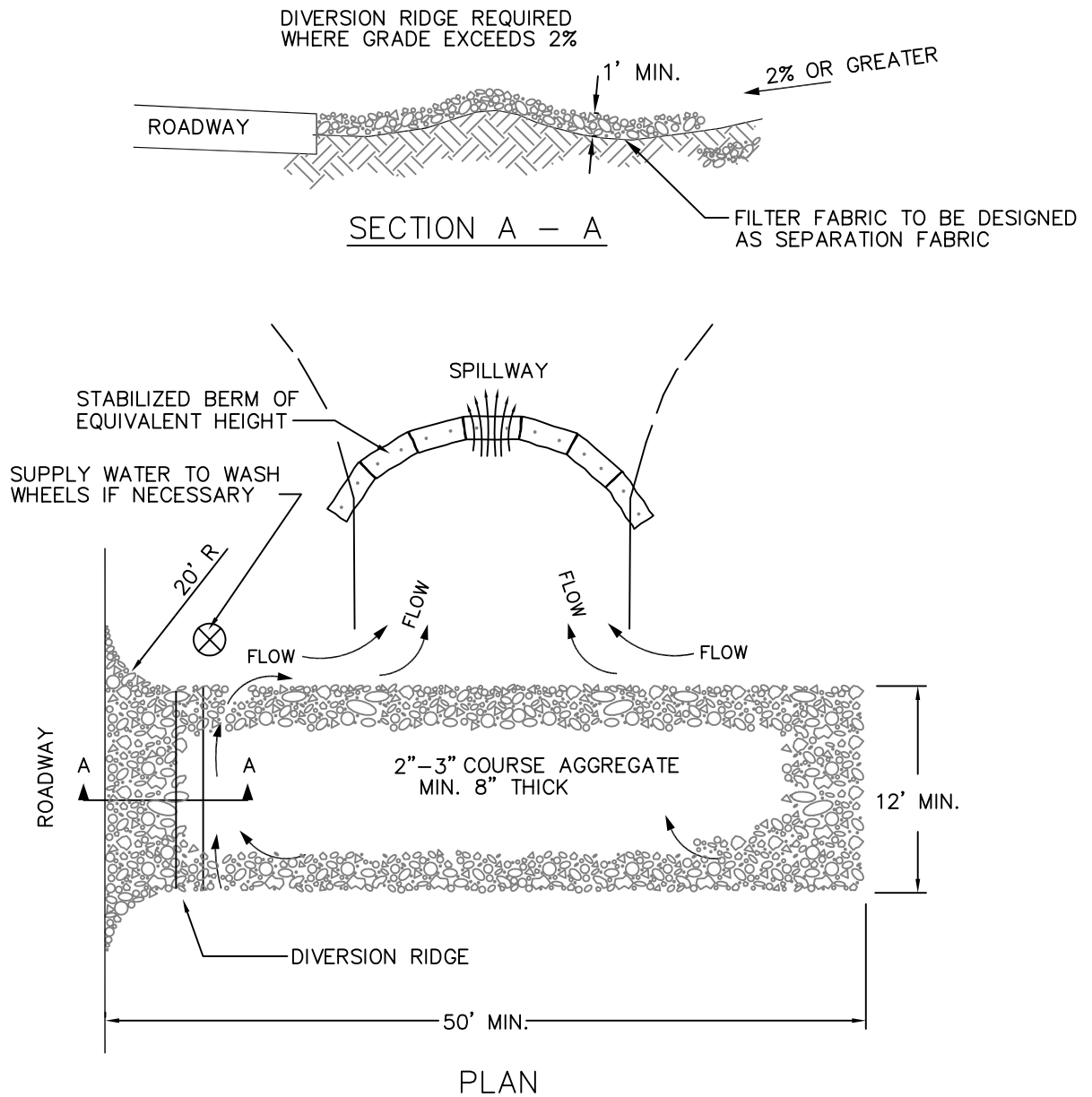
NOT TO SCALE

City of West Jordan, Utah



SILT FENCE

PLAN
5100



NOTES:

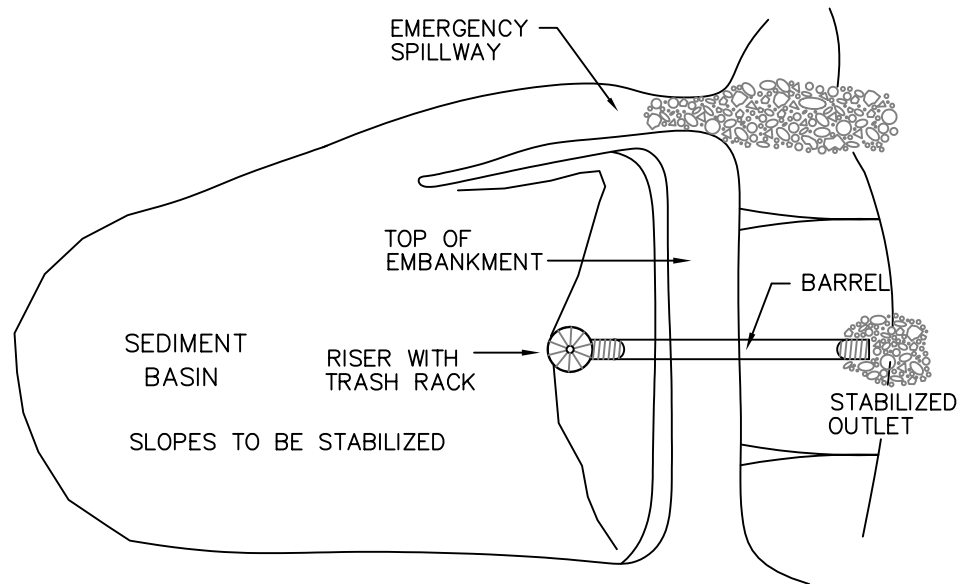
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. THE INTENT OF THIS IS TO KEEP THE STREETS FREE FROM DIRT AND OR SEDIMENT
5. DEPTH OF AGGREGATE WILL BE DETERMINED BY DESIGN ENGINEER BASED ON EXISTING SOIL TYPE.
6. GEOTEXTILE FABRIC SHALL BE USED FOR ENTRANCE

City of West Jordan, Utah

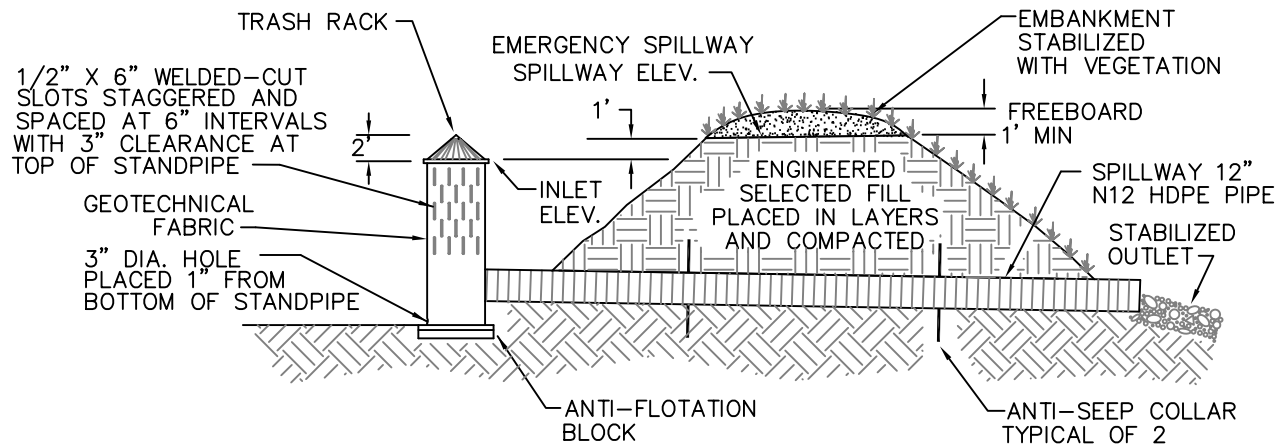


TEMPORARY
GRAVEL CONSTRUCTION
ENTRANCE/EXIT

PLAN
5105



PLAN



SECTION

NOTES:

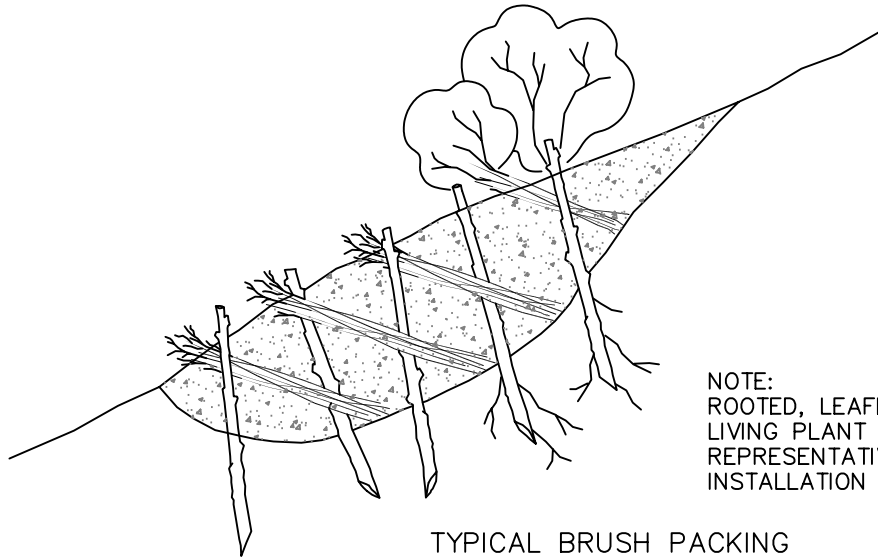
1. SEDIMENT BASIN TO BE SIZED PER SEDIMENT LOAD CALCULATIONS.

City of West Jordan, Utah

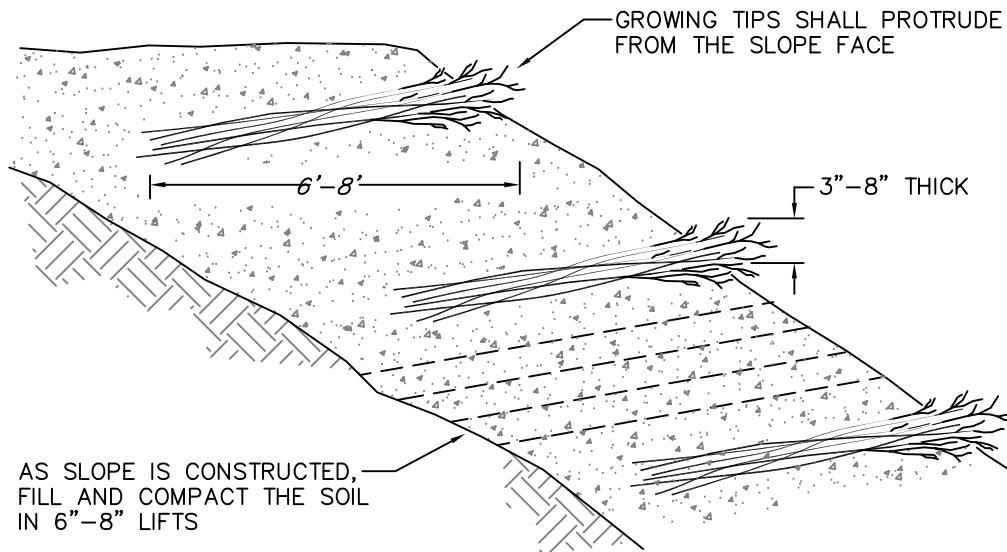


TYPICAL
SEDIMENT BASIN

PLAN
5110



COVER BRUSH LAYER IMMEDIATELY WITH
6" (150mm) OF FILL SOIL, WATER AND
COMPACT ACCORDING TO SPECIFICATIONS



NOTES:

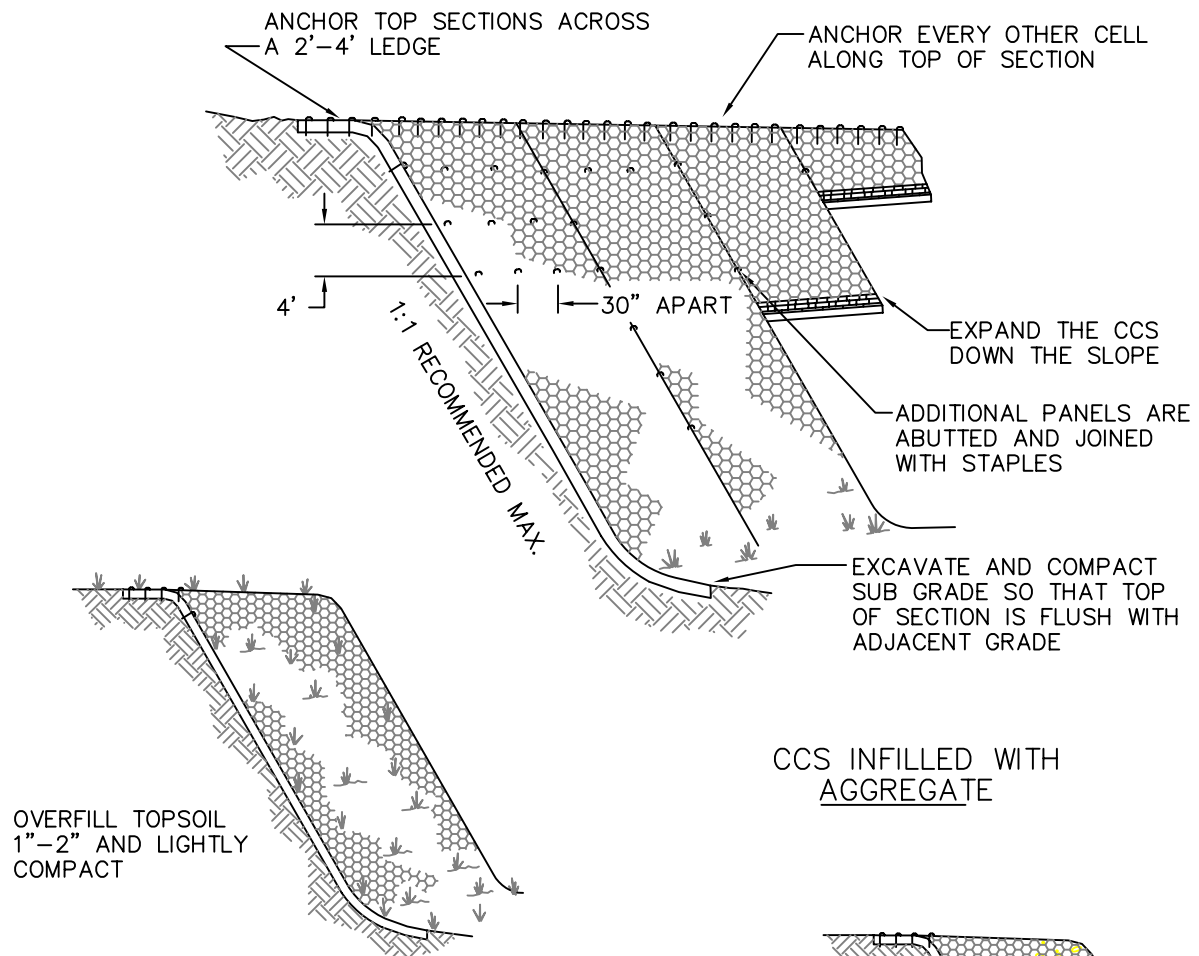
1. REPAIR OR FILLING OF SMALL SLUMPS, SLIPOUTS,
AND HEADOUTS.
2. PLANT MATERIAL HARVEST & INSTALLATION SHOULD BE
PERFORMED SURRING IT'S DORMANT SEASON.
3. USE SITE APPROPRIATE PLANTS.
4. ALL CUTTINGS SHOULD BE SOAKED FOR A MINIMUM OF 24 HOURS.
5. BRUSHLAYERING USES LIVE PLANT MATERIAL AND MUST BE TREATED AS SUCH.

City of West Jordan, Utah



BRUSH
LAYERING

PLAN
5200



CCS INFILLED WITH TOPSOIL AND VEGETATED WITH GRASS

NOTES:

1. SURFACE OF SLOPE SHALL BE LEVELED WITH GULLIES FILLED AND WELL COMPACTED.
2. SHAPE AND COMPACT SUB GRADE SURFACES TO DESIGN ELEVATIONS AND GRADES.
3. THE CELLS SHALL BE ANCHORED SECURELY TO PREVENT DISPLACEMENT AND DEFORMATION OF PANELS WHEN BACKFILLING.
4. INFILL FROM CREST OF THE SLOPE TO TOE TO PREVENT DISPLACEMENT. LIMIT DROP HEIGHT TO 3'.

OVERFILL WITH LOOSE GRANULAR MATERIAL 1" AND COMPACT

NOT TO SCALE

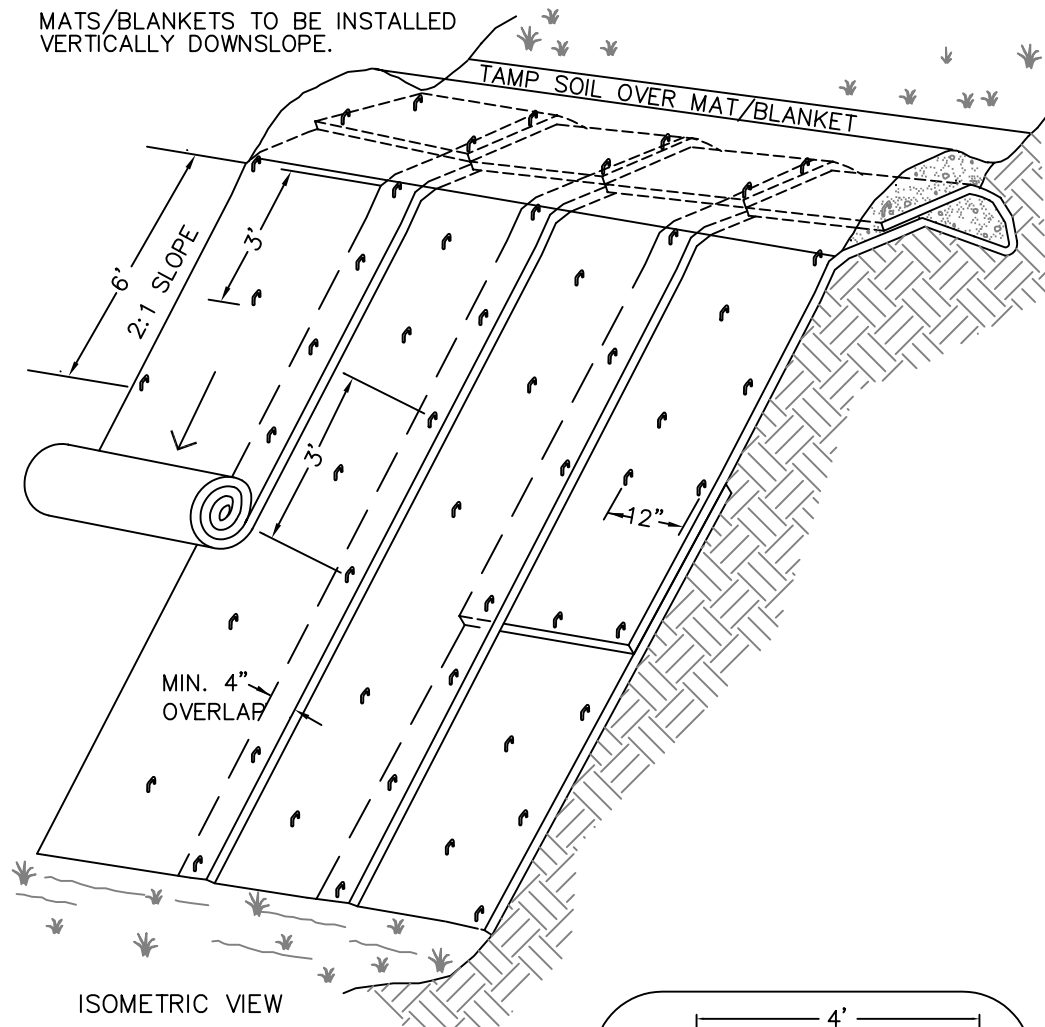
City of West Jordan, Utah



CELLULAR CONFINEMENT
SYSTEM FOR SLOPE
STABILIZATION

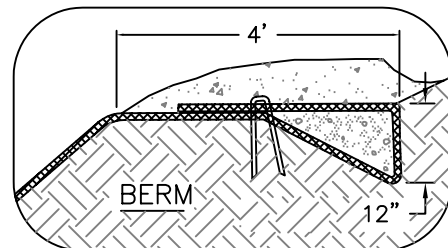
PLAN
5205

MATS/BLANKETS TO BE INSTALLED
VERTICALLY DOWNSLOPE.



ISOMETRIC VIEW

TYPICAL SLOPE
SOIL STABLIZATION



NOT TO SCALE

NOTES:

1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, SNOW, AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
4. STAPLES LENGTH TO BE LONG ENOUGH TO BE EMBEDDED INTO UNDISTURBED SOIL.

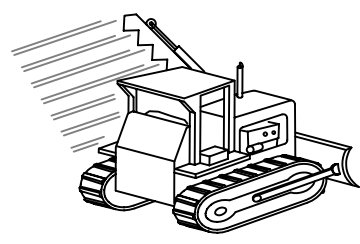
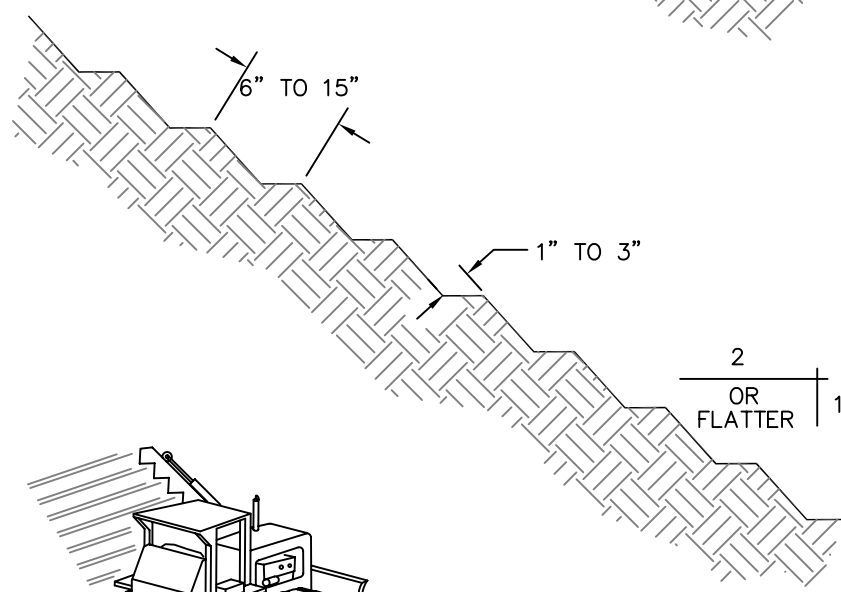
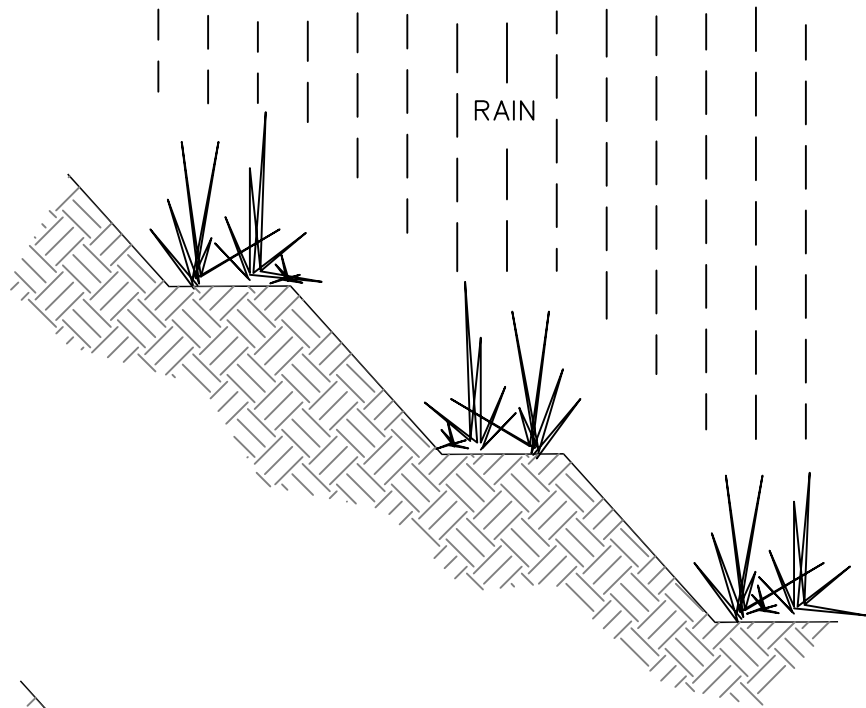
City of West Jordan, Utah



EROSION BLANKETS &
TURF REINFORCEMENT MATS
SLOPE INSTALLATION

PLAN

5210



NOTE:
TO BE USED ON
SLOPE 4:1 & GREATER

NOT TO SCALE

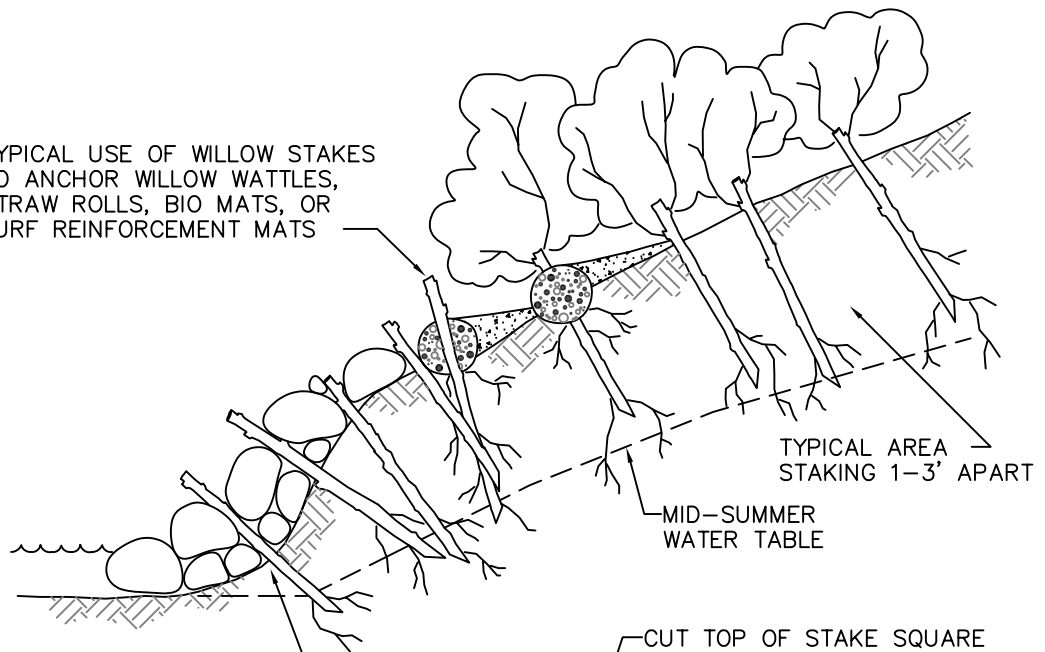
City of West Jordan, Utah



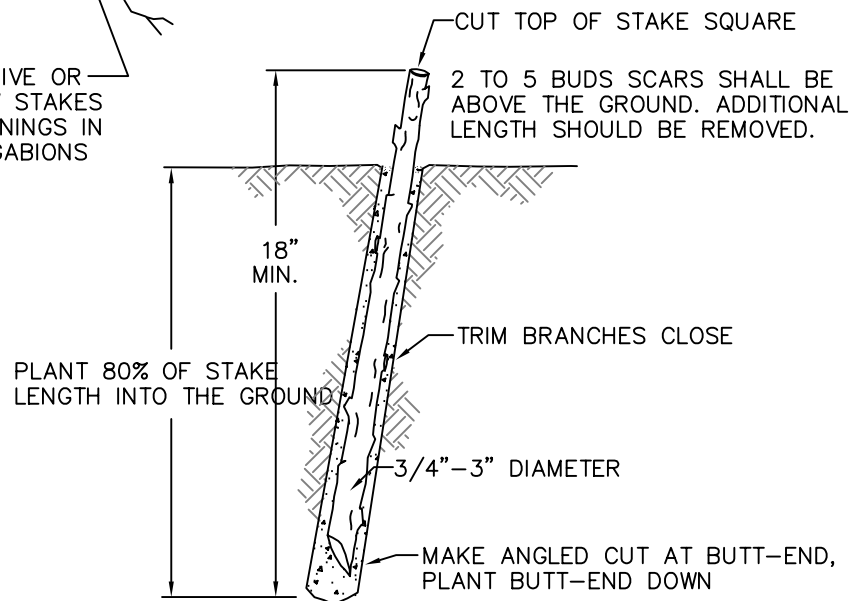
GROOVED OR
SERRATED SLOPE

PLAN
5215

TYPICAL USE OF WILLOW STAKES TO ANCHOR WILLOW WATTLES, STRAW ROLLS, BIO MATS, OR TURF REINFORCEMENT MATS



TYPICAL - DRIVE OR PLANT WILLOW STAKES THROUGH OPENINGS IN RIP RAP OR GABIONS



NOTES:

1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION, USE A PILOT BAR IN FIRM SOILS.
4. SOAK CUTTINGS FOR 24 HOURS (MIN.) PRIOR TO INSTALLATION.
5. TAMP THE SOIL AROUND THE STAKE.
6. PLANTING MATERIAL SHOULD BE APPROPRIATE TO THE SITE AND TO BE APPROVED BY THE CITY OF WEST JORDAN
7. STREAM BANK ONLY

NOT TO SCALE

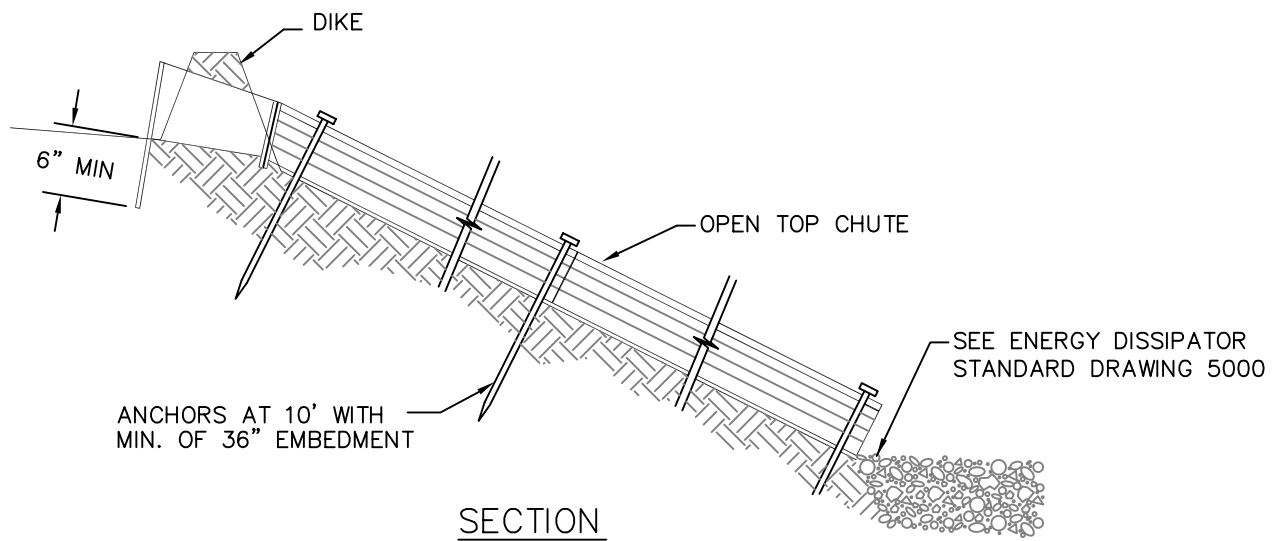
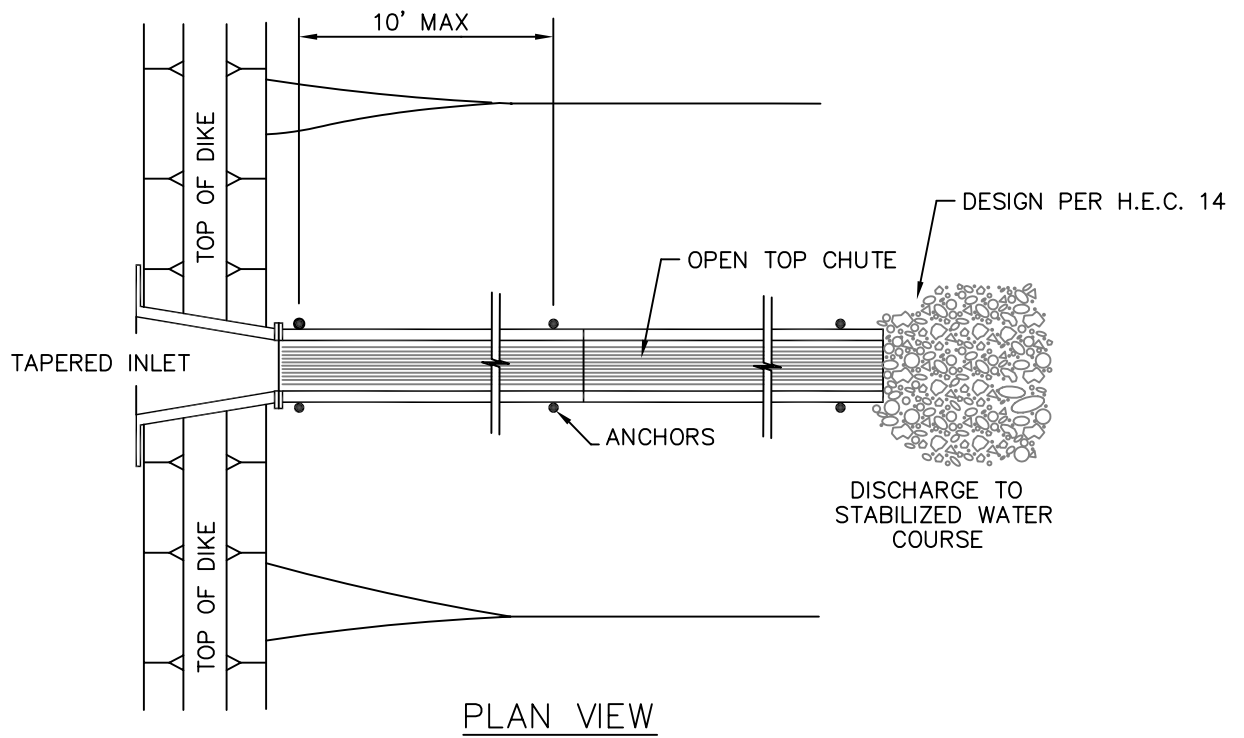
City of West Jordan, Utah



LIVE STAKING

PLAN

5220

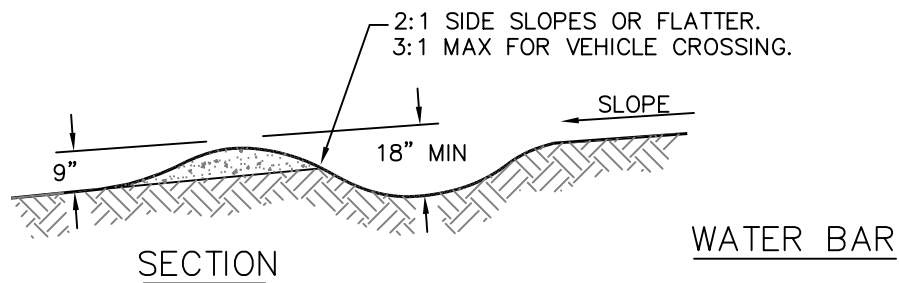
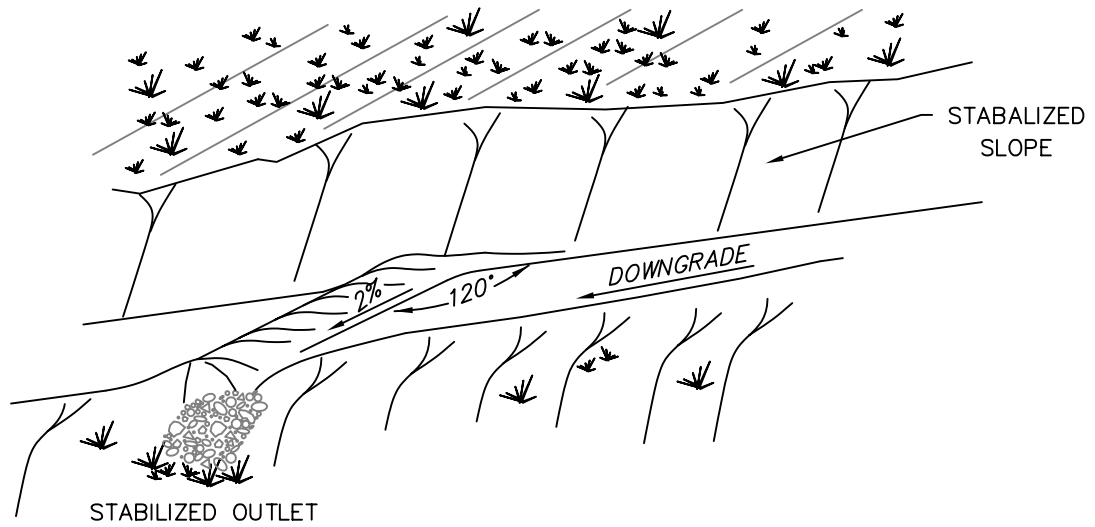
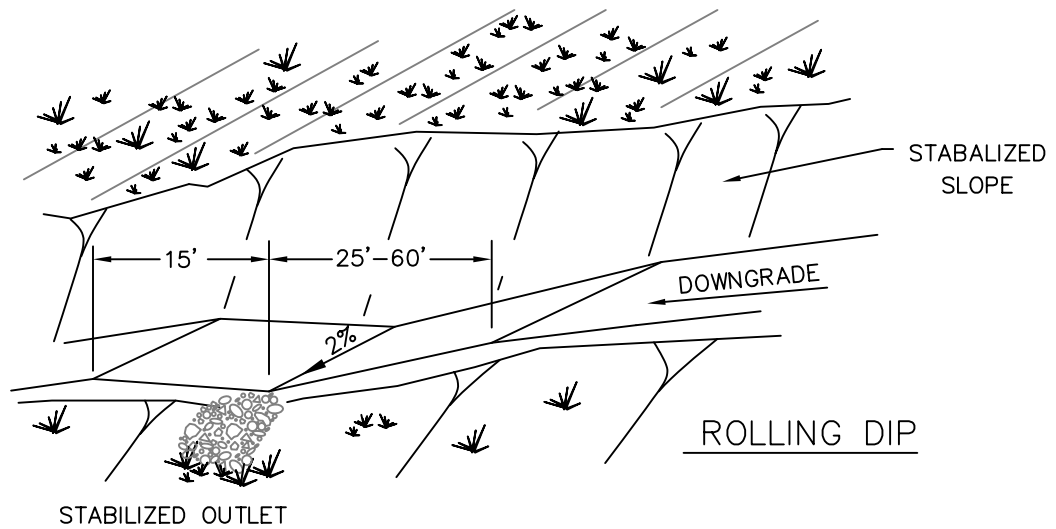


City of West Jordan, Utah



OVER SIDEDRAIN

PLAN
5225



NOTES:

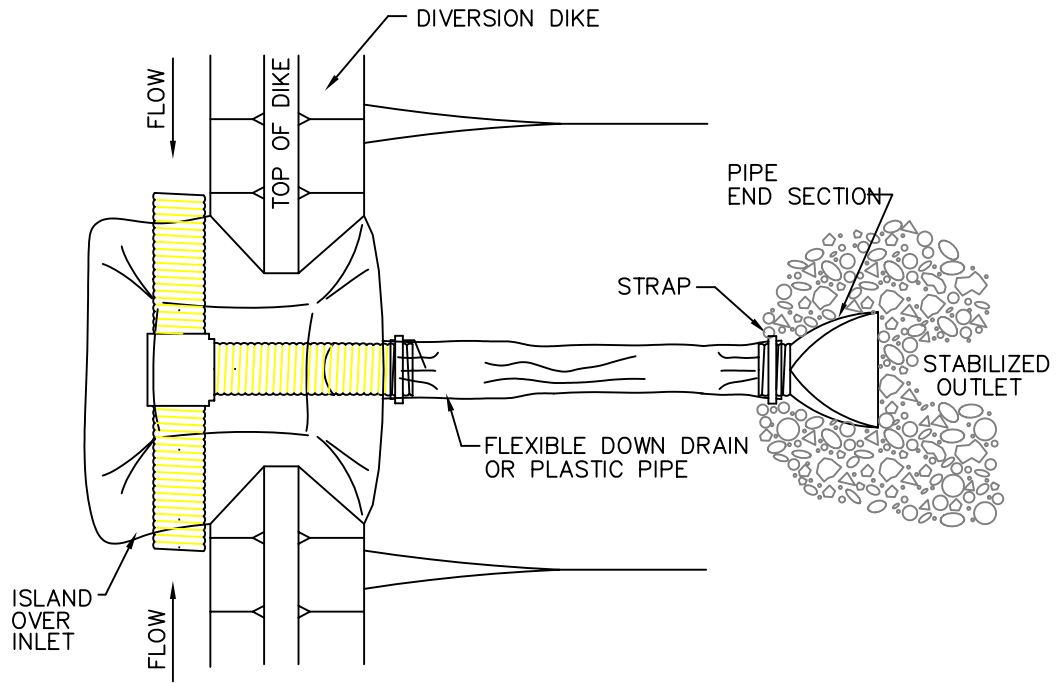
1. SPACING TO BE CALCULATED BASED ON CONTRIBUTING AREA.
2. STABILIZE GRADE SURFACE SUCH THAT RUNOFF WILL REMAIN ON GRADE SURFACE.
3. SOIL TO BE STABILIZED WITH APPROVED VEGETATION.
4. NEVER OUTLET WATER BARS OR ROLLING DIPS ONTO UNPROTECTED FILL SLOPES

City of West Jordan, Utah

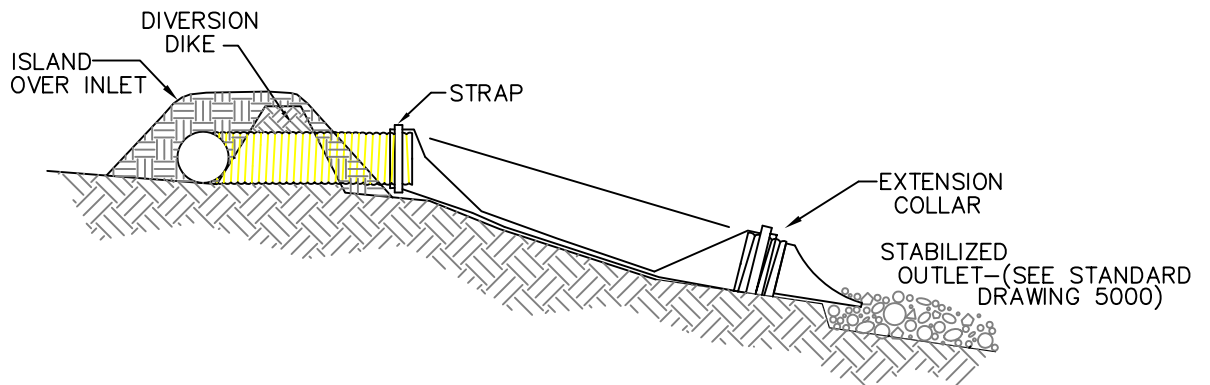


ROLLING DIP
AND WATERBAR

PLAN
5230



PLAN VIEW



SECTION

NOTES:

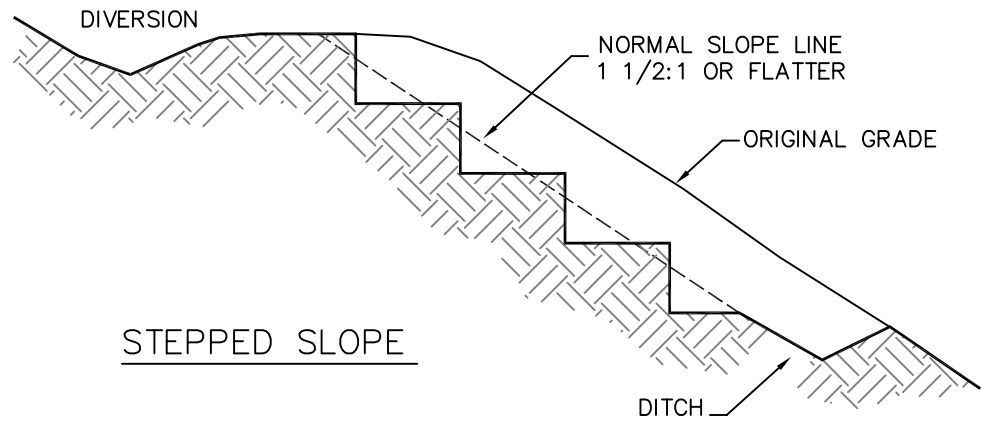
1. ENTRANCE SECTION SHALL BE WELL ENTRENCHED AND STABLE
2. DRAIN SHOULD EXTEND DOWNSLOPE BEYOND THE TOE OF THE SLOPE TO A STABLE AREA OR APPROPRIATELY STABILIZED OUTLET.

City of West Jordan, Utah

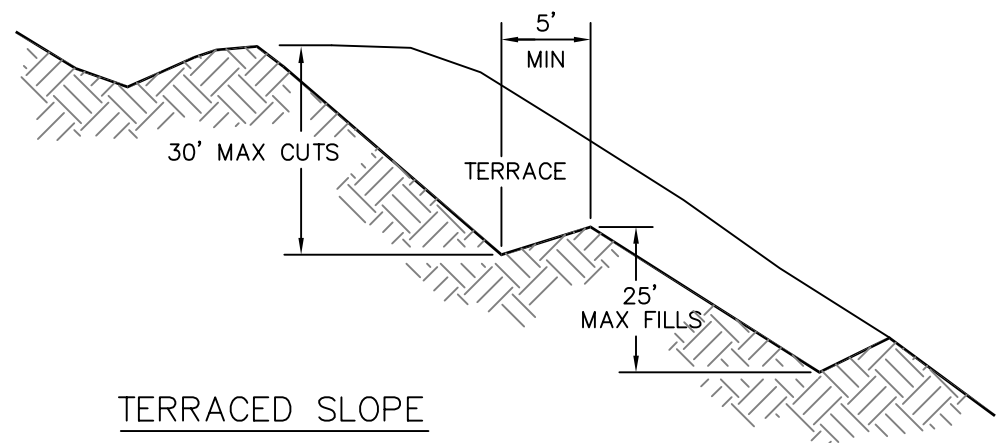


SLOPE DRAIN

PLAN
5235



STEPPED SLOPE



TERRACED SLOPE

NOT TO SCALE

NOTES:

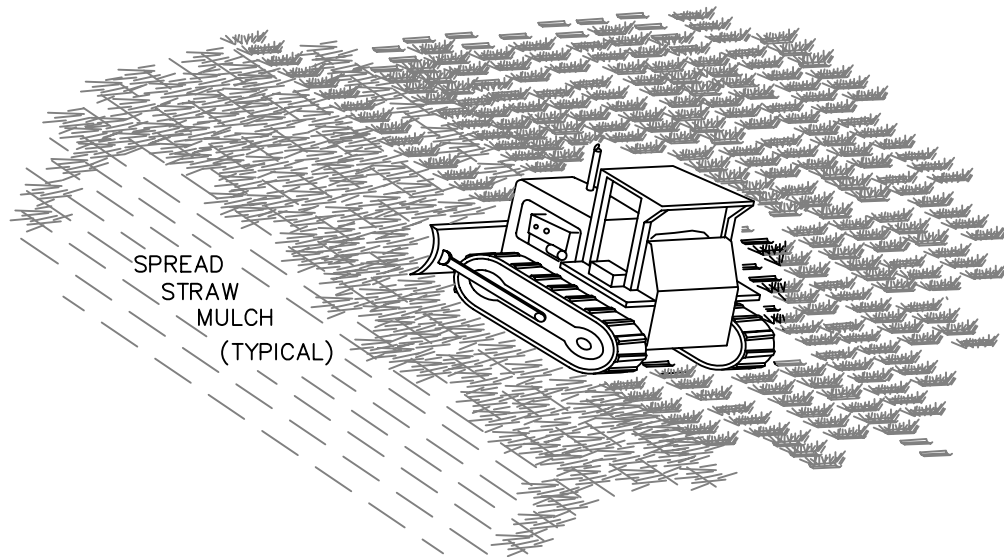
1. VERTICAL CUT DISTANCE SHALL BE LESS THAN HORIZONTAL DISTANCE.
2. VERTICAL CUT SHALL NOT EXCEED 2 FT. IN SOFT MATERIAL AND 3 FT. IN ROCKY MATERIAL.

City of West Jordan, Utah



STEPPED OR
TERRACED SLOPE

PLAN
5240



STRAW ANCHORING

NOTES:

1. ROUGHEN SLOPE WITH BULLDOZER
2. BROADCAST SEED AND FERTILIZER.
3. SPREAD STRAW TO COVER SOIL WITH APPROXIMATELY 30% COVERAGE
4. APPLY STRAW TO SLOPE SUCH THAT COVERAGE CAN NOT BE REDUCED BY NATURAL ELEMENTS SUCH AS PRECIPITATION OR WIND.
5. CRIMP STRAW WITH AN APPROVED CRIMPER IN STAGES TO COVER APPROXIMATELY 30% COVERAGE.
6. REPEAT STEPS 3 & 4 UNTIL TOTAL STRAW TONAGE IS APPLIED

City of West Jordan, Utah



STRAW
ANCHORING

PLAN
5245

BIOLOGS ROLLS MUST BE PLACED
ALONG SLOPE CONTOURS

3'-4'
(1.2m)

ADJACENT ROLLS SHALL
TIGHTLY ABUT

SPACING DEPENDS
ON SOIL TYPE AND
SLOPE STEEPNESS

(VARIES)

SEDIMENT, ORGANIC MATTER,
AND NATIVE SEEDS ARE
CAPTURED BEHIND THE ROLLS.

LIVE STAKE

1" X 1" STAKE

NOT TO SCALE

NOTE:

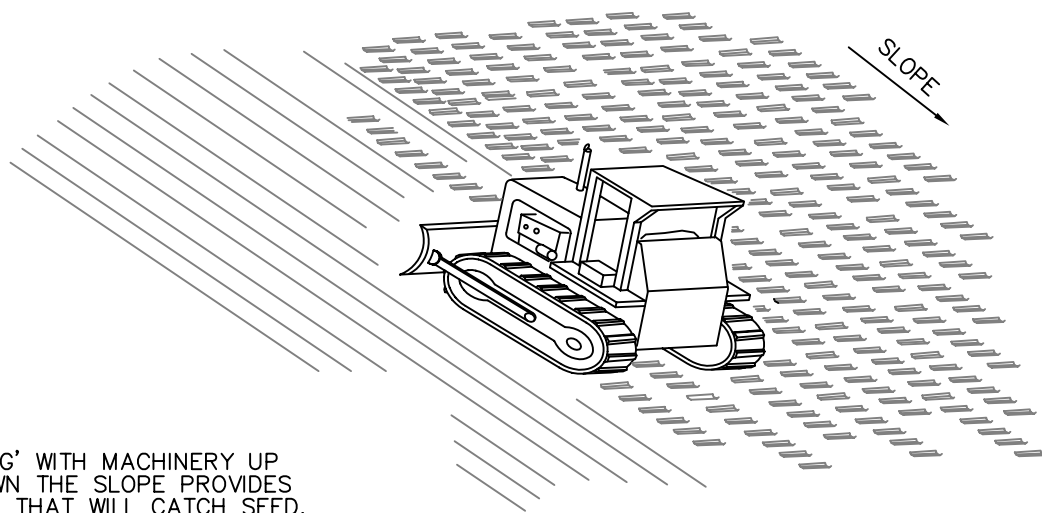
1. STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3"-5" DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.
2. SPACING TO BE CALCULATED USING THE SOIL TOLERANCE FACTOR "T"

City of West Jordan, Utah



BIOLOG
ROLLS

PLAN
5250



'TRACKING' WITH MACHINERY UP
AND DOWN THE SLOPE PROVIDES
GROOVES THAT WILL CATCH SEED,
RAINFALL AND REDUCE RUNOFF.

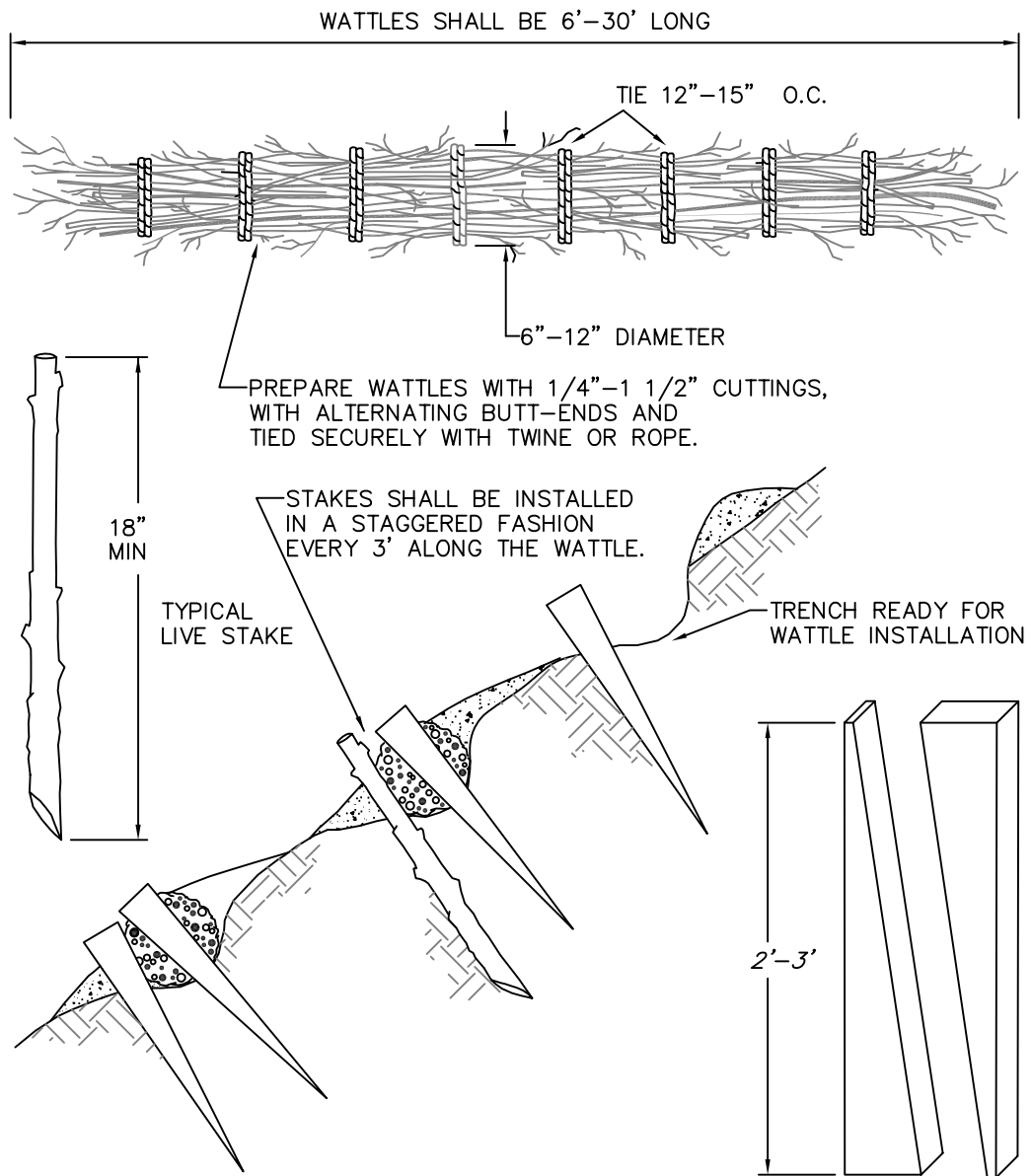
TRACKING

City of West Jordan, Utah



SURFACE
ROUGHENING

PLAN
5255



NOTES:

1. HARVEST AND INSTALL WATTLES DURING DORMANT SEASON.
2. INSTALL WATTLES ON SLOPE CONTOURS.
3. ALL WORK PROCEEDS FROM THE BOTTOM OF THE SLOPE TO THE TOP.
4. FILL OR PARTIALLY COVER WATTLE WITH SOIL FROM SLOPE OR TRENCH ABOVE.
5. COMPACT AND WORK SOIL INTO COMPLETED WATTLES.
6. CHOOSE PLANT MATERIALS APPROPRIATE FOR THE SITE
7. ALL CUTTINGS SHOULD BE SOADKED FOR A MINIMUM OF 24 HOURS.

TYPICAL CONSTRUCTION STAKE
SAW 2X4 LUMBER ON DIAGONAL

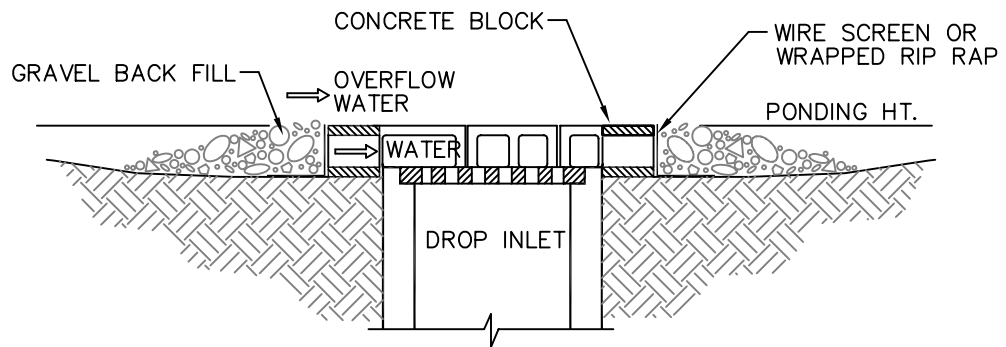
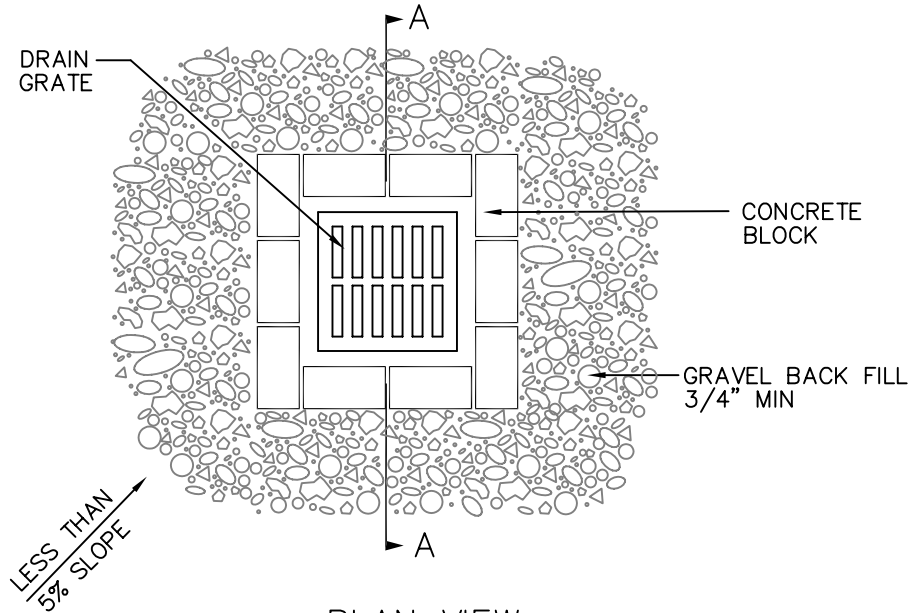
NOT TO SCALE

City of West Jordan, Utah



SLOPE
WATTLE
(LIVE FASCINE)

PLAN
5260



NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. EXCAVATE A BASIN OF SUFFICIENT SIZE ADJACENT TO THE DROP INLET.
3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWN SLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. A TEMPORARY DIKE MAY BE NECESSARY ON THE DOWN SLOPE SIDE OF THE STRUCTURE.
4. INSTALL FABRIC ON TOP OF GRATE.

City of West Jordan, Utah

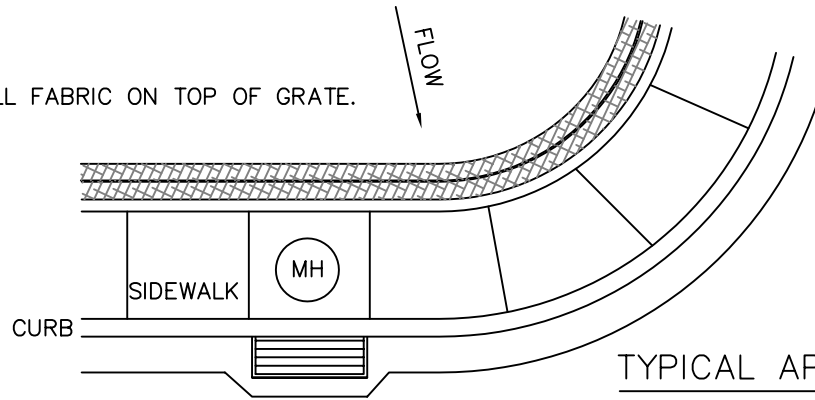


BLOCK AND GRAVEL DROP
INLET SEDIMENT BARRIER

PLAN

5300

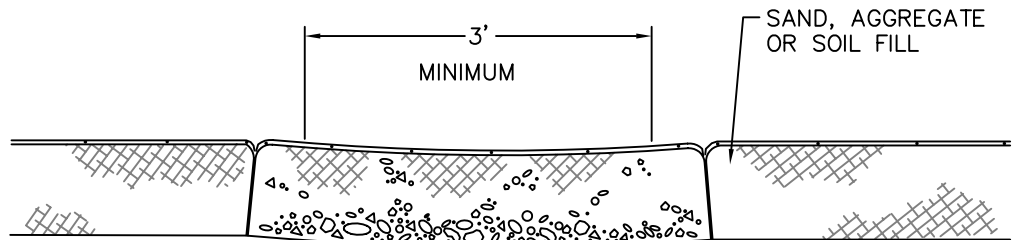
INSTALL FABRIC ON TOP OF GRATE.



TYPICAL APPLICATION

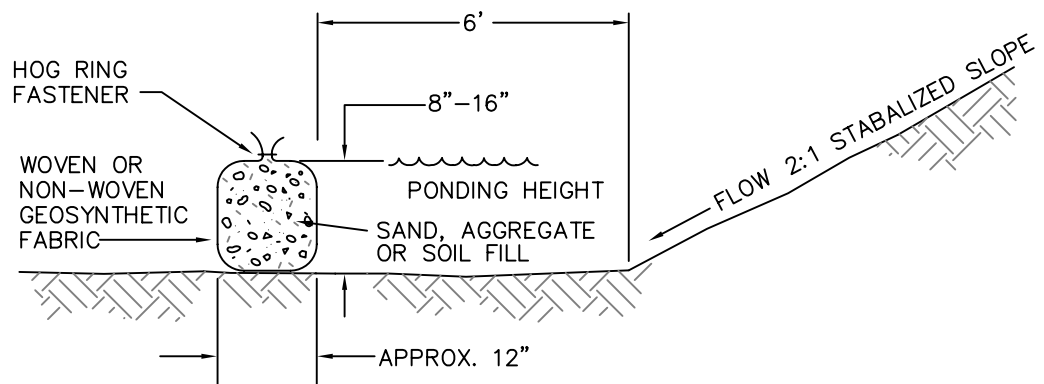
PERIMETER SEDIMENT BARRIER

DRAINAGE CHAMBER (OPTIONAL)



LOCATE DRAINAGE CHAMBER
AT LOW SPOT FOR ADEQUATE
DRAINAGE OF PONDED STORM WATER

FRONT VIEW



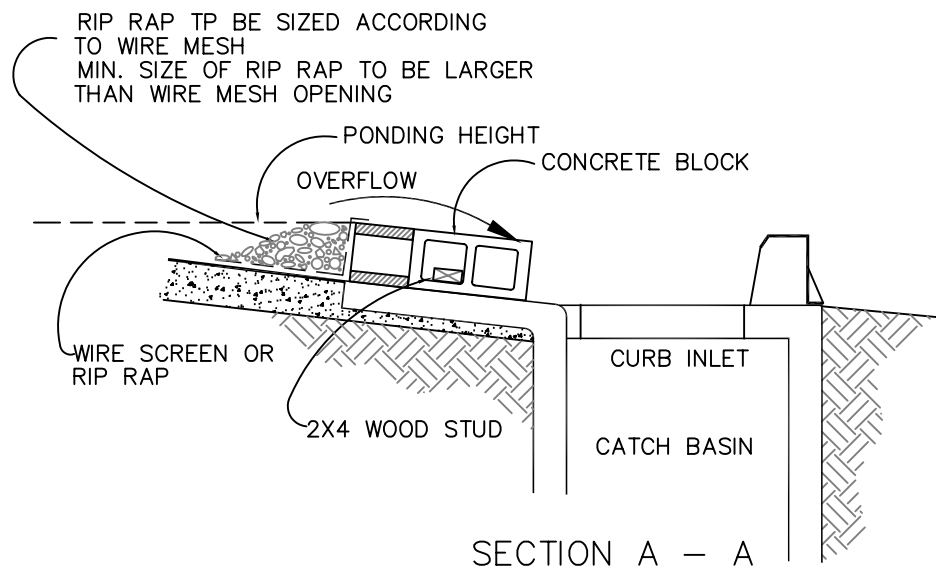
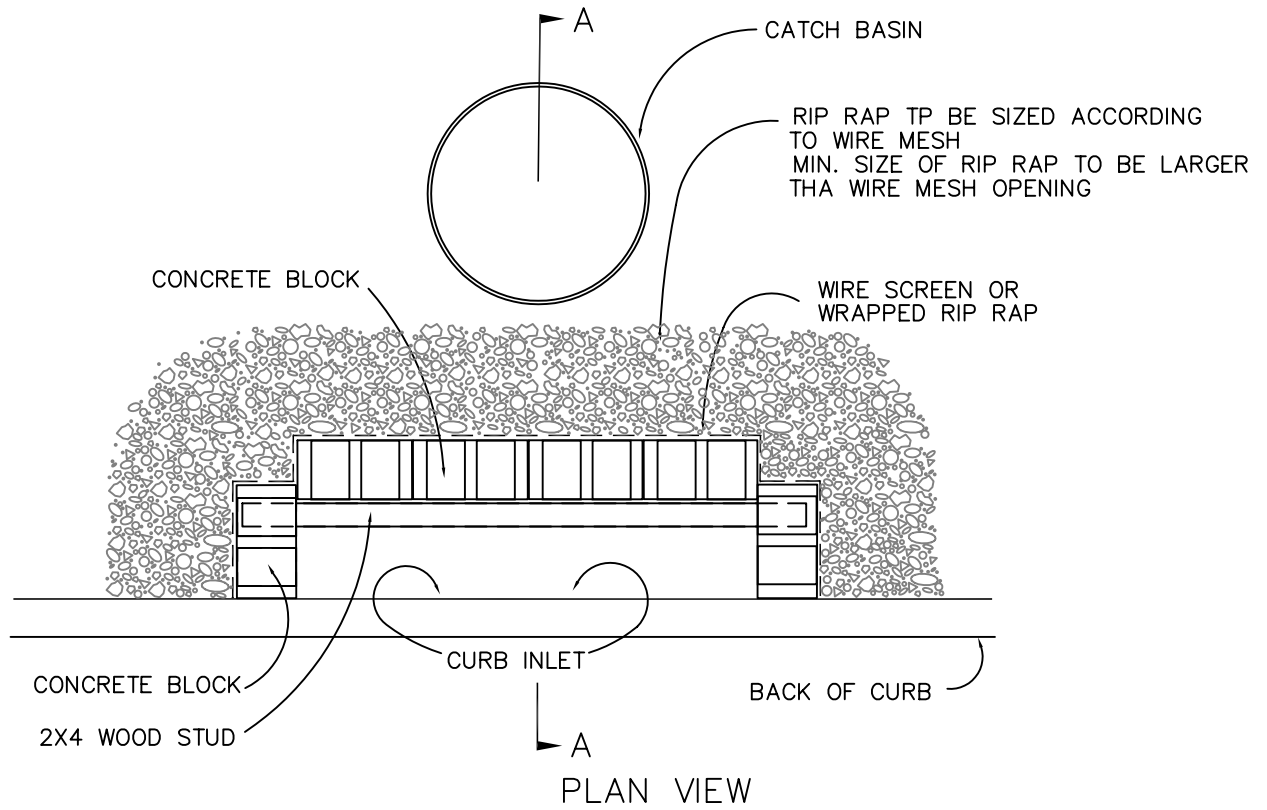
SIDE VIEW

City of West Jordan, Utah



CONTINUOUS
BERM

PLAN
5305



NOTES:

1. USE BLOCK AND GRAVEL TYPE SEDIMENT BARRIER WHEN CURB INLET IS LOCATED IN GENTLY SLOPING STREET SEGMENT, WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. BARRIER SHALL ALLOW FOR OVERFLOW FROM SEVERE STORM EVENT.
3. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.

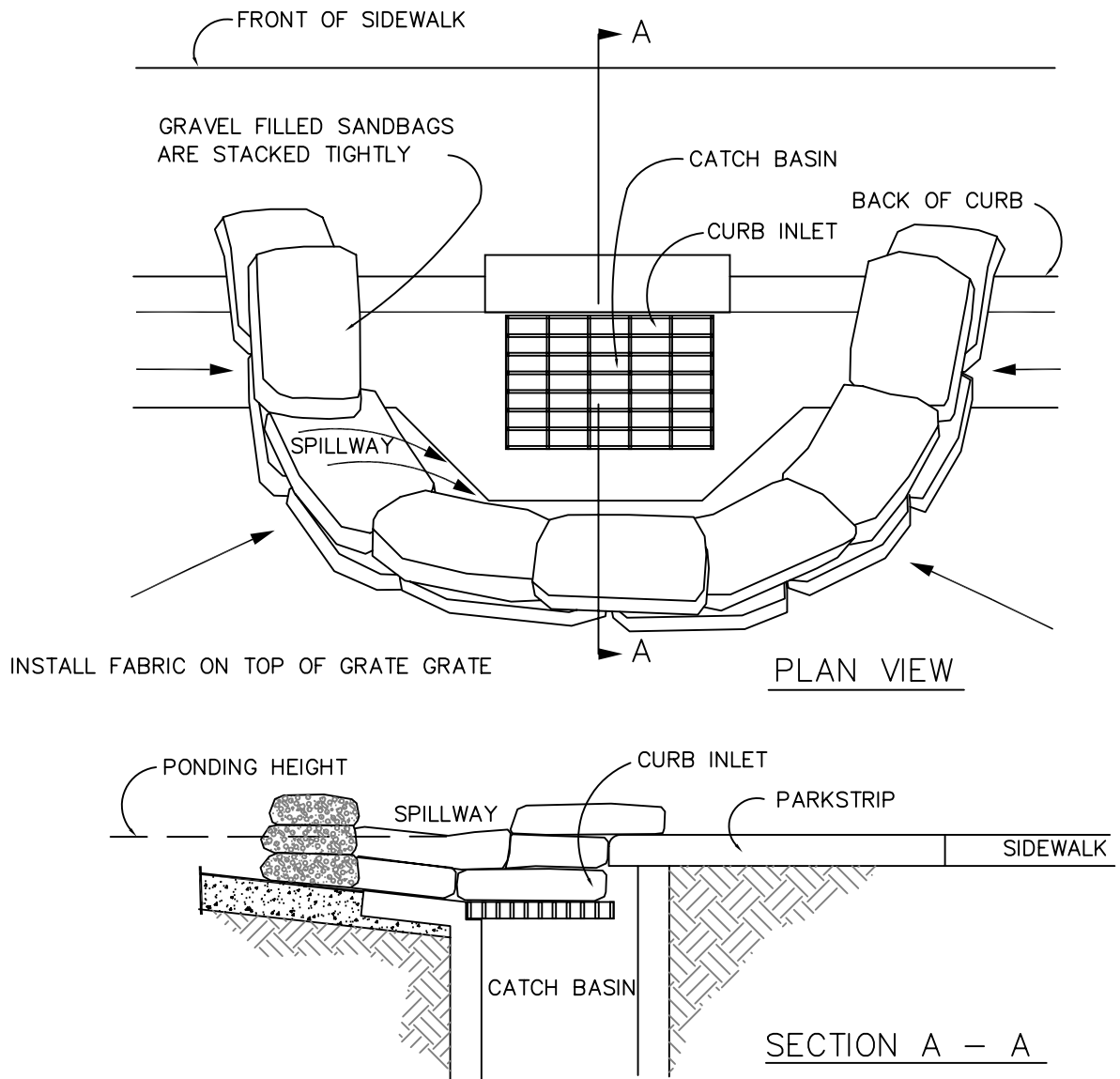
City of West Jordan, Utah



CURB INLET
SEDIMENT BARRIER
(BLOCK & GRAVEL)

PLAN

5315



NOTES:

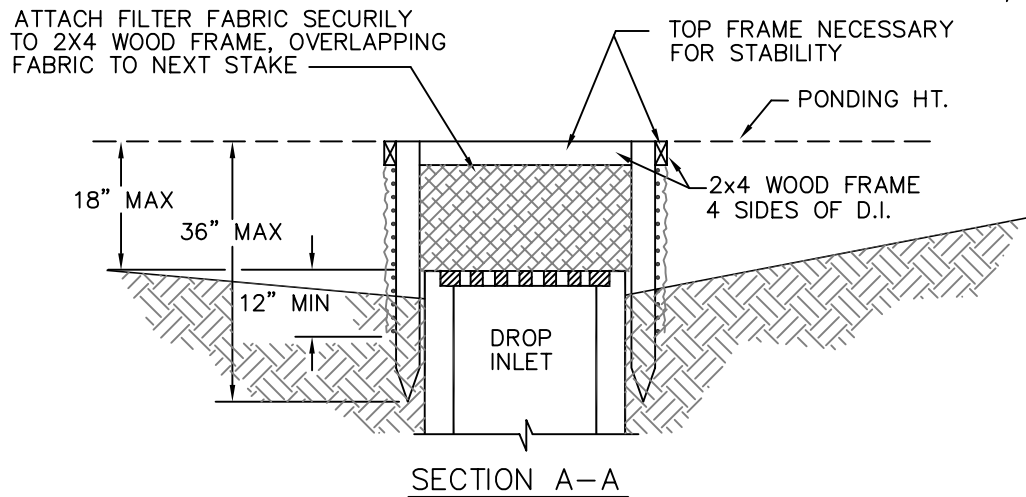
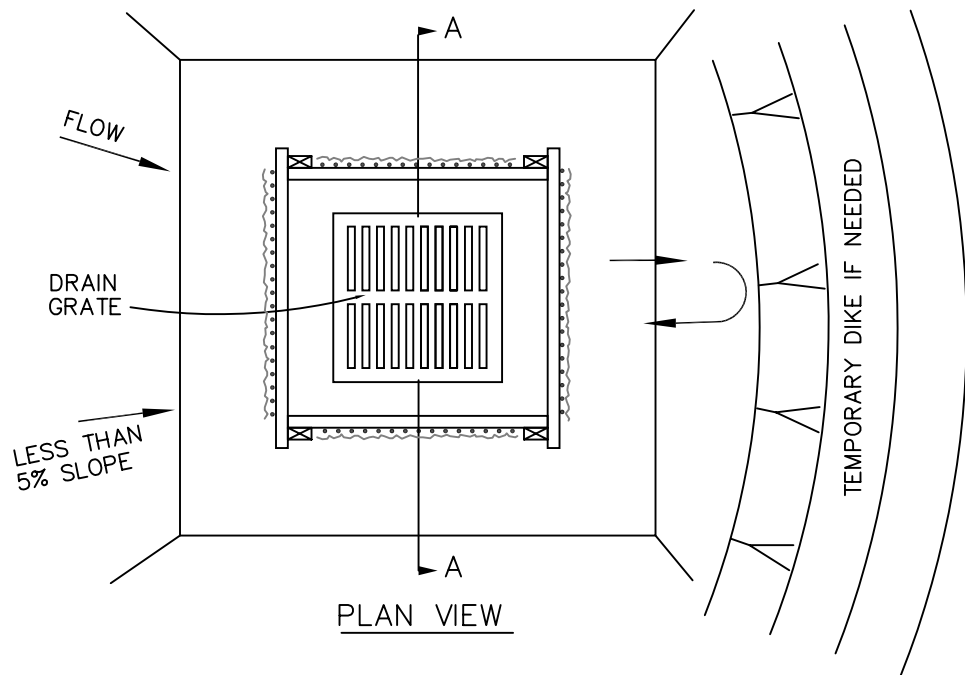
1. PLACE CURB TYPE SEDIMENT BARRIERS ON GENTLY SLOPING STREET SEGMENTS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. SANDBAGS, OF EITHER BURLAP OR WOVEN GEOTEXTILE FABRIC, ARE FILLED WITH GRAVEL, LAYERED AND PACKED TIGHTLY.
3. LEAVE ONE SANDBAG GAP IN THE TOP ROW TO PROVIDE A SPILLWAY FOR OVERFLOW.
4. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.

City of West Jordan, Utah



CURB INLET
SEDIMENT BARRIER
(SANDBAGS)

PLAN
5320



NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. USE 2"x4" WOOD OR EQUIVALENT METAL STAKES, 3' MINIMUM LENGTH.
3. INSTALL 2"x4" WOOD TOP FRAME TO INSURE STABILITY.
4. THE TOP OF THE FRAME (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWN SLOPE TO PREVENT RUNOFF FROM BY-PASSING THE INLET. A TEMPORARY DIKE MAY BE NECESSARY ON THE DOWN SLOPE SIDE OF THE STRUCTURE.

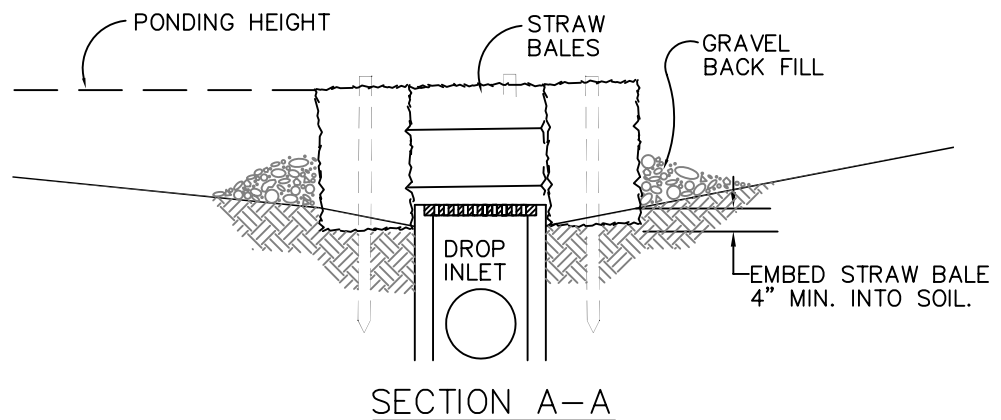
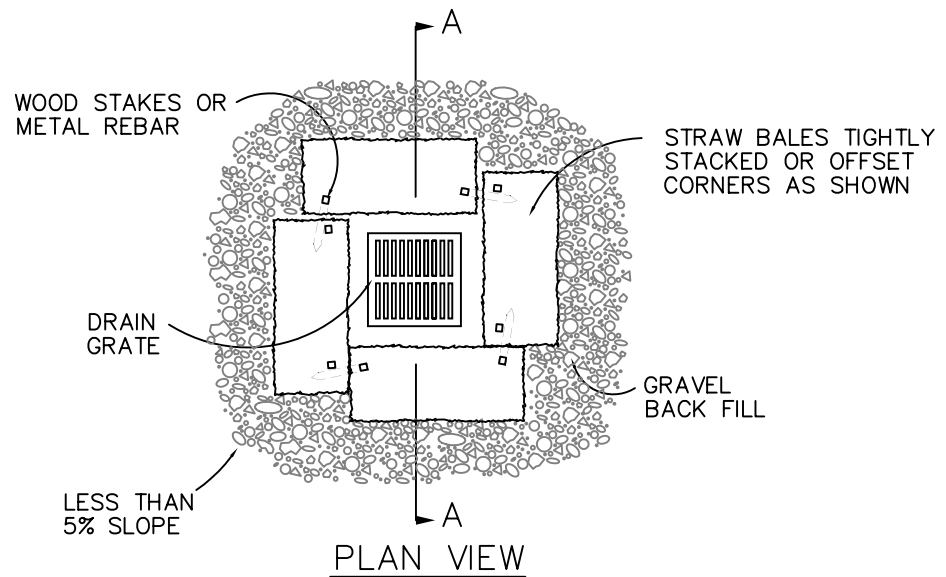
NOT TO SCALE

City of West Jordan, Utah



SILT FENCE
DROP INLET
SEDIMENT BARRIER

PLAN
5325



NOTES:

1. DROP INLET SEDIMENT BARRIERS ARE TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS. (LESS THAN 5%)
2. EMBED THE BALES 4" INTO THE SOIL AND OFFSET CORNERS OR PLACE BALES WITH ENDS TIGHTLY ABUTING. GRAVEL BACK FILL WILL PREVENT EROSION OR FLOW AROUND THE BALES.
3. THE TOP OF THE STRUCTURE (PONDING HEIGHT) MUST BE WELL BELOW THE GROUND ELEVATION DOWN SLOPE TO PREVENT RUNOFF FROM BYPASSING THE INLET. EXCAVATION OF A BASIN ADJACENT TO THE DROP INLET OR A TEMPORARY DIKE ON THE DOWN SLOPE OF THE STRUCTURE MAY BE NECESSARY.
4. ALL LOOSE STRAW DEBRIS MUST BE CLEARED UP ON A REGULAR BASIS

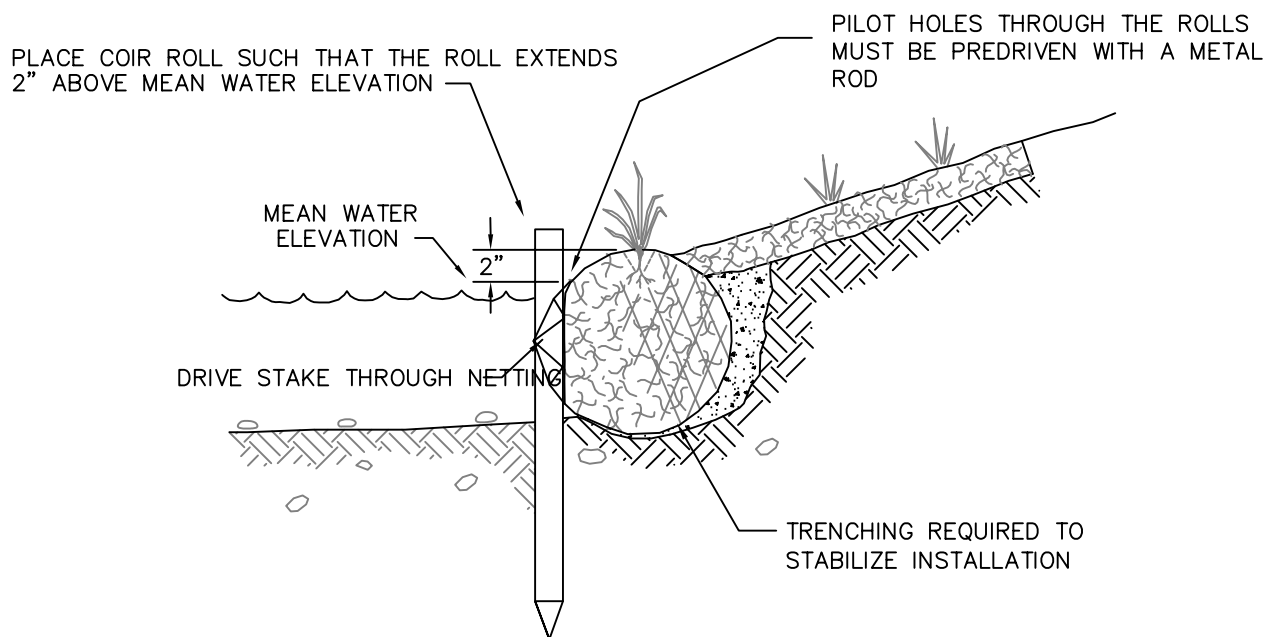
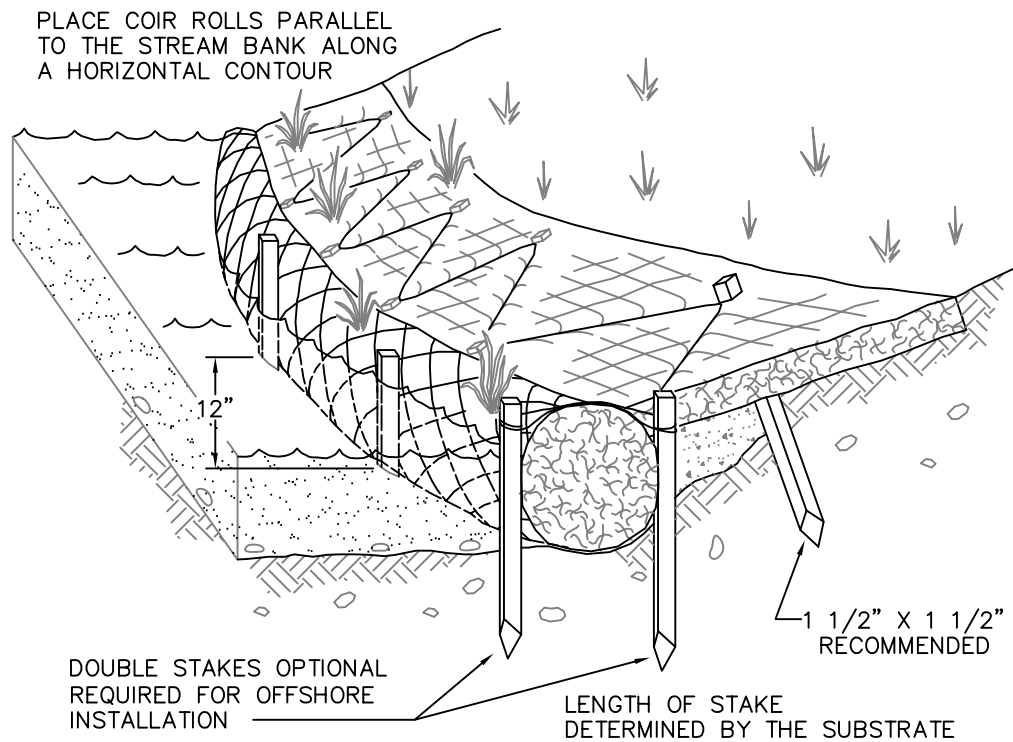
City of West Jordan, Utah



STRAW BALE/GRAVEL
DROP INLET
SEDIMENT BARRIER

PLAN

5330



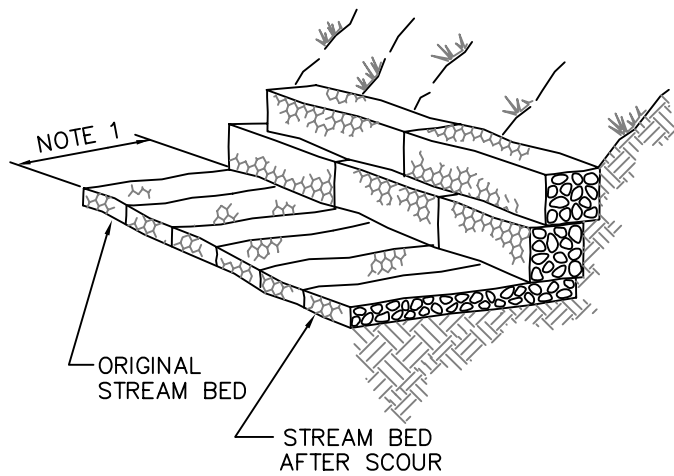
NOT TO SCALE

City of West Jordan, Utah

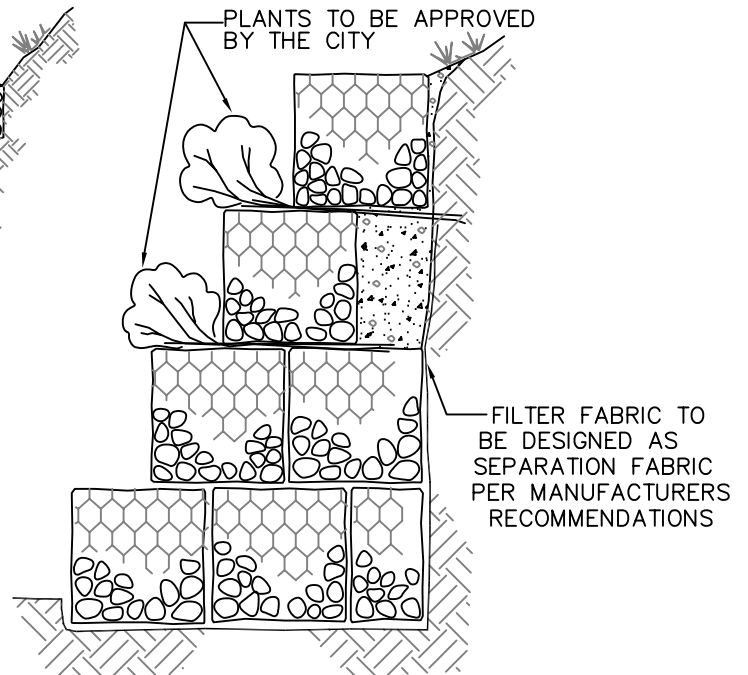


COIR ROLL/COIR MATS

PLAN
5400

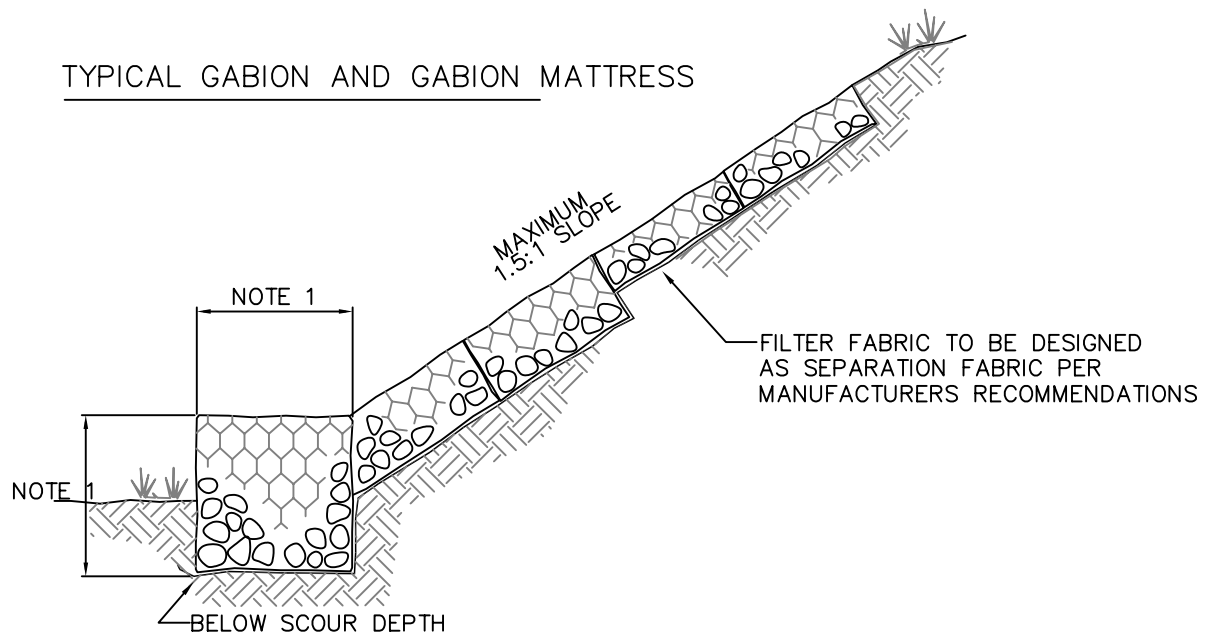


1/2 GABION CHANNEL



TYPICAL VEGETATED ROCK GABION

TYPICAL GABION AND GABION MATTRESS



NOTES:

1. TO BE DESIGNED PER H.E.C. 11
2. BASKET FASTENERS & BASKET MATERIAL TO BE APPROVED BY THE CITY

City of West Jordan, Utah



GABIONS

PLAN
5405

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SECTION 01525

TEMPORARY CONSTRUCTION AIDS AND ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish temporary utilities, including electricity, lighting, telephone service, water and sanitary facilities; temporary controls, including barriers, protection of work and water control; and construction facilities, including parking, progress cleaning and temporary building as required.

1.02 TEMPORARY UTILITIES

- A. Temporary Electricity: Contractor shall provide, maintain and pay for all power required by the Contractor, including electrical service to the field office.
- B. Temporary Lighting: Contractor shall provide all temporary lighting required for prosecution of his work and for employee and public safety. As a minimum, lighting levels during working hours shall meet the requirements of UOSHA, subsection 1926.56 illumination.
- C. Telephone Service: Contractor shall provide, maintain and pay for telephone service to the field office.
- D. Temporary Water Service
1. The Contractor shall provide for all workers on the project, an adequate and reasonably convenient, uncontaminated drinking water supply. All facilities shall comply with the regulations of the local and State Department of Health.
 2. Contractor shall be responsible to arrange for water, both potable and non-potable water.
 3. When water is taken from a City water system or any other potable water supply source for construction purposes, suitable precautions shall be taken to prevent cross connection and contamination of the water supply.
- E. Temporary Sanitary Facilities
1. Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and State Department of Health.

1.03 TEMPORARY CONTROLS

- A. Barriers: Provide barriers as necessary to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into the atmosphere. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations for dust prevention shall be strictly enforced.
- C. Protection of Work: Contractor shall protect installed work and provide special protection where specified in individual specification sections. Contractor shall provide temporary and removable protection for installed products, and shall control activity in immediate work area to minimize damage.
- D. Open Burning: No open burning or waste materials is allowed.
- E. Explosives and Blasting: The use of explosives on the work is not allowed.
- F. Noise Abatement: In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.
- G. Storm and Ground Water:
 - 1. The Contractor shall provide and maintain at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work, whether the water be surface or underground water.
 - 2. In excavation, fill and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water into private property or into streets or drainage ways inadequate for the increased flow.
 - 3. The Contractor shall maintain effective means to minimize the quantity of sediments leaving the work area either by storm water or the Contractor's own dewatering operations.

1.4 CONSTRUCTION UTILITIES

- A. Parking: Contractor shall provide temporary parking areas to accommodate use of construction personnel. Parking shall be located in an area approved by the Engineer.
- B. Progress Cleaning:
 - 1. Contractor shall maintain areas free of waste materials, debris and rubbish. He shall also maintain the site in a clean and orderly condition. Upon completion of work, repair all damage caused by equipment and leave the project free from rubbish or excess materials of any kind.
 - 2. Thoroughly clean all spilled dirt, gravel or other foreign materials caused by the construction operations from all streets and roads at the conclusion of each day's operation.
 - 3. It shall be the responsibility of the Contractor to promptly clean up and remove any oil and or fuel spills caused by the Contractor or his subcontractors during the course of the project. The Contractor shall properly dispose of contaminated soil according to local and State laws. The Contractor shall be responsible for any damages to the Owner resulting from the Contractor's actions in promptly cleaning up said spills.

1.5 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

- A. Contractor shall remove temporary above grade or buried utilities, equipment, facilities and materials prior to application for final progress payment. Clean and repair damage caused by installation or use of temporary work. Restore existing facilities used during construction to their original condition.

1.6 MEASUREMENT AND PAYMENT

- A. Temporary utilities and facilities shall not be measured or paid as a separate item but shall be included as part of the various items to which it relates.

*** END OF SECTION ***

SECTION 01554

TRAFFIC CONTROL

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. General. The work shall consist of establishing traffic control and maintaining safe, convenient use of public roads and rights-of-way.
- B. This section covers Traffic Control Plan requirements and materials and labor necessary for its implementation. It also includes issues related to Traffic Control Maintainer and flagging, work zone traffic control devices, advance warning arrow panels and pilot cars.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00555 – Prosecution and Progress.
- B. Section 00727 – Scope of Work
- C. Section 00727 – Control of Work.
- D. Section 01558 – Temporary Pavement Markings
- E. Section 02842 – Delineators.
- F. Section 02891 – Traffic Signs.
- G. Section 02765 – Pavement Marking Paint.

1.03 REFERENCES

- A. AASHTO Roadside Design Guide, current edition.
- B. Manual of Uniform Traffic Control Devices (MUTCD), current edition.
- C. ATSSA: American Traffic Safety Services Association.
 - 1. Quality Standards for Work Zone Traffic Control Devices
- D. NCHRR – Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features.
- E. OSHA Construction Industry Standards (29 CFR Part 1926), Subpart G, Signs, Signals, and Barricades.

1.04 SUBMITTALS

- A. Submit traffic control plan in accordance with the Special Conditions and UDOT State Specifications. The traffic control concept shown on the plans is for bidding purposes and is intended to serve as a guideline only. The Contractor shall be responsible for the preparation and adequacy of any traffic control plan utilized, including this suggested plan, and shall submit the final traffic control plan (prepared, signed and sealed by a Utah licensed professional engineer) in drawing form to the Engineering inspector.
- B. Submit to the Engineering inspector a detailed signing and traffic detouring plan in drawing form for each phase for approval. Post detour routes to provide clear guidance to traffic as approved by the Engineering inspector.

1.05 GENERAL

- A. Control traffic at those locations indicated and in conformance with the plans approved by the Engineering inspector.
- B. Furnish, install, construct, maintain, and remove detours, road closures, lights, temporary signals, signs, barricades, K-rail, fences, flares, miscellaneous traffic devices, flagmen, drainage facilities, paving, and such other items and services as are necessary to adequately safeguard the public from hazard and inconvenience. All such work shall comply with the ordinances, directives, and regulations of authorities with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor.
- C. After devices have been installed, maintain and keep them in good repair and working order until no longer required. Replace such devices that are lost or damaged, to such an extent as to require replacement, regardless of the cause of such loss or damage.
- D. Prior to the start of construction operations, notify the Engineering inspector, South Jordan City, UDOT, police and fire departments in whose jurisdiction the project lies, giving the expected starting date, completion date, and the name and telephone number of a responsible person who may be contacted at any hour in the event of a condition requiring immediate correction.

1.06 TRAFFIC CONTROL DEVICES AND SIGNS

- A. Construction signing, striping, barricades, and other traffic control devices used for handling traffic and public convenience shall conform to the latest edition of the Federal Highway Administration "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD).
- B. Signs shall be reflectorized when they are used during hours of darkness. Provide cones, pylons, barricades, or posts used in the diversion of traffic with flashers or other illumination if in place during hours of darkness.
- C. Maintain a 24-hour emergency service to remove, install, relocate, and maintain warning devices and furnish to the authority having jurisdiction names and telephone numbers of three persons responsible for this emergency service. In the event these persons do not promptly respond or the authority having jurisdiction deems it necessary to call out other forces to accomplish emergency service, the Contractor will be held responsible for the cost of such emergency service.
- D. During the duration of a detour, cover all signs not in accordance with the traffic control plan. Relocate existing signs to provide visibility from all relocated traffic lanes.
- E. Temporary traffic striping, where used, shall be removable pavement marking tape. Pavement markings shall be white or yellow, weather and traffic resistant reflective film on conformable backing and pre-coated with a pressure-sensitive adhesive that does not require an activation process.

Temporary pavement markings shall conform to the following minimum reflective values as specified. Express reflective values as candlepower per foot-candle per square foot measured on a 1 foot by 2 foot panel at 86 degrees incidence.

Divergence Angle	White	Yellow
0.20	0.20	0.18
0.50	0.18	0.16

Supply striping tape in rolls ready for application. Use pavement message tape 20 to 30 mils thick, that does not shrink or release prematurely, and that has an easily removable liner.

- F. At the end of each workday, place temporary pavement markers on any roadway surfaces open to traffic. Apply pavement markers to a clean and dry surface during daylight hours. During winter shutdown, place permanent paint striping and pavement messages.
- G. Press the tape into the surface until it adheres to the pavement surface.

1.07 VEHICULAR TRAFFIC CONTROL

- A. Reduce speed limit through the construction zone to 25 mph and post accordingly.
- B. Traffic lane transitions from permanent lanes to construction zone patterns shall be transitioned in accordance with the requirements for the normal posted speed limit and as shown on the plans.
- C. Where traffic is directed around or adjacent to the construction area, the contractor shall provide, lights, signs, and other devices required for the control of traffic as required by the UDOT traffic regulations and said "Manual of Uniform Traffic Control Devices." The engineering inspector shall have the right to relocate or direct the Contractor to relocate traffic control devices.
- D. In the event the Engineering inspector finds the worksite to be improperly barricaded or delineated and the Contractor is either unavailable or unresponsive to requests for improvement, the Engineering inspector will furnish and set up barricades and delineators as required. Two hundred dollars (\$200) will be charged the Contractor for each set-up event plus five dollars (\$5) "rental" for each barricade or delineator for each day's or partial day's use until such barricades or delineators are returned in good condition by Contractor or the Owner's yard.
- E. All roadways and sidewalks shall be returned to unrestricted vehicle and pedestrian usage when construction is not underway.
- F. Truck operations in and out of construction and staging areas shall be controlled by flagmen at all times.
- G. The maximum delay to the public due to Contractor construction activities is four hours.
- H. Construction in Intersections: Maintain at least one through lane in each direction on the following intersecting streets during working hours while constructing within the intersection
- I. Detour Routing: Notify the Engineering inspector at least 2 calendar days in advance and complete coordination prior to the detouring of traffic along the affected streets.

1.08 ACCESS TO ADJACENT PROPERTIES

- A. General: Maintain reasonable access from the project to all adjacent properties at all times during construction. Prior to restricting normal access from public streets to adjacent properties, notify each property owner or responsible person, at least three working days prior to the disruption, informing him of the nature of the access restriction, the approximate duration of the restriction, and the best alternative access route for that particular property.

1.09 BIDDING REQUIREMENTS

- A. The apparent low bidder will:
1. Submit three copies of the Traffic Control Plan to the Engineer no later than the fourth Wednesday following the bid opening. Submit plans in 11x17 format prepared using AutoCAD software. All plans must be signed and sealed by a professional engineer licensed in the State of Utah. When available, the City will provide basemap CAD files to the Contractor on a CD-ROM at no cost.
 2. Attend a mandatory meeting at the time and location as directed by the Engineer with City staff and the following:
 - a. Contractor's traffic control designer
 - b. Contractor's traffic control maintainer
 - c. Resident engineer
 - d. City's Traffic Engineer or designated representative
 3. Ensure compliance with the plans and specifications. Modify plan if necessary to meet all applicable requirements.
 4. The City will grant no additional contract time for preparing or modifying the Traffic Control Plan.
 5. Do not begin work. Do not implement traffic control until written authorization is received from the Engineer.

1.10 CERTIFICATIONS

- A. After April 1, 2002, use devices and systems which meet NCHRP-350 Report crash test requirements as defined in the four categories by the Federal Highway Administration. Some exceptions will be acceptable as stated below.
1. Category 1: Cones, tubular marker, delineators, and drums without lights must be certified by the manufacturer as meeting NCHRP-350 Report requirements.
 2. Category 2: portable sign stands with signs, Type I, II, and III barricades, vertical panels, Category 1 devices with light attachments and devices not expected to cause significant vehicle velocity change. These devices and systems must be certified by FHWA as meeting NCHRP-350 Report test requirements.
 3. Category 3: Portable/temporary precast concrete barrier manufactured after October 1, 2002 must be certified as meeting NCHRP-350 Report test requirements.
 - a. Manufactured date to be stamped into top of each barrier section using a numeric format (ex: 10/2002) with 75 mm x 50 mm numerals, 6 mm deep).
 - b. Portable/temporary precast concrete barrier manufactured prior to October 1, 2002 and meeting NCHRP-230 may be used until they are no longer serviceable.
 4. Category 3: Crash cushions and truck mounted attenuators must be certified by FHWA as meeting NCHRP-350 Report test requirements

- a. The appropriate GREAT CZ, manufactured by Energy Absorption Systems, may be used until they have completed their normal service life.
5. Category 4: Advanced warning arrow panels and portable variable message signs do not have to meet NCHRP-350 Report test requirements.

1.11 TRAFFIC CONTROL PLAN REQUIREMENTS

A. Traffic Control Plan (TCP) Checklist and Guidelines – In preparing the Traffic Control Plan, the design professional will need to address the following items:

1. The Traffic Control Plan (TCP) shall be drawn on 24" x 36" or 11" x 17" sheets, unless otherwise approved by the City's Project Manager. TCPs prepared for work occurring on all streets shown on the Circulation Element of the General Plan shall be prepared by a Registered Civil Engineer or Registered Traffic Engineer.
2. Draw the TCP with ink using legible lettering and symbols.
3. Indicate contractor's name, address and telephone number. Include name and telephone number of the 24-hour contact person presenting the Contractor.
4. Indicate a north arrow and scale on the drawings. If the drawing is NOT-TO-SCALE (N.T.S.), indicate so on the drawing.
5. Show all nearby streets with street names to assure proper orientation.
6. Show existing traffic signals and regulatory signs, as appropriate.
7. Show existing striping, pavement markings, painted crosswalks and bike lanes.
8. Show existing curbs, gutters, sidewalks, driveways and intersections in the construction work zone including areas affected by taper transition.
9. Indicate total roadway widths. Dimension existing striping from edges of pavement.
10. Indicate posted speed limits.
11. Show location and dimensions of the construction work zone.
12. Show staging areas and materials storage area, as appropriate.
13. Indicate locations of construction signs, barricades, and delineators.
14. Label all taper lengths and widths, delineator spacing and sign spacing.
15. Use a legend to define all symbols and designate them with UDOT nomenclature.
16. Show all parking restriction zones and signs, as appropriate.
17. Road closures will require approval from the City Engineering and the City Council.
18. Signs and barricades will be required to direct pedestrians through or around the construction work zone and shall be shown on the TCP.
19. Indicate the encroachment permit number or improvement plans number on the traffic control plan.
20. Indicate on the plan the duration of the construction work and subsequent traffic control

B. Traffic Control Plan General Notes – The following notes need to be attached to and adhered to in preparing and implementing the Traffic Control Plan.

1. All traffic control devices shall conform to the latest edition of the UDOT's Traffic Manual of Traffic Control Devices for Construction and Maintenance Work Zones and the Standard Specifications for Public Works Construction.
2. The City Engineer or his representative has the authority to initiate field changes to assure public safety.
3. All traffic control devices shall be removed from view when not in use.
4. Work hours shall be restricted to between 7:00 a.m. and 10:00 p.m. unless otherwise approved.
5. Trenches must be back filled or plated during non-working hours.

6. Pedestrian controls shall be provided as shown on the plans.
 7. Temporary "NO PARKING" signs will be posted 24-hours prior to commencing work.
 8. Access to driveways will be maintained at all times unless other arrangements are made.
 9. The Contractor shall replace all traffic signal loop detectors damaged during construction within 72-hours of them being damaged.
 10. All striping removed or damaged, will be replaced by the Contractor within 24-hours (or replaced with temporary tape).
 11. All Workers shall be equipped with an orange vest (or a reflective vest at night). All flaggers shall also be equipped with a hard hat, C28 "Stop/Slow" paddle, shall be trained in the property fundamentals of flagging traffic, and be certified as indicated in this section
 12. Any work that disturbs normal traffic signal operations shall be coordinated with the City of West Jordan's Traffic Engineer, 48-hours prior to beginning construction.
 13. The Contractor shall maintain all traffic control devices 24-hours per day and 7-days per week.
 14. A minimum of twelve (12) foot travel lanes must be maintained unless otherwise approved by the Engineering Department.
 15. All night work will require written approval from the Engineering Department. Lane closures, road detours, road closures, and traffic signal modifications associated with overnight construction activities will require warning signs be placed at least one week in advance of starting construction
 16. A solar powered flashing arrow board shall be required on all arterial street land closures.
- C. Design the traffic control plan resolving discrepancies between the various standards for traffic control in accordance with Section 00727 – Control of Work paragraph 1.5.B and the following:
1. UDOT Standard Traffic Control Drawings 745-2 Series. UDOT Standards Drawing 745-60, 745-60A, 745-60B, and 745-60D for post mounted signs.
 2. Manual of Uniform Traffic Control Devices (MUTCD), latest edition.
- D. Follow the requirements and limitations identified in the Traffic Control Special Provision (if included), Section 00555, Prosecution and Progress, paragraph 1.11. Limitation of Operations, Section 00725, Scope of Work, paragraphs associated with the maintaining of traffic and Section 00820 – Legal Relations and Responsibility to Public, paragraph 1.10 "Public Convenience and Safety – Traffic and Pedestrians".
- E. Consider the safe and efficient movement of traffic when land closures are proposed.
1. Open lanes to traffic wherever and whenever practical.
 2. Minimize and restrict land closures to the locations and times essential for prosecution of work.
- F. Provide for concrete barriers and attenuation to satisfy hazard mitigation according to UDOT Standard Drawing 745-2 Detail AA, and 745-2E Detail E-1.
- G. Provide for delineation and temporary pavement markings and/or removal as needed for traffic control or as required in accordance with this section, paragraph 1.6, lines H and I.
- H. Provide protection for all hazards (i.e.: bridge parapets, barrier blunt ends, poles, large equipment to include but not limited to cranes, pile drivers, etc.) when hazard is within AASHTO clear zone requirements for approach traffic.

- I. Use the following format and provide the following documentation:
1. Section I: Description of each phase
 - a. List phases, and corresponding bid items and elements of work to be accomplished in each phase.
 - b. Accounting for each contract bid item and element of work, reference the traffic control detail designed to provide for the safe and efficient movement of traffic and safety of workers.
 - c. All contract bid items and elements of work must be identified and included in the phasing.
 2. Section II: CAD generated drawings showing detailed Traffic Control Plan for each phase:
 - a. Adapt Standard Drawings and work zone traffic control examples contained in the MUTCD to reflect actual project conditions such as curves, grades, presence of ramps, intersections and accesses.
 - b. Use basemap CAD files when supplied by the City as a basis for the Traffic Control Plan drawings.
 - c. Use the same level of detail as in the MUTCD and UDOT Standard Traffic Control Drawings.
 - d. Include the anticipated duration of the traffic control setup used in each phase.
 - e. Provide for the safe passage of pedestrians and bicyclists through the work zone in accordance with the Americans with Disabilities Act and the MUTCD.
 - f. Indicate clearly, the following:
 - i. Proposed regulatory speed reductions in accordance with this Section, paragraph 3.6.
 - ii. For all tapers; length of taper, device spacing, land or shoulder closures, amount of land shift in accordance with this Section, paragraph 3.3.A.
 - iii. Length of buffer zone, in accordance with this Section, paragraph 3.3.A.
 - iv. Device spacing used in tangents in accordance with this Section, paragraph 3.3.B.
 - v. Lengths of work zones, land and shoulder widths and area available for vehicle recovery.
 - vi. Proposed changes to be made to existing traffic signals including: timing changes, phase changes, etc.
 - vii. Sign locations for required and existing signs.
 - viii. Existing signs that are to be removed, covered, relocated or otherwise changed from the original configuration.
 - ix. Worker parking, work vehicle and equipment access to and from work area, staging and material sites.
 3. Section III: Emergency and Special Situations
 - a. Identify procedures for dealing with emergencies and special situations.
- J. Provide temporary pavement markings on newly constructed asphalt pavement and refresh as needed until the final surfacing is placed in accordance with Section 01558: Temporary Pavement Markings, as directed by the Engineer.
- K. Completely remove all existing traffic marking that conflict with the Traffic Control Plan, in accordance with Section 02765. Do not use paint or other material to cover markings.

1.12 TRAFFIC CONTROL MAINTAINER

- A. Certified by the City or by the American Traffic Safety Services Association (ATSSA) as a Traffic Control Technician. Certifications are available through:

1. Associated General Contractors
1135 South West Temple
Salt Lake City, Utah
Telephone: (801) 363-2753
2. American Traffic Safety Services Association (ATSSA)
15 Riverside Parkway, Suite 100
Fredericksburg, Virginia 22406-1022
Telephone: (800) 272-8772
Internet: www.atssa.com

B. Authority:

1. Obtains and uses all labor, equipment, and materials necessary to maintain traffic control.
2. Changes traffic control operations per the traffic control plan.

C. Responsibility and Duties:

1. Oversees all traffic control operations.
2. Implement the Traffic Control Plan.
3. Remains available 24-hours a day, 7-days a week and can be on-site within 30-minutes of notification.
4. Corrects deficiencies immediately upon verbal or written notification from the Engineer or representative.
5. Inspect and document inspections of traffic control on a from acceptable to the Engineer at least four times each day as follows:
 - a. Before beginning of shift.
 - b. At mid-shift.
 - c. Half-hour after evening shift ends.
 - d. At the midpoint of the off-shift period.
6. Coordinates project traffic control with emergency services and local law enforcement agencies.
7. Inspect and document inspections of traffic control twice each day when no construction work is being done.
 - a. One during light hours and one during nighttime hours.
 - b. Conduct inspections a minimum of 8-hours apart.
8. Completes a daily record of traffic control activities using a form acceptable to the Engineer.
9. Submit to the Engineer, inspection and activities forms each week on a day and time acceptable to the Engineer.
10. Provide a daily report of all planned traffic control activities to the Engineer by 7:00 AM each day. Provide the report each day during the contract.

1.13 TRAFFIC AND ACCESS

- A. The Contractor's operations shall not cause unnecessary inconvenience to the public. The public right-of-way shall be maintained at all times unless the City authorizes interruption. The Contractor's desire to close and/or detour traffic is to be authorized through the preparation of the required plans, which will then be approved by the City's Traffic Engineer or authorized representative.

- B. Safe and adequate access shall be provided and maintained to all public protection devices and to all critical utility locations. Facility access shall be continuous and unobstructed unless otherwise approved by the City's Traffic Engineer.

1.14 STORAGE OF EQUIPMENT AND MATERIALS IN PUBLIC STREETS AND RIGHTS-OF-WAY

- A. Construction materials and equipment shall not be stored or parked on public streets, roads, or highways. During any material or equipment loading and/or unloading activities that may temporarily interfere with traffic, acceptable detour(s) will be provided for the duration of the activity. Any associated expense for this activity will be the responsibility of the Contractor.
- B. Excavated material, including suitable material that is intended for adjacent trench backfills or other earth backfill as specified in Section 5 of this specification, shall not be stored in the public streets, roads, or highways that remain in service for the public. Any waiver of this requirement must be obtained from the proper local authority and approved by the Engineer. All excess and unsuitable material shall be removed from the site as soon as possible. Any spillage shall be removed from roadways prior to use by the public.

1.15 STREET CLOSURES, DETOURS, AND BARRICADES

- A. The Contractor shall comply with the requirements of all applicable responsible units of government for closure of any street, road, or highway. The Contractor shall provide the required barriers, guards, lights, signs, temporary bridges, and flaggers together with informing the public of any detours and construction hazards by the most suitable means available such as local newspapers, local radio stations, etc. The Contractor shall also be responsible for compliance with additional public safety requirements that may arise during construction. The Contractor shall furnish and install, and upon completion of the work, promptly remove all signs, warning devices, and other materials used in the performance of this work.
- B. Unless otherwise specified, not less than seven (7) days prior to closing, or partially closing, or reopening any street, road, or highway, the Contractor shall notify in writing, the Fire Chief, Police Chief, County Sheriff, State Highway Patrol, schools that operated school buses, or any other government official as may be appropriate.
- C. Unless otherwise specified, the Contractor shall furnish to the Engineer a written plan showing the proposed method of signing, barricading for traffic control, and safety for the street detours and closures.
- D. All temporary detours will be maintained to ensure use of public rights-of-way is provided in a safe manner. This may include dust control, grading, graveling, etc., as required by the City's project manager and this specification.

1.16 MAINTENANCE OF WORK ZONE TRAFFIC CONTROL

- A. Implement and maintain traffic control per the Traffic Control Plan. Implement changes to traffic control required in order to meet UDOT Standard Specifications. Drawings and MUTCD at no additional cost to the City. Coordinate changes to traffic control and the Traffic Control Plan with

the Engineer prior to implementation.

- B. Meet all requirements of this Section, paragraph 1.7 when traffic control devices are required to be in place overnight or on weekends.
- C. Meet the acceptable classification as identified by *Quality Standards for Work Zone Traffic Control Devices* published by American Traffic Safety Services Association (ATSSA) for traffic control devices.
 - 1. Wash devices weekly unless conditions warrant more frequent cleaning.
- D. Maintain traffic control devices during and after all snow plowing operations at no additional cost to the City. Clear snow away from all traffic control devices so that the devices function as intended.

1.17 WAGE RATES FOR TRAFFIC CONTROL PERSONNEL (Federal Aid Jobs Only)

- A. Payment of wages must be as stated below during the time the certified Traffic Control Maintainer, or others involved in setting up or maintaining traffic control devices working under the direction of the certified Traffic Control Maintainer, is on the project site and does any of the following work:
 - 1. Laborer I – for moving traffic control devices by hand: loading or unloading devices on to or off of the truck: and for all hours required to be at the project site except those hours spent in the truck driver classification.
 - 2. Truck Driver – for all hours spent driving on the project site in the performance of the duties required to maintain the traffic control. The rate of pay is determined by the size of vehicle being driven. Pickup Truck being the smallest.

1.18 MEASUREMENT AND PAYMENT

- A. For items of work for which specific lump sum prices are established in the contract, payment for the work will be made at the contract lump sum price. Progress payments will be made based upon the percentage of estimated total time that traffic control will be required unless otherwise specified in Section 7 of this specification. Payment will constitute full compensation for all flaggers, labor, materials, equipment and all other items necessary and incidental to completion of the work.
- B. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 7 of this specification.
- C. Partial Payments – Based on the percentage of the project completed, excluding the cost of traffic control.
- D. Price Adjustments:
 - 1. The City reduces payment when traffic control is not in compliance with the Traffic Control Plan, or when the contractor fails to meet all requirements cited or referenced in this specification.
 - a. The amount per day by which the Contractor's compensation will be reduced is calculated using the daily charge for Calendar Day in the Schedule of Liquidated Damages in Table 1 of Section 00555 or the Contract lump sum bid price for Traffic Control divided by the number of contract days, whichever is greater.
 - 2. A Stop Work Order issued due to non-compliance with this specification is not considered to be

an authorized suspension of contract time. Contract time will continue to accrue as defined in Section 00555, paragraph 1.14 – “Determining Contract Time”.

- E. Include in the bid item “Traffic Control” all materials, equipment, labor, flagging, pilot car, temporary pavement markings and/or removal and workmanship required for the design, implementation and maintenance of the Traffic Control Plan.
- F. Provide the Engineer in writing with a detailed analysis showing impacts to traffic control caused by extra work that necessitates modifications to the Traffic Control Plan. Negotiate and agree to either a lump sum price for additional Traffic Control or agree to unit prices to be used for additional traffic control measures or devices required, prior to performing the extra work.

PART 2 -- PRODUCTS

2.01 PILOT CAR

- A. Equip with a reflectorized sign:
 - 1. Comply with Section 02891: Traffic Signs.
 - 2. MUTCD sign G20-4
- B. Equip with a minimum two rotating lights or strobe lights.
 - 1. Minimum 100-mm diameter and minimum 1830 mm mounting height
 - 2. Yellow color

2.02 FLAGGER EQUIPMENT AND CLOTHING

- A. Comply with UDOT’s “Flagger Training Handbook”.
- B. Comply with Standard Drawings 745-1.
- C. Clothing:
 - 1. Flagger vest and hard hat: Orange, red-orange, or fluorescent version of these colors with:
 - a. Minimum 83870 mm² each on the front and back of strong yellow-green reflective tape, or
 - b. Minimum of 41935 mm² each on the front and back of strong yellow-green non-reflective tape, with 41935 mm² white reflective tape placed on both sides of the non-reflective tape on the front and back.
 - c. Orange or fluorescent orange hardhat with 6450 mm² of white or strong yellow-green reflective tape placed around the base of the hard hat and visible to traffic.

2.03 TRAFFIC CONTROL SIGNING AND DEVICES

- A. Signs:
 - 1. Comply with paragraph 1.5.
 - 2. Comply with Section 02891 – Traffic Signs.
 - 3. Comply with Standard Drawing 745-1.
 - 4. Comply with Standard Drawings 745-60, 745-60A, 745-60B, and 745-60D when using post mounted signs.

B. Channelizing Devices:

1. Comply with paragraph 1.5.
2. Comply with Standard Drawing 745-1.
 - a. Comply with Section 02891, paragraph 2.1.E. – Reflective Sheeting.
 - b. Use construction orange tubular markers and cone during daylight hours only.

C. Precast Concrete Barrier:

1. Comply with paragraph 1.5.
2. Comply with UDOT Standard Drawings 745-2, Detail AA, and 745-2E, Detail E-1.
3. Use an approved construction zone attenuator or permanent style end sections, as listed in UDOT Guidelines for Attenuators and End Section.
 - a. Use a construction zone attenuator when approach ends of temporary precast barrier are within AASHTO clear zone.
 - i. Use AASHTO Roadside Design Guide to determine proper clear zone distance requirements.
 - ii. Install attenuators or end sections as per UDOT Standard Drawings 735-1 series and manufacturers recommendations.
4. Do not use a truck-mounted attenuator (TMA) to protect temporary precast barrier end for more than 24-hours. Use properly rated TMA as directed in this Section, paragraph 2.3.D.

D. Use properly rated truck-mounted attenuator for the posted speed limit prior to construction.

1. NCHRP-350 Test Level 2 for speeds 45 mph or less.
2. NCHRP-350 Test Level 3 for speeds greater than 45 mph.

2.04 ADVANCE WARNING ARROW PANEL

A. Advance Warning Device:

1. Meet all standards as specified in the MUTCD, Section 6F.53 – Arrow Panels.
2. Perform all functions as specified in UDOT Standard Drawing 745-1 and the MUTCD.

PART 3 -- EXECUTION

3.01 MODIFICATION OF TRAFFIC CONTROL PLANS

- A.** Each phase of construction must use an authorized Traffic Control Plan. If a construction phase is proposed that is not covered by the Traffic Control Plan, submit a proposed plan to the Engineer for review.
1. Submit proposed plans to the Engineer 10 working days before the Traffic Control Plan is to be implemented.
 2. Do not begin work until the new Traffic Control Plan is authorized for use and has been fully implemented.
 3. Implement changes required to meet UDOT Standard Specifications, Standard Drawings and MUTCD at no additional cost to the City.
 - a. Comply with this Section, paragraph 1.4.A.1.

3.02 FLAGGING

- A. Flaggers must have a current flagging certificate and must present proof of certification upon request by the City.
 - 1. Acceptable certifications
 - a. UDOT Contractor Certification (Utah Valley State College).
 - b. American Traffic Safety Service Association (ATSSA).

3.03 TRAFFIC CONTROL SIGNING AND DEVICES

- A. Use posted speed limit prior to construction to compute sign spacing, taper lengths, buffer zones and construction clear zone.
 - 1. Use plastic drums for land closure taper devices for speeds 50 mph and greater.
 - 2. Do not use cone or tubular markers at night.
- B. Use posted speed during construction to compute the tangent spacing for channelizing devices.
- C. Remove all traffic control from site of work when not required within 24-hours.
 - 1. Remove traffic control devices from the roadway a distance twice that of the Construction Clear Zone (Table 1 – Standard Drawing TC 2A) if they will be used within 24-hours of the daily work stoppage and are not required for immediate traffic control.
 - a. Obtain written permission from property owner prior to storing traffic control devices on private property.
 - 2. Cover post mounted signs when directed by Engineer.
 - a. Cover signs completely with an opaque and durable covering.

3.04 ADVANCE WARNING ARROW PANEL

- A. May substitute Type C units for Type B units.
 - 1. Comply with UDOT Standard Drawing 745-1.
- B. Do not substitute Type B units for Type C units.
- C. Remove Advance Warning Arrow Panel from the site of work when not needed for the control of traffic within a 4-hour period.

3.05 TRAFFIC SIGNALS

- A. Use uniformed police officers when construction activities are impacting an operating signalized intersection.
- B. Use of flaggers at traffic signals is permitted when the signals have been turned to red flash mode.
 - 1. Each approach is to be controlled by a separate flagger(s).
 - a. Flaggers can control only two lanes of approach traffic.
 - i. Third land control permitted when left or right turn bays are present.
- C. Changes to traffic signal operations will be done by the City.

3.06 CONSTRUCTION ZONE SPEED LIMIT REQUIREMENTS

- A. Obtain approval from the Engineer for regulatory speed reductions.
 - 1. See Standard Drawing 745-2, General Note 9.
 - 2. Use speed reduction only when construction activities impact traffic.
 - 3. Restore regulatory speed limit at locations where construction activities are not impacting traffic.
 - 4. See Standard Drawing 745-60, 745-60A, 745-60B, 745-60D for post-mounted sign requirements.

*** END OF SECTION ***

SECTION 02112

CLEARING, GRUBBING, AND STRIPPING

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This section describes the work included in clearing, grubbing, stripping and preparing the project site for construction operations.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02200 - Earthwork
- B. Section 02222 - Protecting Existing Underground Utilities
- C. Section 02223 - Trenching, Backfilling and Compacting
- D. Section 02900 - Revegetation Plan
- E. State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste, Solid Waste Permitting and Management Rules, R315-301 Through 320

1.03 CLEARING

- A. Remove and dispose of only those trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth not shown to be protected which are necessary for construction of the project. Remove all evidence of their presence from the surface including sticks and branches greater than 1-inch in diameter or thickness. Remove and dispose of trash piles, and rubbish, and fencing. Protect structures and piping above and belowground, trees, shrubs, and vegetative growth and fencing which are not designated for removal.
- B. Preserve and protect the existing vegetation not required, or otherwise authorized, to be removed. Vegetation specifically shown on the drawings to be protected shall be protected from damage or injury caused by Contractor's construction operations, personnel, or equipment by the use of protective barriers or other methods approved by the Engineering inspector. Removal of existing vegetation within the designated R/W not specially required to be removed will require approval of the Engineering inspector.
- C. Trees shall not be used for anchorages. If tree climbing is necessary, safety ropes shall be used, and the use of climbing spurs will not be permitted.
- D. The Contractor shall be responsible for injuries to vegetation caused by Contractor's operations, personnel, or equipment. The term "injury" shall include, without exceptions, bruising, scarring, treating, and breaking of roots, trunks, or branches. Injured vegetation shall be repaired or treated without delay. Repairs or treatment shall be as recommended by and under the direction of, an experienced horticulturist or licensed tree surgeon provided by the Contractor and approved by the Engineering inspector. If vegetation cannot be treated or repaired, the Contractor will be responsible for replacing the damaged vegetation. The Engineering inspector must approve replacement vegetation. No noxious or non-native vegetation shall be planted or introduced into the construction areas.

1.04 GRUBBING

- A. After clearing, remove and dispose of wood or root matter, including stumps, trunks, roots, or root systems greater than 1-inch in diameter or thickness to a depth of 12-inches below the ground surface. Options available for disposal include burning (with appropriate permits and approvals), gathering and hauling material to an approved disposal site, or chipping and shredding the material according to City standards and mixing it with the topsoil. Further discussions of this item are included in the Land Disturbance Design and Construction Standards, Section 2.2.

1.05 TOPSOIL

- A. Existing soil material containing sod, grass, or other vegetation and topsoil shall be removed to the existing topsoil depth or 12-inches, whichever is less, from all construction areas except existing pavement and slopes steeper than 1:1.
1. Strip, segregate, and stockpile existing topsoil from the following areas:
 - a. Wetland areas
 - b. Pipeline excavations and stockpile areas
 - c. Road excavations
 - d. All staging, service, and storage areas
 2. Stripping shall be to the existing topsoil depth or 12-inches, whichever is less. All suitable topsoil materials, which are stripped, shall be used in accordance with the contract documents and may be placed directly or else shall be stockpiled in areas designated by the Engineering inspector. Topsoil stripped from wetland areas and areas known to be occupied by endangered plant species will be stockpiled in separate areas designated by the Engineering inspector and will be respread in the wetland and habitat areas from which they were removed to the depth of 12-inches.
 3. Topsoil that has been stripped shall be placed at an approximate thickness of 6-inches or as directed by the Engineering inspector, on all other areas which have been excavated or otherwise disturbed by construction activities except slopes greater than 1:1 unless otherwise instructed by the Engineering inspector. Areas to receive topsoil are as follows:
 - a. Roadway excavation and embankment slopes
 - b. Pipeline alignment
 - c. Disturbed areas within staging, service and storage areas
 - d. Other areas as directed by the Engineering inspector
 - e. Disturbed Ute ladies-tresses habitat and wetlands areas shall receive topsoil removed from the original habitat, as described in 1.05.B.2 above.
 4. Topsoil, which cannot be placed directly in the final location, shall be stockpiled temporarily in designated areas and later placed in the final location as directed by the Engineering inspector. The area over which topsoil is to be placed shall be clean of debris. The surface shall generally conform to smooth lines, slopes, and grades so that adequate control of thickness of topsoil placed can be maintained.

PART 2 -- PRODUCTS

2.01 TREES AND SHRUBBERY

- A. Existing trees, shrubbery, and other vegetative material may not be shown in the Contract

Documents. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve in place, trees that are specifically shown in the drawings and designated to be preserved.

2.02 PRESERVATION OF TREES, SHRUBS, AND OTHER PLANT MATERIAL

- A. Save and protect plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.
- B. When trees are close together, restrict entry to area within drip line by fencing. In areas where no fence is erected, protect the trunks of trees 2 inches or greater in diameter by encircling the trunk entirely with boards held securely by 12-gage wire and staples. This protection shall extend from ground level to a height of 6 feet. Cut and remove three branches where those required to affect the work to provide balanced appearances of any tree. Treat cuts with a tree sealant.

PART 3 -- EXECUTION

3.01 CLEARING AND GRUBBING LIMITS

- A. Prior to actual, in-the-field clearing and grubbing efforts, the Contractor shall have a licensed land surveyor survey the clearing and grubbing limits for the project and mark the limits clearly. Once the surveying has been completed, the Contractor shall then install the silt fence prior to the main effort of clearing and grubbing the project. Clear and grub excavation and embankment areas associated with new structures, slabs, and roadways. Do not intrude into those areas designated as habitat for endangered plant species.

3.02 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

- A. Remove cleared and grubbed material from the worksite and dispose of in accordance with these design and construction standards, local laws, codes, and ordinances.

3.03 AREAS TO BE STRIPPED

- A. Strip excavation and embankment areas associated with the project, new structures, slabs, walks, and roadways. Strip stockpile areas.

*** END OF SECTION ***

SECTION 02200

EARTHWORK

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The work of this Section includes all earthwork required for construction of the Work. Such earthwork shall include, but not be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work specified in the Contract Documents, which shall include, but not be limited to, the furnishing, placing, and removing of sheeting and bracing necessary to safely support the sides of all excavation; all pumping, ditching, draining, and other required measures for the removal or exclusion of water from excavation; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork, all in accordance with the requirements of the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

- A. The Contractor's attention is directed to the provisions for "Shoring and Bracing Contract Documents" in Section 6705 of the Utah Labor Code. The Contractor, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the Owner and shall be in receipt of the Owner's written acceptance of the Contractor's detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system standards established in the Construction Safety Orders of the State of Utah, such alternative systems plans shall be prepared by a civil or structural engineer licensed in the State of Utah.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the Contract Documents, all work specified herein shall conform to or exceed the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.

1. Commercial Standards:

ASTM D 422-63(1972)

ASTM D 698-78

ASTM D 1140-54(1971)

ASTM D 1556-82

ASTM D 1663-84

Method for Particle-Size Analysis of Soils.

Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5lb (2.49kg) Rammer and 12-in (304.8 mm) Drop.

Test Method for Amount of Material in Soils Finer than the No. 200 (75 mm) Sieve.

Test Method for Density of Soil in Place by the Sand Cone Method.

Test Method for Compressive Strength of Molded

ASTM D 2419-74(1979)	Soil-Cement Cylinders. Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
ASTM D 2487-83	Classification of Soils for Engineering Purposes.
ASTM D 2901-82	Test Method of Cement Content of Freshly-mixed Soil Cement.
ASTM D 2922-81	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 4318-84	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 QUALITY ASSURANCE

- A. General: All soils testing will be done by a testing laboratory of the Owner's choice at the Contractor's expense.
- B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D 698. Field density in-place tests will be performed in accordance with ASTM D 1556, ASTM D 2922, or by such other means acceptable to the Engineer.
- C. In case the tests of the fill or backfill show non-compliance with the required density, the Contractor shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the Owner and shall be at the Contractor's expense.
- D. Particle size analysis of soils and aggregates will be performed using ASTM D 422.
- E. Determination of sand equivalent value will be performed using ASTM D 2419.
- F. Unified Soil Classification System: References in these specifications to soil classification types and standards set forth in ASTM D 2487 shall have to meanings and definitions indicated in the chart illustrated at the end of this Section. The chart is reproduced herein for the convenience of the Contractor only, and no limitation, amendment, or modification is intended thereby. The Contractor shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

PART 2 -- PRODUCTS

2.01 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

- A. General: Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock or sand, free from grass, roots, brush, or other vegetation.
- B. Fill and backfill materials to be placed within 6-inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3-inches.
- C. Suitable Materials: Soils not classified as unsuitable as defined in paragraph entitled, "Unsuitable

Material" herein, are defined as suitable materials and may be used in fills, backfilling, and embankment construction subject to the specified limitations. In addition, when acceptable to the Engineer, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

- D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required to meet the requirements of this Section or to meet the quantity requirements of the project the Contractor shall provide the imported materials at no additional expense to the Owner, unless a unit price item is included for imported materials in the bidding schedule.
- E. The following types of suitable materials are designated and defined as follows:
1. Type A: Crushed rock, gravel, or sand with 100 percent passing a 1-inch sieve and a sand equivalent value not less than 50.
 2. Type B: Crushed rock, gravel, or sand with 100 percent passing a ½-inch sieve and a sand equivalent value not less than 50.
 3. Type C: Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a Number 4 sieve, and a sand equivalent value not less than 30.
 4. Type D: Crushed rock or gravel with 100 percent passing a 1-inch sieve and not more than 10 percent passing a Number 4 sieve.
 5. Type E: Crushed rock or gravel with 100 percent passing a ½-inch sieve and not more than 0 percent passing a Number 4 sieve.
 6. Type E: Crushed rock or gravel meeting the following gradation requirements:

Sieve Size	Percentage Passing
2-inch	100
1½-inch	94-96
1-inch	20-40
¾-inch	4-8

7. Type G: Crushed rock aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base for pavements. At the option of the Contractor, the grading for either the 1½-inch maximum size or ¾-inch maximum size shall be used. The sand equivalent value shall be not less than 22, and the material shall meet the following gradation requirements:

Sieve Size	Percentage Passing	
	1½-inch Max	¾-inch Max
1½-inch	90-100	-
1-inch	-	100
¾-inch	50-85	90-100
No. 4	25-45	35-55
No. 30	10-25	10-30
No. 200	2-9	2-9

8. Type H: Drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements:

Sieve Size	Percentage Passing
1-inch	100
¾-inch	90-100
3/8-inch	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

The drainrock shall have a sand equivalent value not less than 75. The surface of the drainrock immediately beneath reservoirs shall be stabilized with hot-applied asphalt after the surface of the drainrock has been finish-graded. The Contractor shall use, at its option, one of the asphalt types listed below:

	Type 1	Type 2
Designation	SC-70	SC-250
Spray Temperature (degrees F)	135-175	165-200
Coverage (gal/sq yd)	0.50	0.50

If the surface remains tacky, sufficient sand shall be applied to absorb the excess asphalt.

9. Type I: Any other suitable material as defined in Paragraph 2.01, herein.
10. Type J: Material which consists of Type H material, or any mixture of Types B, C, G, and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D 2901. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633.
11. Type K: Stockpiled topsoil material which has been obtained at the site by removing soil to a depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris as specified.

2.02 UNSUITABLE MATERIAL

- A. Unsuitable soils for fill material shall include soils which, when classified under the standard method for "classification of Soils, for Engineering Purposes," ASTM D 2487, fall in the classification of Pt, OH, CH, MH, or OL.
- B. In addition, any soil containing organic matter, having a plastic limit of less than 8-percent when tested in accordance with the requirements of ASTM D 4318 and containing more than 25 percent of material, by weight, passing the Number 200 sieve when analyzed according to the requirements of ANSI/ASTM D 1140; or any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classed as unsuitable material.

2.03 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

- A. The Contractor shall use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.
- B. Where these Specifications conflict with the requirements of any local agency having jurisdiction, or with the requirements of a material manufacturer, the Engineer shall be immediately notified. In case of conflict therewith, the Contractor shall use the most stringent requirement, as determined by the Engineer.
- C. Fill and backfill types shall be used in accordance with the following provisions:
 1. Embankment fills shall be constructed of Type I material, as defined in Paragraph 2.01E, herein, or any mixture of Type I and Type A through Type H materials.
 2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" herein, shall consist of the following materials for each pipe material listed below.
 - a. Mortar coated pipe, concrete pipe, and asbestos-cement pipe shall be provided Type A, B, C,

- D, or E pipe zone backfill material.
- b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other coated pipe shall be backfilled with Type C pipe zone backfill material.
- c. Plastic pipe and vitrified clay pipe shall be backfilled with Types B, C, or E pipe zone backfill material.
- 3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be Type I backfill material or any of Types A through H backfill materials or any mixture thereof.
- 4. Final backfill material for pipelines under paved areas, as defined under "Pipe and Utility Trench Backfill" shall be Type G backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill, except that Type K material shall be used for final backfill in agricultural areas unless otherwise noted on the Contract Documents.
- 5. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
- 6. Aggregate base materials under pavements shall be Type G material constructed to the thicknesses shown or specified.
- 7. Backfill around structures shall be Type I material, or Types A through Type H materials, or any mixture thereof.
- 8. Backfill materials beneath structures shall be as follows:
 - a. Drainrock materials under reservoirs or other structures shall be Type H material.
 - b. Under concrete reservoirs, Types G or H materials shall be used, except where concrete encasement is required by the Contract Documents.
 - c. Under structures where groundwater must be removed to allow placement of concrete, Type F material shall be used.
 - d. Under structures other than concrete reservoirs, Type D, E, G, or H material shall be used, except where concrete encasement is required by the Contract Documents.
- 9. Backfill used to replace pipeline trench over-excavation shall be Type F material for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.
- 10. The top 6-inches of fill on reservoir roofs, embankment fills around reservoirs, and all other embankment fills shall consist of Type K material, topsoil.
- 11. Where required by the Contract Documents, pea gravel shall be Type E material.

PART 3 -- EXECUTION

3.01 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

- A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or shall be removed from the site prior to performing any excavation or placing any fill. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including taking care of storm water, groundwater, and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. Excavations shall be sloped or otherwise supported in a safe

manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

- B. Excavation Beneath Structures and Embankments: Except where otherwise specified for a particular structure or ordered by the Engineer, excavation shall be carried to the grade of the bottom of the footing or slab. Where shown or ordered, areas beneath structures or fills shall be over-excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6-inches of native material and where such subgrade is sloped, the native material shall be benched at no additional cost to the Owner. When such over-excavation is shown on the Contract Documents, both over-excavation and subsequent backfill to the required grade shall be performed by the Contractor at its own expense. When such over-excavation is not shown but is ordered by the Engineer, such over-excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of 6- inches, brought to optimum moisture content, and rolled with heavy compaction equipment to 95-percent of maximum density.
- C. Excavation Beneath Concrete Reservoir: Excavation under the reservoir shall extend to the bottom of the drainrock layer. After such excavation has been completed, the exposed surface shall be rolled with heavy compaction equipment to 95-percent of maximum density and then graded to provide a reasonably smooth surface for placement of the drainrock. Areas under the reservoir upon which fill is to be placed shall be scarified to a depth of 6-inches, brought to optimum moisture content, and compacted to 95-percent of maximum density.
- D. Excavation Beneath Paved Areas: Excavation under areas to be paved shall extend to the bottom of the aggregate base, if such base is called for; otherwise it shall extend to the paving thickness. After the required excavation has been completed, the exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to 95-percent of maximum density.
- E. Notification of Engineer: The Contractor shall notify the Engineer at least 3 days in advance of completion of any structure excavation and shall allow the Engineer a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

3.02 PIPELINE AND UTILITY TRENCH EXCAVATION

- A. General: Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the Contractor, but shall be as shown on the typical trench detail.
- B. Trench Bottom: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.

- C. Open Trench: The maximum amount of open trench permitted in any one location shall be 500- feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. Special care shall be taken in late fall, winter and early spring to ensure material put back in the trenches is not frozen. All frozen material shall be removed from the trench prior to backfilling with non-frozen, appropriate material. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any travelled roadway or occupied structure. In such cases, however, barricades and warning lights meeting OSHA requirements shall be provided and maintained.
- D. Trench Over-Excavation: Where the Contract Documents indicate that trenches shall be over-excavated, they shall be excavated to the depth shown, and then backfilled to the grade of the bottom of the pipe. Work specified in this Paragraph shall be performed by the Contractor at its own expense.
- E. Over-Excavation: When ordered by the Engineer, whether indicated in the Contract Documents or not, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All work specified in this Section shall be performed by the Contractor at its own expense when the over-excavation ordered by the Engineer is less than 6 inches below the limits shown. When the over-excavation ordered by the Engineer is 6-inches or greater below the limits shown, additional payment will be made to the Contractor for that portion of the work which is located below said 6-inch distance. Said additional payment will be made under separate unit price bid items for over-excavation and bedding if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.
- F. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level at least one foot above the top of the pipe before trench is excavated.

3.03 OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN

- A. Any over-excavation carried below the grade ordered, specified, or shown, shall be backfilled to the required grade with the specified material and compaction. Such work shall be performed by the Contractor at its own expense.

3.04 EXCAVATION IN LAWN AREAS

- A. Where excavation occurs in lawn areas, the sod shall be carefully removed and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn; provided, that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling and testing of the pipeline, the sod shall be replaced in a manner so as to restore the lawn as near as possible to its original condition.

3.05 EXCAVATION IN VICINITY OF TREES

- A. Except where trees are shown in the Contract Documents to be removed, trees shall be protected from injury during construction operations. No tree roots over 2-inches in diameter shall be cut without express permission of the Engineer. Trees shall be supported during excavation as may be directed by the Engineer.

3.06 ROCK EXCAVATION

- A. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.
- B. Said rock excavation shall be performed by the Contractor at its own expense; provided, that should the quantity of rock excavation be affected by any change in the scope of the work, an appropriate adjustment of the contract price will be made under a separate bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price.
- C. Explosives and Blasting: Blasting will not be permitted, except by express permission of the Engineer on a case-by-case basis. The use of explosives will be subject to the approval and regulations of all agencies having jurisdiction. If blasting is utilized at the site of the Work, the Contractor shall take all precautions and provide all protective measures necessary to prevent damage to property and structures or injury to person. Prior to blasting, the Contractor shall secure all permits required by law for blasting operations and shall provide any additional hazard insurance required by the Owner. The Contractor shall have a fully qualified and experienced blasting foreman in charge of all blasting operations.
- D. The Contractor will be held responsible for all and shall make good any damage caused by blasting or resulting from its possession or use of explosives on the work.
- E. All operations involving the handling, storage, and use of explosives shall be conducted in accordance with the requirements of the OSHA Standards for Construction, and in accordance with all local laws and regulations.

3.07 DISPOSAL OF EXCESS EXCAVATED MATERIAL

- A. The Contractor shall remove and dispose of all excess excavated material at its own expense.

3.08 BACKFILL - GENERAL

- A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

- B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation.

3.09 PLACING AND SPREADING OF BACKFILL MATERIALS

- A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness. When compaction is achieved using flooding and jetting methods, each layer shall not exceed 3-feet in thickness after compaction.
- B. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.
- C. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.
- D. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

3.10 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

- A. Each layer of Types A, B, C, G, H, I, and K backfill materials as defined in Paragraph 2.01E, herein, where the material is graded such that at least 10 percent passes a Number 4 sieve, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.
- B. Each layer of Type D, E, F, and J backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor, except when such materials are used for pipe zone, backfill vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is least.
- C. Fill on reservoir and structure roofs shall be deposited at least 30 days after the concrete roof slab has been placed. Equipment weighing more than 10,000 pounds when loaded shall not be used on a roof. A roller weighing not more than 8,000 pounds shall be used to compact fill on a roof.
- D. Flooding ponding, or jetting shall not be used for fill on roofs, backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.
- E. Pipe zone backfill materials that are granular, may be compacted by a combination of flooding and vibration using concrete vibrators or by jetting, when acceptable to the Engineer.
- F. Pipeline trench zone backfill materials, containing 5-percent or less of material passing a No. 200 sieve, may be compacted using flooding and jetting or vibration if the Contractor uses effective procedures that yield the specified compaction test results. Flooding and jetting shall not be done in such a manner that the pipe or nearby utilities are damaged, in areas of poorly draining or expansive soils, or where the use of the procedure is prohibited by any agency having jurisdiction over the

street or right-of-way. Approved jet pipes or immersible vibrators shall be used so that each backfill layer is saturated and consolidated to its full depth before the next layer is placed. Jet pipes shall be kept at least 6 inches away from the pipe where the backfill is being consolidated and 2-feet away from other pipes or utilities.

- G. Equipment weighing more than 10,000-pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use heavier equipment is impractical or restricted due to weight limitations.
- H. Compaction Requirements: The following compaction test requirements apply to Type A, B, C, G, H, I, and K materials. Type D, E, F, and J materials do not require testing. Where agency or utility company requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density
Pipe zone backfill portion above bedding for flexible pipe	90
Pipe zone backfill bedding and overexcavated zones under bedding/pipe for flexible pipe	90
Pipe zone backfill portion above bedding for rigid pipe.	90
Pipe zone backfill bedding and over-excavated zones under bedding/pipe for rigid pipe.	90
Final backfill, beneath paved areas or structures.	95
Final backfill, not beneath paved areas or structures.	90
Trench zone backfill.	90
Embankments	90
Embankments, beneath paved areas or structures.	95
Backfill beneath structures, reservoirs.	95
Backfill around structures, on reservoir or structure roof.	95
Topsoil (Type K material)	90
Aggregate base (Type G material)	95

- I. The Contractor shall maintain the indicated trench cross section up to a horizontal plane lying 6-inches above the top of the pipe.

- J. If, at any location, under said horizontal plane the Contractor slopes the trench walls or exceeds the maximum trench widths indicated in the Contract Documents, the pipe zone backfill shall be "improved" or the pipe class increased as specified herein, at no additional cost to the Owner. "Improved" backfill shall mean sand-cement backfill or other equivalent method acceptable to the Engineer.
- K. If the allowable deflection specified for the pipe is exceeded, the Contractor shall expose and reround or replace the pipe, repair all damaged lining and coating, and reinstall the pipe zone material and trench backfill as specified at no additional expense to the Owner.

3.11 PIPE AND UTILITY TRENCH BACKFILL

- A. Pipe Zone Backfill: The pipe zone is defined as the trench cross-sectional area between a line 6-inches below the bottom of the pipe, i.e., the subgrade, to a level line 6 inches above the top of the pipe. The bedding for flexible pipe is defined as that portion of pipe zone backfill material between the subgrade and the bottom of the pipe zone backfill material between the subgrade and a level line which varies from the bottom of the pipe to the springline as shown on the Contract Documents.
- B. Bedding shall be provided for all sewers, drainage pipelines, and other gravity flow pipelines. For other pipelines the bedding may be omitted if all the following conditions exist:
 - 1. The pipe bears on firm, undisturbed native soil which contains only particles that will pass a one-inch sieve.
 - 2. The trench excavation is not through rock or stones.
 - 3. The trench conditions match those specified by the pipe manufacturer for installation of pipe directly on the subgrade.
 - 4. The subgrade soils are classified as suitable fill and backfill materials per Paragraph 2.01.
 - 5. The subgrade soils have, as a maximum, a moisture content that allows compaction.
- C. Where bedding is required, after compacting the bedding the Contractor shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.
- D. The pipe zone shall be backfilled with the specified backfill material. The Contractor shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.
- E. Trench Zone Backfill: After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed. The inches above the top of the pipe to a level line 18 inches below finished surface grade, or if the trench is under pavement, 18 inches shall be filled with water to prevent flotation.
- F. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18-inches of finished grade, or if the trench is under pavement, all backfill within 18-inches of the subgrade.

3.12 EMBANKMENT CONSTRUCTION

- A. The area where an embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and

rolled or otherwise mechanically compacted to 95 percent of maximum density under structures and paved areas, and 90 percent of maximum density elsewhere.

- B. Where embankment or structure fills are constructed over pipelines, the first 4-feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe.

*** END OF SECTION ***

SECTION 02210

SITE GRADING (Building Construction)

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Principal work in this Section: Furnish materials and perform labor required to execute this work as indicated in the Contract Documents, as specified and as necessary to complete the Contract, including, but not limited to these major items:
1. Coordinate the work of this Section with other trades including off-site construction.
 2. Verify all elevations at the job site.
 3. Protect existing improvements designated to remain.
 4. All excavating, filling, backfilling, compacting and grading required for the project, except as excluded in Paragraph B below.
 5. Pumping, draining, shoring, cribbing, and other protective measures.
 6. Layout and setting of lines and levels.
 7. Cut, cap and remove inactive utility lines encountered in the path of new construction.
 8. Protect finished grading from damage.
 9. Remove surplus or unsatisfactory materials from the site including above or below grade improvements, such as footings, not removed during demolition operations.
- B. Related work specified elsewhere.
1. Above grade demolition.
 2. Trenching, backfilling and compacting for utilities.
 3. Base course and subgrade under asphalt paving.
 4. Soil enrichments and topsoil for landscaped areas.
 5. Finish grading for landscaping and asphalt paving.
 6. Cut, cap and remove inactive utility lines encountered in the path of new construction.

1.02 SITE CONDITIONS

- A. Soils Investigation Reports: The soils investigation reports prepared for the project site shall be used to identify site conditions at the project.
- B. Data: Maps, boring logs, geotechnical and soils investigation reports, and like reference data, are not included in the Contract Documents but are made available to the Contractor for information only. Neither the Owner, Engineer or Architect shall assume any responsibility for any conclusions the Contractor may draw from such information. Information in the reports shall not relieve the Contractor of his responsibility for the work required. Logs of soil borings included in the above mentioned reports do not constitute a guarantee of the uniformity of soil conditions over the entire site, not a guarantee against variations of the ground water. The Contractor shall determine existing conditions under which he shall operate in performing the work.
- C. Site Visitation: In preparing the proposal, the Contractor is assumed to have visited the site, carefully examined the Contract Documents, and determined the methods of removal and storage of materials, the sequencing of operations and the attendant problems. No allowance will be made

subsequently to the Contractor for errors due to negligence in observing the site conditions.

- D. Earthwork Quantities: Any earthwork quantities shown in the Contract Documents are for permit purposes only. The Contractor shall be responsible for his own quantities.

1.03 QUALITY ASSURANCE

- A. General: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this Section.
- B. Inspections and Tests: The Owner will employ a Soils Engineer to inspect and test the work of this Section. At the completion of this work the Soils Engineer will be required to submit a written report certifying that the site was developed with acceptable materials in accordance with the Contract Documents. The Soils Engineer shall be permitted free and unrestricted access to the site as required for the performance of his duties.

1.04 REFERENCE STANDARDS

- A. General: Conform to the following reference standards to the extent specified.
- B. American Society for Testing and Materials (ASTM). D 1557-78: Test Methods for Moisture-Density Relations of Soils and Soils-Aggregate Mixtures using 10-lb. (4.54 kg.) Rammer and 18-in. (457mm.) Drop.
- C. State of Utah, Division of Industrial Safety.
- D. Ordinances. Codes and Regulations: Work shall be constructed in accordance with the requirements of all legally constituted authorities having jurisdiction. Including all local ordinances, codes and the safety orders of the State Division of Industrial Safety.

PART 2 -- PRODUCTS

2.01 SOIL MATERIALS

- A. General: Soil materials, in general, shall be free of debris, roots, wood, scrap material, vegetable matter, refuse soft unsound particles, frozen deleterious, or objectionable materials.
- B. Backfill and Fill: Backfill and fill shall conform to the general requirements for soil materials above for soil materials above and shall be an unclassified granular soil material from the site or borrow material. Maximum, particle size shall be 6-inches. Backfill and fill materials shall be approved by the Soils Engineer.
- C. Borrow Material: Obtain material required for fill in excess of that produces within the grading limits of the work from borrow areas selected and paid for by the Contractor and approved by the soils Engineer. Borrow material shall be granular and non-expansive of low expansion potential (expansion index less than 35) and shall contain sufficient fines (binder material) so as to be relatively impermeable when compacted. The Soils Engineer shall evaluate and/or test the

material for its conformance with the specification prior to the delivery to the site. The Contractor shall notify the Soils Engineer at least 72 hours prior to importing fill to the site. Rocks larger than 3-inches in diameter shall not be used unless they are sufficiently broken down.

PART 3 -- EXECUTION

3.01 PROTECTIVE MEASURES

A. Underground Utilities:

1. Prior to the commencement of any excavations, telephone Blue Stakes Underground Service Alert. Two working days shall be allowed after contacting Blue Stakes before the excavation work is started to allow utility owners to be notified. If any utilities are to remain in place, provide adequate protection during earthwork operations to prevent damaging them.
2. Should uncharted or incorrectly charted utilities be encountered during excavation, notify the utility owner for instructions. Cooperate with the utility owner in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner and pay all costs thereof.
3. Should old utility lines be encountered which prove to be abandoned in place, they shall be removed as part of the excavation, or if sufficiently below grade, as determined by the Soils Engineer, may be capped and left in place.
4. If seepage pits or cesspools are encountered, do not fill until approval has been obtained from the Soils Engineer.
5. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, during occupied hours, except when permitted in writing and then only after acceptable temporary utility services have been provided.

B. Drainage:

1. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding the project site and surrounding area. Grade perimeter of excavations so that water run-off drains away from the excavations.
2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting of footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering appurtenances necessary to convey water away from excavations.
3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting areas. Do not use trench excavations as temporary drainage ditches.
4. Dispose of water resulting from dewatering operations in a manner that will not cause damage to public or private property, or constitute nuisance or menace to the public in accordance with local requirements.
5. Protect sloped embankments from erosion and during rainy weather by covering with impermeable membranes or by using other approved methods.

C. Shoring, Cribbing and Bracing: Shore, crib and brace the excavations as necessary to prevent cave-ins and to support and protect adjacent construction, in accordance with Federal, State and local laws. All such shoring shall be designed by a licensed civil or structural engineer employed by the Contractor.

- D. Benchmarks and Monuments: Protect benchmarks, monuments, and other reference points against displacement and damage. Repair or replace benchmarks, monuments and other permanent survey data that becomes displaced or damaged due to the performance of this work at no cost to the owner.
- E. Dust Palliation: Control dust at the site by intermittent watering and sprinkling while the work of the Section is being performed.
- F. Preservation of Property from Damage: Existing improvements, adjacent property, utility and other facilities, and trees and plants that are not to be removed shall be protected from injury or damage. Repair or replace existing improvements damaged during the conduct of this work with material of same kind, quality and size. Materials or equipment temporarily removed for protection and not damaged shall be reinstalled.
- G. Provide necessary barricades and protection to protect the public, personnel, equipment and premises from damage, harm, hazard or disturbance arising out of this work. Conduct work using the most quiet of available, suitable processes and equipment to keep noise down, and take necessary care to reduce amount of dust carried in the air, by an effective dust palliation program.
- H. Use of Explosives: The use of explosives is not permitted.
 - 1. Trees and plants that are not to be removed shall be protected from injury by the Contractor at his expense. Perform excavations within the drip-lines of large trees to remain by hand and protect the root system from damage or dry-out to the grades extent possible. Maintain a moist condition for the root system and cover exposed roots as directed by the Landscape Architect. Paint root cuts of one inch diameter and larger with emulsified asphalt tree paint.

3.02 GROUND SURFACE PREPARATION

- A. Clearing and Grubbing: All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, debris and other unsatisfactory material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. The removals shall extend to a depth of three feet below the existing ground surface or subgrade, whichever is deeper.
- B. Benching: Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped or benched, or broken up, as directed, in such manner that the fill material will bond with the existing surface and in accordance with the recommendations of the soils investigation report.
- C. Verification: Verify with the Soils Engineer that all site clearing work has been satisfactorily completed.
- D. Preparation of Subgrades:
 - 1. General area fills and backfills: Scarify the subgrade to a depth of at least 8-inches and compact to at least 90-percent of the maximum density obtainable by the ASTM D1557 method of compaction. Moisten or dry as necessary to obtain a moisture, content that does not vary more than two percent from optimum.
 - 2. Structural fills and backfills: Scarify the subgrade to a depth of at least 8-inches and compact to at least 95-percent of the maximum density obtainable by ASTM D1557 method of

compaction. Moisten or dry as necessary to obtain a moisture content that does not vary more than two percent from optimum.

3.03 EXCAVATION

- A. Excavate all materials encountered regardless of their nature to the lines and grades indicated or necessary to complete the work. Remove all existing fill soils and disturbed natural soils for their entire depth. Size excavations to allow for placing and removing formwork, installing protective shoring and bracing as may be necessary to prevent caving or sloughing of banks, and to allow for installation of waterproofing and other services.
- B. Clean out excavations of any loose material to firm undisturbed soil.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.
- D. Shore and crib excavations if required to maintain their stability.
- E. Material Storage: Stockpile satisfactory excavated materials until required for backfill of fill. Place, grade and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain. Dispose of excess soil material and waste materials as herein specified.
- F. Stability of Excavations: Slopes sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe conditions until completion of backfilling.
- G. Slopes: When completed, the average plans of excavation slopes shall conform to the slopes indicated in the Contract Documents and no point on the completed slopes shall vary from the designated plane by more than 6-inches. All debris and loose material shall be removed.

3.04 FILLS

- A. Fills shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Compaction shall be continuous over the entire area. Equipment shall make sufficient passes to obtain a uniformly the desired density. Each lift shall be compacted before the overlaying lift as placed.
- B. General area fill shall be placed in loose lifts not to exceed 12-inches in depth. Each lift shall be compacted to a minimum of 95 percent of maximum dry density when tested in accordance with ASTM D1557. Flooding or jetting techniques to accomplish compaction will not be allowed.
- C. Soils shall be treated so that the moisture content at the time of compaction is near optimum. Do not place fill during unfavorable weather conditions. If work is interrupted by heavy rain, do not resume operations until the proper moisture content and density of materials have been achieved.

- D. Materials larger than 3-inches in size shall be placed in the fill so they are completely surrounded by compacted fine aggregate. No nesting of rocks will be permitted. Material placed within the upper 12-inches of fill shall be selected material that contains no rocks or hard lumps greater than 3-inches in size and shall have an expansion index of less than 35.
- E. If during the grading operations, soil types other than those analyzed in the soils report are encountered, consult the Soils Engineer to determine the suitability of these soils as fill materials.
- F. The Soils Engineer shall observe the placement of compacted fill and conduct in-place field density tests on the compacted lifts to check for adequate moisture content and the required relative compaction. Where less than the required relative compaction is indicated, additional compaction effort shall be applied and the soil moisture conditioned as necessary until the required relative compaction is attained.

3.05 BACKFILLING

- A. Place backfill as specified in paragraph 3.04 FILLS, as construction operations permit, but not before the following operations take place:
 - 1. Work to be covered has been inspected and approved.
 - 2. Concrete formwork and loose soils and debris have been removed from the excavation.
 - 3. Underground utility locations have been recorded.
 - 4. Shoring and bracing have been removed, voids have been filled and compacted.
 - 5. Waterproofing and prefabricated in-plane wall drainage system, if any, have been inspected and approved.
 - 6. Permanent or temporary horizontal bracing is in place on walls supported by a floor or roof.
- B. Compact backfill as specified in paragraph 3.04, FILLS.
- C. Where backfill is required on both sides of a structure, place it simultaneously so that the weight of fill remains approximately equal on both sides at all times.
- D. Brace construction which has not been designed to withstand eccentric loading during backfilling.
- E. Backfill only after the structure to be backfilled against has attained its design strength or has been properly braced to resist the load of the backfill. No compacting by flooding or jetting will be permitted.
- F. Keep rollers and other heavy equipment at least four feet from footings, foundations, piers and walls of building and appurtenance.

3.06 GRADING

- A. The locations and elevations of all constructions are indicated in the Contract Documents and unless inconsistencies are brought to the City's attention in writing prior to commencement of work, the Contractor will be held responsible for the proper location and elevations of the completed work.
- B. Grade all areas to the lines and levels required. Finish areas free from irregular and abrupt surface changes. Keep grades straight between changes in elevations. Rough grading shall be within plus or minus 0.1-foot of the elevations shown in the Contract Documents. Finish grades shall be the

maximum elevations shown in the Contract Documents with a minus tolerance of ½-inch of uniformly distributed.

- C. For roadways, the required subgrade elevation shall be such that when base and indicated construction are added, the final elevations will be those shown in the Contract Documents.

3.07 DISPOSAL

- A. Satisfactory excavated materials, in excess of that required for filling and backfilling, and unsatisfactory materials, shall be disposed of off-site in a legal manner.
- B. Burning and burying materials on-site is prohibited.

3.08 PROTECTION OF NEWLY GRADED WORK

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerance.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather scarify surface re-shape, and compact to required density prior to further construction.
- C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.09 FIELD QUALITY CONTROL

- A. All site grading operations will be observed by the Soil Engineer. The Soil Engineer will have to following duties at a minimum:
 - 1. Observe the results of the clearing and grubbing operations to assure that all unsuitable materials have been properly removed.
 - 2. Inspect the exposed subgrade in fill areas, observe proofrolling, and delineate areas requiring overexcavation.
 - 3. Evaluate the suitability of on-site and import soils as structural fill.
 - 4. Perform field density tests to monitor the quality of compacted fill and backfill.
 - 5. Monitor foundation bearing materials to conform that appropriate bearing materials are present at the design grades. Recommend adjustments needed to construct footings.
- B. Field Density Tests:
 - 1. The location and frequency of the tests will be at the Soil Engineer's discretion.
 - 2. If, in the Engineer's opinion, based on reports submitted by the Soil Engineer, subgrade, fill and backfill have been placed below specified density or on improperly prepared subgrades, remove in-place soils, and provide additional compaction and tests at no additional costs to the Engineer.
- C. Notice: Provide the Soil Engineer at least two working days notice prior to start of each phase of

earthwork operations.

- D. Verifications of Elevations: Provide written certification by a licensed surveyor or civil engineer upon completion of earthwork operations that grades are within the tolerance specified.
- E. Lines and Levels: Employ a licensed surveyor or civil engineer to lay out the work and establish the necessary markers, benchmarks, batter boards and stakes.

3.10 ADJUSTING

- A. Regrading: Raise or lower existing manholes and cleanouts in regraded areas and carefully remove, clean and reset frames and covers to finished grade.

3.11 CLEANUP

- A. Cleanliness of Site: During progress of work, keep premises reasonably free of debris and waste materials.
- B. Removal of Debris: Upon completion and before final acceptance of work, remove all debris, rubbish, left-over materials, tools and equipment from site.
- C. Keep sidewalks and streets adjoining the property clean and free of debris, excavated materials, rubbish and other materials resulting from the performance of this work which might affect the safety and free passage of the streets, sidewalks, utilities and property.

*** END OF SECTION ***

SECTION 02222
EXCAVATION AND BACKFILL
FOR STRUCTURES

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. This section covers excavating, backfilling and compacting for inlet structures, emergency spillway retaining wall, PDPE liner and manholes. Other structures may also conform to this section as directed by the City.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02292 – Embankment Construction
B. Section 02712 – Storm Drainage System
C. Section 03300 – Cast-in-Place Concrete

1.03 SUBMITTALS

- A. If requested by the City, the Contractor shall furnish to the Soils Engineer, a certified test results from an approved laboratory showing that the free draining gravel material and structural fill material conforms to the Contract Document requirements. The test result will be paid for by the City.

PART 2 -- PRODUCTS

2.01 RETAINING WALL BACKFILL

- A. Retaining wall backfill material shall be native material or shall be embankment fill material.
B. Wall backfill material shall be free from frozen lumps, rocks larger than 6-inches in the largest dimension, roots, trash, lumber and organic material. Suitability of material for wall backfill in accordance with these criteria will be as determined by the Soils Engineer.

PART 3 -- EXECUTION

3.01 EXCAVATION

- A. Excavation shall be performed to the lines and grades indicated in the Contract Documents. During excavation, material satisfactory for backfilling shall be stockpiled in a safe manner. Excavated material not required or not satisfactory for backfill shall be removed from the site.
B. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the

excavation, from sliding or settling. Localized slides or settlements shall be promptly removed and corrected by the Contractor.

3.02 BACKFILL

- A. Backfill material shall not be placed against concrete structure that has not been properly cured. No backfill material shall be placed until concrete has cured for a minimum of 7 days or until the compressible strength is 3,000 psi, whichever is greater.
- B. Backfill material shall be placed in no more than 6-inch loose lifts.
- C. All backfill material shall be placed and compacted to at least 95-percent of Standard Proctor Density at a moisture content within plus 2-percent to minus 2-percent of optimum as determined by ASTM D-698.
- D. Where the moisture content is not suitable and/or sufficient compaction has not been obtained, the fill shall be reconditioned to an approved moisture content and recompact to the minimum required compaction, unless recommended otherwise by the Soils Engineer, prior to placing any additional fill material.
- E. Unless otherwise specified, the Contractor shall be responsible for arranging for the placing and compacting of approved fill material in accordance with the Contract Documents. If the Soils Engineer should determine that the Contractor is failing to meet the minimum requirements, the Contractor shall stop operations and make adjustments as necessary to produce a satisfactorily compacted fill at no additional cost to the City.
- F. Sufficient personnel, equipment, sumps or other means should be provided to maintain the site in an acceptable dry condition for the duration of construction and curing of the structure.

3.03 REMOVAL OF WATER

- A. Dewatering shall be accomplished in accordance with Section 01525 – Temporary Construction Aids and Environmental Controls. The Contractor shall provide and maintain at all times, ample means and devices with to remove promptly and to properly dispose of all water entering the excavation.
- B. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. No water shall be drained into work built under construction without prior approval of the City.
- C. Dewatering shall be accomplished by well, points, sumping, or any other acceptable method, which will provide a dewatered excavation. Any dewatering method shall be subject to the approval of the City.

3.04 COMPACTION TESTS

- A. Field density tests shall be made in accordance with ASTM D698.
- B. The cost of field density tests shall be borne by the Contractor.

*** END OF SECTION ***

SECTION 02271
EROSION CONTROL

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to install, maintain and remove temporary erosion control as shown and as directed by the City, including coordinating temporary control measures with permanent control requirements.

1.02 RELATED WORK AND REFERENCES

- A. Section 02292 – Embankment
- B. Section 02273 – Interceptor, Roadway and Toe Ditch

1.03 TEMPORARY BERM

- A. Temporary berms consist of a ridge of compact soil, with or without a shallow ditch, constructed at the top of fill slopes, or transverse to the centerline of fills.

1.04 SLOPE DRAIN

- A. Slope drains carry water down cut and fill slopes to prevent erosion before installation of permanent facilities or the growth of adequate ground cover.

1.05 SEDIMENT STRUCTURES

- A. Sediment structures consist of various types of structures to trap and store sediment.
 - 1. Permanent sediment basins are excavated storages of defined side slopes with riprap placed at the inlet and outlet and are limited to drainage areas of 50 acres or less. Basins shall be checked and maintained per Subsection 3.01.J.
 - 2. Silt fence is a temporary structure of steel fence posts, wire mesh fencing and a permeable filter fabric used on drainage areas of one acre or less.

1.06 CHECK DAM

- A. A check dam is a barrier composed of stones placed across a natural or constructed drainage channel. Do not consider a check dam as a substitute for a sediment basin or silt fence. A check dam does not reduce the required sediment capacity of these facilities.

PART 2 -- PRODUCTS

2.01 TEMPORARY BERM

- A. Existing soil

2.02 TEMPORARY SLOPE DRAIN

- A. Pipe Culvert
- B. Riprap – Refer to Section 02275
- C. End Section

2.03 SEDIMENT STRUCTURES

- A. Existing soil
- B. Riprap – Refer to Section 02275

2.04 SILT FENCE

- A. Wood or steel posts – 5-feet in length
- B. Galvanized steel wire mesh – 1/12-inch minimum, 6 by 6-inch opening maximum.
- C. Filter fabric
 - 1. Synthetic filter fabric (pervious sheet of propylene, nylon, polyester or ethylene yarn and allow a flow rate of 0.06 gal/sq.yd. min. and have a filter efficiency of 97-percent.
 - 2. Synthetic filter fabric will contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F.

2.05 CHECK DAMS

- A. Check dams are constructed using the following materials:
 - 1. Stone – As specified
 - 2. Silt fence – Refer to Subsection 2.06

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. The Contractor will develop an Erosion Control Plan for all phases of work altered or added to the project. Submit the plan two weeks prior to clear and grub activities for approval by the City.
- B. Coverage under all necessary permits will terminate upon completion of the project.

- C. The Erosion Control Plan shall address the following items:
1. Staging areas
 2. Haul roads and borrow sites
 3. Disposal areas
 4. Topsoil storage
 5. Wood chip stockpiles
 6. Alteration and/or additions to the location and type of fence, sediment structures, check dams and other erosion control devices.
- D. Do not start earth-disturbing work until temporary erosion control measures are in place.
- E. Install all erosion control in a timely manner and as a proactive measure to prevent erosion during construction.
- F. Space surface runoff control structures as follows:

SLOPE GRADIENT (percent)	STRUCTURE INTERVAL (feet)
10	150
15	100
20	50
30	40
40	36
50 or greater	30

- G. Do not pollute streams, canals, lakes or other watercourses. Use the erosion control measures indicated. Notify the City immediately upon discovery of any pollution of these watercourses.
- H. Use the Erosion Control Plan and Contract Documents when constructing erosion control items.
- I. Use the most restrictive requirements if a conflict occurs between erosion control specifications and federal, state, or local agency's laws, rules or regulations.
- J. Maintain erosion control facilities during the construction period, including shutdown periods. At the end of each shift, the Contract shall inspect temporary erosion control measures to ensure that they are in place and functioning properly. At least once a week, the Contractor shall clean, adjust and otherwise maintain temporary erosion control measures.
- K. Erosion control measures shall be checked after every storm event.
- L. All erosion control measures shall be cleaned and maintained when no more than half of the design volume has been filled with collected sediment and repaired when damaged or deemed ineffective.
- M. Remove sediment when it reaches a depth that interferes with the operation of the structure.

- N. Use and maintain sediment structures until all disturbed areas draining into it are lined or has established vegetation.
- O. When removing sediment structures, comply with Subsection 3.01.G.

3.02 TEMPORARY BERM

- A. Place and compact the entire width of the berm in accordance with Section 02292 – Dam Embankment Construction.
- B. Grade the area at inlet and outlet to drain.
- C. Extend all transverse berms on the downstream side of the slope drain across the grade at the approximate 10-degree angle with a line perpendicular to centerline.
- D. Widen the tip width of the transverse berm and flatten the side slopes in order to facilitate passage of equipment over them.
- E. Before achieving final roadway elevations, construct embankments with the surface super elevated, permitting the placement of temporary berms and side drains on the low side of the roadway section.
- F. Construct temporary berm Type B during all full suspensions of work.

3.03 TEMPORARY SLOPE DRAIN

- A. Place drains at maximum intervals of 1,000-feet along a continuous slope.
- B. Anchor temporary slope drain.
- C. Use pipe end section or lining at drain inlet.
- D. Use pipe end section, loose riprap and sediment trap at drain outlet.

3.04 PERMANENT SEDIEMENT BASIN

- A. Locate basins as shown on the project drawings.

3.05 SILT FENCE

- A. The height of a silt fence shall be a minimum of 16-inches above the original ground surface and will not exceed 35-inches above ground elevation.
- B. Cut fiber fabric to the full length of the barrier to avoid the use of joints or seams. When joints or seams are unavoidable, splice filter cloth together at a support post, with a minimum 6-inch overlap and securely seal.
- C. When wire mesh is used to support filter fabric, place posts a maximum of 10-feet apart. When wire mesh is not used to support filter fabric, place posts at a maximum of 6-feet apart.

- D. When a silt fence is constructed across a ditch line or swale, the measure must be of sufficient length to eliminate end flow. The plan configuration shall resemble an arc or horseshoe with the ends oriented upslope. Place posts a maximum of 3-feet apart.
- E. Toe in silt fence and wire mesh as shown on the Standard Drawings.

3.06 CHECK DAMS

- A. Refer to Contract Documents.

*** END OF SECTION ***

SECTION 02272

FABRIC, EROSION CONTROL MATS AND GEOTEXTILES

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to install geotextiles as indicated in the Contractor Documents.

1.02 RELATED WORK AND REFERENCES

- A. Section 02925 – Topsoil
- B. Section 02933 – Seeding
- C. Section 02273 – Interceptor, Roadway and Toe Ditch

1.03 USAGE

- A. Any fabric, erosion control mat or geotextile to be used on the project, including recommended products, must be approved by the City. The Contractor must submit samples, calculations and a manufacturer's letter of recommendation for usage of their product for its proposed purpose on this project.

1.04 PERMANENT USAGE

- A. All fabric, erosion control mats and geotextiles to be used on the project shall be manufactured for permanent erosion control.

1.05 METHOD OF INSTALLATION

- A. The Contractor shall submit an installation plan to the City for approval. The installation plan must be approved by the City prior to installation of fabric, erosion control mat or geotextile.

1.06 PRODUCT SUBSTITUTION

- A. Criteria for approved equals shall include, but not be limited to, velocity, shear sediment loss and vegetation density.

1.07 DEFINITIONS

- A. A *sandy soil* is one with a USDA soil texture classification of any of the following: sand, loamy sand, sandy clay loam or a sandy clay.

- B. A *non-sandy soil* is one with a USDA soil texture classification of any of the following: loam, silt loam, silt, clay loam, silty clay loam, silty clay or clay.

PART 2 -- PRODUCTS

2.01 TOE DITCH

- A. Turf reinforcement mat (TRM) – Use *Bon Terra America SFB12* or approved equal.

2.02 INTERCEPTOR DITCH

- A. Permanent erosion and reinforcement matrix – Use *Synthetic Industries – PYRAMAT Erosion Matrix* or approved equal.

2.03 ROADWAY DITCH

- A. Turf reinforcement mat (TRM) – Use *Bon Terra America SFB12* or approved equal.

2.04 CUT AND FILL SLOPES

- A. Soil retention blanket, Type 1
1. Use *North American Green SC150, Xcel Superior*, or approved equal for slopes steeper than 3:1 up to and including 2:1 in sandy soils.
 2. Use *North American Green S75, Xcel Superior*, or approved equal for slopes steeper than 3:1 up to and including 2:1 in non-sandy soils.
- B. Soil retention blanket, Type 2
1. Use *North American Green SC150* or approved equal for 1.5:1 slopes in all soil types.

2.05 BLANKET DRAIN AND SPECIFIED CLAY REMOVAL AREAS

- A. Filter fabric, Type A – Use *Mirafi 140N Nonwoven Polypropylene Filter Fabric* or approved equal.

2.06 RIPRAP LOCATIONS AND STABILIZED CONSTRUCTION ENTRANCE

- A. Filter fabric, Type B – Use fabric with the properties list in the following table:

PHYSICAL PROPERTY	REQUIREMENTS
Grab tensile strength	220 lbs. (ASTM D1682)
Elongation failure	60-percent (ASTM D1682)
Mullen burst strength	430 lbs. (ASTM D3768)
Puncture strength	125 lbs. (ASTM D751)
Equivalent opening	Size 40-80 (US std Sieve)(CW-02215)

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Inspection and testing - Obtain test samples and test for acceptance of geotextile prior to delivery of the geotextile to the project. A minimum of three random samples of the geotextile is required.
- B. Basis for rejection - Should any individual sample selected at random fail to meet any specification requirement, and then reject that roll and obtain two additional samples at random. If either of these two additional samples fails to comply with any portion of the specification, reject the entire quantity of rolls represented by that sample.
- C. Shipment and storage – Protect the geotextile from direct sunlight, chemicals, mud, dirt and debris during shipment and storage. Replace, at the Contractor's expense, any geotextile damaged or deteriorated during shipping, storage or construction.
- D. Packaging requirements – Wrap the geotextile uniformly onto suitable cylindrical forms or cores to aid in handling and unrolling. Package each roll of geotextile and the form or core upon which it is rolled to ensure protection of the geotextile from damage due to ultraviolet light and moisture during normal storage and handling.
- E. Labeling or tagging – Identify each roll by a tag or label securely affixed to the outside of the roll on one end. This tag or label must list the following required information: Name of the manufacturer, brand name of the product, roll width, roll length, and roll weight.
- F. Place the geotextile on an area that is smooth, free of projections or depressions. Do not drag the fabric across the subgrade, but roll out as smoothly as possible in the direction of vehicle travel. Remove wrinkles and folds to the City's satisfaction by stretching and staking as required.
- G. Overlap the longitudinal and transverse joints as per manufacturer's recommendations or file sew to provide 90-percent of the fabric strength. Thread shall be polypropylene. Secure the edges of the fabric by 10-inch long pins placed at a minimum of 10-feet on centers for parallel rolls and 5-feet on centers for roll ends. Use 1/4 -inch diameter pins in conjunction with 1 1/2-inch diameter washers.
- H. No construction equipment is allowed to run over or operate directly on the geotextile. A minimum of 6-inches of fill is required to be placed on the geotextile before construction equipment may run over or operate on the geotextile.
- I. Slope stability measures shall be in place no later than 3 weeks after placing fill to finished grade.

3.02 DITCH

- A. Install geotextile in accordance with the approved Installation Plan per Subsection 1.05 – Method of Installation.

B. Seeding

1. When seeding prior to geotextile installation, all check slots and other areas disturbed must also be reseeded.
2. When soil filling, seed geotextile and entire disturbed areas after installation, prior to filling mat with soil.

3.03 CUT AND FILL SLOPES

- A. Follow manufacturer's recommended installation procedures for installing soil retention blankets.
- B. The soil retention blanket, whether installed as slope protection or as a flexible channel liner in accordance with the approved materials list, shall be placed within 24 hours after seeding or sodding operations have been completed, or as approved by the City. Prior to placing the blanket, the area to be covered shall be relatively free of any rocks or clods over 1-1/2-inches in dimension and all sticks or other foreign material which will prevent the close contact of the blanket with the soil. The area shall be smooth and free of rills and other depressions. If, as a result of rain, the prepared bed becomes crusted or eroded or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's expense.
- C. Installation and anchorage of the soil retention blanket shall be in accordance with the manufacturer's recommendations and the Contract Documents.
- D. The Contractor shall submit one full set of manufacturer's literature and manufacturer's installation recommendation for the soil retention blanket selected in accordance with the approved materials list.

3.04 BLANKET DRAIN AND SPECIFIED CLAY REMOVAL AREAS

- A. Follow manufacturer's recommended installation procedures for installing filter fabric in the locations specified in the Contract Documents.

3.05 RIPRAP LOCATIONS AND STABILIZED CONSTRUCTION ENTRANCE

- A. Follow manufacturer's recommended installation procedures for installing filter fabric in the locations specified in the Contract Documents.

*** END OF SECTION ***

SECTION 02273
INTERCEPTOR, ROADWAY
AND TOE DITCH

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to construct ditches and channels as shown in the Contract Documents. This includes placing and compacting suitable material in embankments and disposing of unsuitable material.

1.02 RELATED WORK AND REFERENCES

- A. Section 02933 - Seeding
B. Section 02274 – Clay Liner
C. Section 02272 – Fabrics, Erosion Control Mats and Geotextiles

PART 2 -- PRODUCTS

2.01 DRAIN ROCK

- A. Free draining material meeting the following gradation:

SIEVE SIZE	PERCENT PASSING
1-inch	100
½-inch	25-60
No. 4	0-10

2.02 RIPRAP

- A. Refer to Section 02275 – Riprap.

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Construct ditches of the type shown in the locations contained in the Contract Documents.
B. Form the ditch as shown in the Contract Documents. Place excavated material in embankments.
C. Dispose of excess or unsuitable material at locations acceptable to the City.

*** END OF SECTION ***

SECTION 02274

CLAY LINER

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to construct clay ditch liner for the interceptor ditches as indicated in the Contract Documents.

1.02 RELATED WORK AND REFERENCES

- A. Section 02271 – Temporary Erosion Control
- B. Section 02112 – Clearing, Grubbing and Stripping
- C. Section 02273 – Interceptor, Roadway and Toe Ditch
- D. Section 2292 – Dam Embankment Construction

PART 2 -- PRODUCTS

2.01 LINER MATERIAL

- A. Liner material will require a permeability of less than 2×10^{-6} ft/min. The soil shall have a plasticity index (PI) of 15 or greater with 100-percent passing the 3-inch sieve and a minimum of 40-percent passing the No. 200 sieve. The liner material shall be free of brush, roots, sod, perishable, unsuitable or frozen material. Native subgrade soils may be used if soil criteria are met.

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Construct clay liner as shown in the Contract Documents.
- B. Prior to placing liner fill, the existing ground surface shall be prepared by removal of all brush, roots, sod, other perishable material, frozen or other unsuitable material.
- C. Liner material shall consist of layers of soils, which have been scarified, moisture conditioned to between optimum and 2-percent over optimum and compacted to at least 98-percent of the maximum dry density as determined by AASHTO T-180.

3.02 ACCEPTANCE TESTING

- A. Quality control testing: The Contractor shall be responsible for quality control of the canal lining.
- B. Compacting testing: Acceptance procedures for compaction: Clay liner will be tested per UDOT Subsection 225.3.3.

*** END OF SECTION ***

SECTION 02275

RIPRAP

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to install riprap as shown in the Contractor Documents. This includes but is not limited to protection of channels, structures and embankments.
- B. The Contractor shall supply and install geotextile fabric and riprap in accordance with the requirements of the Contract Documents.
- C. As used in this specification riprap is a layer of stone or rock designed to protect and stabilize the surface of the soil from erosion from water or wind. Riprap may be used to stabilize cut and fill slopes, channel slopes and bottoms, inlets and outlets for culverts, bridges, slopes drains and shorelines to due wave action.

Riprap is classified as either graded or uniform. Graded Riprap includes a wide range of stone or rock sizes. Uniform riprap consists of stone or rocks approximately the same size. Graded riprap is preferred to uniform as it provides a dense, flexible cover. Riprap sizes are designed by either the mean diameter or the weight of the stones.

Proper slope selection and surface preparation are essential for successful long-term functioning riprap. Adequate compaction of fill areas and proper use of filter blankets are necessary

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02200 – Earthwork
- B. Section 02292 – Embankment
- C. Section 02272 – Fabrics, Erosion Control Mats and Geotextiles
- D. Section 02112 – Clearing, Grubbing and Stripping

3.1 SUBMITTALS

- A. Submit a letter-identifying source of stone.
- B. Submit analysis from an independent laboratory showing specific gravity, gradation, absorption and durability of stone.

PART 2 -- PRODUCTS

2.01 RIPRAP MATERIAL

- A. The riprap material shall be sound, durable rock, which is roughly rectangular in shape and of

suitable quality to ensure permanence in the condition in which it is to be used. Rounded stone, boulders, sandstone, or similar soft stone or relatively thin slabs will not be acceptable. Material shall be free from overburden, spoil, shale, and organic material.

- B. Gradation: The riprap should be a well graded mixture with 50% by weight larger than the specified design mixture should be 1.5 times the d50 size with smaller sizes grading down to a minimum one inch and shall meet the requirements of Table 1 or this specification.

The design criteria for sizing stone for stability is in the USDA, SCS field Design Manual, Manual of standards for Erosion and Sediment Control Measures. The minimum thickness of the riprap protection should be 1.5 times the maximum stone diameter, but shall not be less than nine inches.

- C. Specific gravity: The specific gravity of the individual stones should be at least 2.5.
- D. The individual classes of rocks used shall conform to the following chart:

RIPRAP GRADATION*						
ROCK SIZE	½ TON RIPRAP	LIGBY RIPRAP	FACING RIPRAP	NO. 1 RIPRAP	NO. 2 RIPRAP	NO. 3 RIPRAP
½ Ton	0-5 %					
¼ Ton	50-100 %	0-5 %				
100 lb.		50-100 %	0-5 %	0-5 %		
75 lb.	95-100 %		50-100 %	25-75 %	0-5 %	
25 lb.		95-100 %	90-100 %	90-100 %	25-75 %	0-5 %
5 lb.					90-100 %	25-75 %
1 lb.						90-100 %

*The gradation in the chart represents the percent that shall be larger than the rock size called out in the left-hand column of the chart.

- B. The sizes of stone used for riprap protection are determined by purpose and site specific conditions.
- C. Bedding: Bedding for riprap shall be well graded, hard, durable aggregate and shall meet the following gradation:

SCREEN OR SIEVE SIZE	% OF MATERIAL PASSING
3-inch	90-100
¾-inch	20-90
No. 4	0-20
No. 200	0-3

- G. **Rock Dimensions:** Rock for outlet protection specified by size shall conform to subsection 2.01.A. The dimension in any plane shall not be less than 25-percent of the dimensions in the Contract Documents.

3.1 QUALITY CONTROL

- A. Visual evaluation of the quarry, including examination of blast samples and diamond drill core samples and suitable tests and service records, may be used to determine the acceptability of the stone. Notify the City in writing of the intended source of stone at least 30 days prior to use. Rock from onsite excavations conforming to these requirements may be used.
- B. To determine the required quality, provide specific gravity, absorption and durability tests of stone as follows:

TEST	TEST METHOD	REQUIREMENT
Apparent Specific Gravity	ASTM C 127	2.48 min.
Absorption	AASHTO 785	4.2-percent max.
Durability (abrasion)	ASTM C 535	40-percent max.
Durability (freeze/thaw)	AASHTO T-104 5 cycles of sodium sulfate	16-percent max weight loss

Based on the formula below, absorption may exceed 4.2-percent if the durability absorption ratio (DAR) is greater than 10. Durability may be less than 52 if DAR is greater than 24.

$$\text{DAR} = \frac{\text{Course Durability Index}}{\text{Percent Absorption} + 1}$$

2.02 GEOTEXTILE FABRIC

- A. The geotextile fabric to be used shall consist of nonwoven, needle-punched, polypropylene or polyester material. The material shall have a minimum fabric weight of 4.5-ounces per square yard and an EOS of 70 to 100.
- B. Material shall be Crown-Zellerbach grade 400 Fibretex, Phillips Petroleum Supac 5-p, or Celanese Fibers Mirafi 140 N.
- C. A geotextile fabric may be used with or in place of gravel filters. The following particle size relationship shall exist.
- Geotextile fabric covering a base with granular particles containing 50-percent or less (by weight) of fine particles (less than US Standard Sieve No. 200 (0.074 mm).

$$\frac{d_{85} \text{ base (mm)}}{\text{EOS filter fabric (mm)}} > 1$$

- Total open area of the filter should not exceed 36-percent
2. Geotextile Fabric covering other soils:
 - a. EOS is no larger than the US Standard Sieve No. 70 (0.21mm)
 - b. Total open area of the filter should not exceed 10-percent
 3. The EOS is the Equivalent Opening Size compared to a US standard sieve size.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Remove stumps, brush, trees and unacceptable materials from the surface. Grade areas to a smooth surface.
- B. Scarify subgrade soils to a depth of at least 10-inches. The scarified soils shall be moisture-conditioned to or slightly above optimum moisture content. Scarified soil shall be compacted to at least 90-percent relative compaction. Relative compaction is defined as the ratio of the in-place soil density to the laboratory maximum dry density as determined by the AASHTO T-99 or T-180 test procedure.
- C. Use bedding material as necessary to place filter fabric on an area that is smooth and free of depressions or projections.
- D. Following installation of filter fabric, place stone for riprap on 6-inches of bedding material in a manner which will produce a well-graded mass of stone with the minimum practical percentage of voids. Place the riprap to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material.

3.02 GEOTEXTILE FABRIC

- A. The geotextile fabric shall be installed with a minimum lap width of 12-inches and in accordance with the manufacturer's recommendations.

*** END OF SECTION ***

SECTION 02276

STABILIZED CONSTRUCTION ENTRANCE

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to the site entrance as shown in the Contract Documents. This includes grading and compacting the area and placing the riprap.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02275 - Riprap
- B. Section 02272 – Fabrics, Erosion Control Mats and Geotextiles
- C. Section 02112 – Clearing, Grubbing and Stripping
- D. Standard Drawing No. 5105 – Temporary Gravel Construction Entrance/Exit

PART 2 -- PRODUCTS

2.01 STABILIZED CONSTRUCTION ENTRANCE

- A. Riprap (No. 3) – Refer to Section 02275 – Riprap.
- B. Filter fabric per Section 02272 – Fabrics, Erosion Control Mats and Geotextiles.

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Clear all vegetation, roots and all other obstructions in preparation for grading.
- B. Prior to placing filter fabric, make sure that the entrance is properly graded and compacted.
- C. To reduce maintenance and loss of aggregate, place filter fabric over the existing ground before placing the stone for the entrance.
- D. Place riprap as shown in the Contract Documents.

3.02 MAINTENANCE

- A. Inspect the entrance at the end of each shift, after significant truck traffic and after every storm event for riprap displacement and sediment buildup.
- B. Apply additional rip when required.

- C. Remove sediments from within the entrance when they prevent proper drainage of the facility.
- D. Provide a vehicle wash-down area with appropriate facilities for vehicles that leave the site. Ensure that all vehicles leaving the site have been properly washed-down and are not tracking dirt, mud or other debris onto existing City streets.
- E. Immediately remove sediment and other materials tracked off the site.
- F. Maintain associated temporary erosion control measures per Section 02271 – Temporary Erosion Control.

*** END OF SECTION ***

SECTION 02277

SEGMENTAL BLOCK RETAINING WALL

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to for installing segmental block retaining wall to the lines and grades indicated in the Contract Documents. This includes furnishing and installing geogrid and appurtenant materials when required for construction of the retaining wall.
- B. Prior to installation, the Contractor shall submit texture and color samples of the concrete blocks for approval by the City. Entire wall shall be constructed of the same block, texture and color.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02292 – Embankment Construction
- B. Manufacturer's specifications and recommendations

PART 2 -- PRODUCTS

2.01 SEGMENTAL RETAININ WALL UNITS

- A. Segmental block retaining wall units shall be KEYSTONE or approved equal.
- B. All units shall be sound and free of cracks or other defects that would interfere with proper placing of the unit or significantly impair the strength or performance of the construction. Cracking or excessive chipping shall be grounds for rejection.
- C. Concrete used to manufacture segmental retaining wall units shall have a minimum 28-day compressive strength of 3,000 psi. The concrete shall have adequate freeze/thaw protection with a maximum moisture absorption rate, by weight of 8-percent.
- D. Segmental retaining wall units molded dimensions shall not vary in size by more than plus or minus 0.08-inches in width or plus or minus 0.04-inches in height from that specified by the manufacturer.
- E. Units shall be positively engaged to the unit below (use connection pins if required) so as to provide 0.75-inch to 1-inch horizontal setback.

2.02 LEVELING PAD MATERIAL

- A. As per manufacturer's recommendations.

2.03 MODULAR BLOCK UNIT FILL

- A. Use free draining crushed stone ½-inch to 1-inch with no more than 5-percent passing the No. 200 sieve, within the modular block units requiring fill material.

2.04 GEOGRID

- A. The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and retain its geometry under construction stresses and shall have high resistance to deformation under sustained long-term load. The geogrid shall be resistant to damage during construction, to ultraviolet degradation and to all forms of chemical and biological degradation encountered in the material being reinforced.
- B. Provide junction strength, minimum GRI-GG2 of 90-percent of ultimate strength.
- C. Provide maximum strain of 10-percent for tension creep test, 10,000 hours for 75-year design life, GRI-GG3.
- D. Provide a long-term allowable design load (100-year) of 1,350 pounds per foot.

2.05 SELECT BACKFILL MATERIAL

- A. Provide backfill free from organic and/or deleterious material conforming to the following gradation:

SIEVE SIZE	PERCENT PASSING
6-inch	100
3-inch	75-100
No. 40	0-60
No. 200	0-15

2.06 FIBERGLASS PINS

- A. If recommended by the manufacturer, provide fiberglass pins to interlock the units.

2.07 PORTLAND CEMENT CONCRETE

- A. Class AA (AE) Concrete.

PART 3 -- EXECUTION

3.01 FOUNDATION SOIL PREPARATION

- A. Excavate the foundation soil to the lines and grades shown in the Contract Documents or as directed by the Engineer.

- B. Fill the over-excavated areas with compacted select backfill material.

3.02 LEVELING PAD

- A. As per manufacturer's recommendations.

3.03 MODULAR BLOCK UNIT INSTALLATION

- A. Place the first course of concrete wall units on the leveling pad. Check the wall units for level and alignment. The first course is the most important to ensure accurate and acceptable results.
- B. Ensure units are in full contact with the leveling pad.
- C. Install connecting pins in modular block units if the manufacturer recommends them.
- D. For block units requiring fill material, fill all voids in block units with modular block unit fill. Tamp fill. Ensure each wall course is completely filled, backfilled and compacted prior to proceeding to the next wall course.
- E. Lay each course ensuring connecting pins protrude into adjoining courses above a minimum of 1-inch. Pull each block unit forward, away from the embankment, against connecting pins in the previous course and backfill as the course is completed. Repeat procedure to the extent of the wall height.
- F. As appropriate where the wall changes elevation, the units can be stepped with grade or turned into the embankment with a convex return end. Provide appropriate buried units on the compacted leveling pad in the area of the convex return end.

3.04 WALL CAP INSTALLATION

- A. Provide a permanent connection between the wall cap units and the top course of the wall units. Use an approved construction adhesive or epoxy for the connection.

3.05 GEOGRID INSTALLATION

- A. Install geogrid according to block manufacturer's recommendations.
- B. Lay the geogrid soil reinforcement horizontally on compacted backfill. Connect to the concrete wall units by hooking the geogrid over the connection pins if pins are required. Otherwise, connect as per the manufacturer's recommendations. Pull the geogrid taut and anchor it before backfill is placed on the geogrid.
- C. Remove the slack in the geogrid at the wall unit connection.
- D. Lay the geogrid at the proper elevations as indicated on the structural drawing.
- E. Verify the correct orientation (roll direction) of the geogrid.

- F. Pull the geogrid taut to eliminate loose folds and pretension the geogrid. Stake or secure the back edge of the geogrid before and during backfill and compaction.
- G. Follow the manufacturer's guidelines relative to overlap requirements of uniaxial and biaxial geogrids.

3.06 FILL PLACEMENT

- A. Place the backfill material in 8-inch lifts and compact.
- B. Place, spread and compact the backfill in a manner that minimizes the development of slack or loss of pretension of the geogrid.
- C. Use only hand-operated compaction equipment within 3-feet of the back surface of the block units.
- D. Place the backfill from the wall rearward into the embankment to ensure the geogrid remains taut.
- E. Do not operate tracked construction equipment directly on the geogrid. Before operation of tracked vehicles, a minimum backfill thickness of 6-inches is required over the geogrid. Keep to a minimum, the turning of tracked vehicles to prevent tracks from displacing the fill and damaging the geogrid.
- F. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds, less than 10 miles per hour. Avoid sudden braking and sharp turning.

*** END OF SECTION ***

SECTION 02279

SILT FENCE

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to install environmental fence.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Standard Drawing No. 5100 – Silt Fence

PART 2 -- PRODUCTS

2.01 FENCE

- A. Polyethylene, high density, UV stabilized
- B. Width – 48-inch minimum
- C. Tensile Strength – 300-lbs along outside edge minimum
- D. Aperture Size – 2-inches to 4-inches by 0.5-inches
- E. Color - Orange

2.02 METAL POSTS

- A. 59-inches to 71-inches long line post – T section
- B. Anchor plates optional
- C. Painted or galvanized

2.03 TWINE, WIRE OR PLASTIC TIES

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Prior to installation, the limits of disturbance for the project shall be surveyed by a licensed land surveyor to determine the location of the silt fence.
- B. Once the limits of disturbance have been surveyed and marked in the field, the Contractor is to then install the silt fence.
- C. Install per manufacturer's recommendations.

- D. Install posts at a spacing such that the fence does not sag more than 2-inches between posts.
- E. Weave the fence over the support post alternating every 2 loops and secure it to the posts with twine, wire or plastic ties.
- F. Inspect the fence weekly and submit the proper report to the City.
- G. Maintain the fence during construction
- H. Remove the fence and post upon completion of construction and dispose of them properly.

*** END OF SECTION ***

SECTION 02290
STORM DRAIN DETENTION BASIN
EMBANKMENT

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. This section covers the preparation and placement of fill for the construction of the proposed storm drain detention basin embankment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01500 – Temporary Construction Aids and Environmental Controls
- B. Section 02222 – Excavation and Backfill for Structures
- C. Section 02710 – Toe Drain
- D. Section 02720 – Storm Drain
- E. Section 02770 – High Density Polyethylene Liner

1.03 NOTIFICATION

- A. A minimum of 48 hours notice shall be provided to the Engineer to schedule inspection of the embankment foundation. Prior to the placement of embankment fill, the Engineer must approve the embankment foundation.

PART 2 -- PRODUCTS

2.01 EMBANKMENT FILL MATERIALS

- A. Embankment fill materials are to be from sources designated by the Engineer. Available soils for the embankment are detailed in the Geotechnical report for the project. Soils in this area are highly erodible and are to be protected from erosion during the construction.
- B. To protect the embankment from erosion, the embankment will be covered with topsoil meeting the topsoil specifications specified in Section 02925.

PART 3 -- EXECUTION

3.01 SITE PREPARATION

- A. All work within the project will be performed in accordance with any necessary permits.

- B. Site Dewatering: The toe drain and outfall line shall be constructed prior to construction of the embankment to provide for dewatering of the foundation.
- C. Prior to placing the embankment materials, the subgrade soils that contain a large amount of organics shall be removed from below the embankment areas. Care shall be taken not to disturb the natural soils below the embankment. The subgrade shall be scarified and recompact. Prior to placement of the embankment, the embankment foundation must be approved by the Engineer (see Section 1.03 – Notification).

3.02 EMBANKMENT FILL PLACEMENT

- A. Embankment fill soils shall be placed in 10-inch maximum loose lifts. The minimum dry density of the compacted fill soils shall be 95-percent of the maximum dry density of the soil as determined by ASTM D-698. The fill shall be compacted at a moisture content within 2-percent of the optimum moisture content as determined by ASTM D-698.
- B. No oversize or segregated material shall be placed so as to nest, or in such a way as to rest against any hard structural surface (such as any portions of the outlet primary spillway pipe or emergency spillway retaining wall).
- C. At least one in-place density test shall be performed for each lift of embankment fill. Any test, which indicates the fill does not meet the above, stated in-place density requirements shall be redone immediately after the fill area has been subjected to additional compaction by the Contractor. This procedure shall be followed until tests show that the lift has been compacted to the required density. Retests shall be marked as such.

*** END OF SECTION ***

SECTION 02291

EMBANKMENT

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to place materials from roadway excavation or borrow, in embankments, including but not restricted to compacting, shaping and maintaining as shown, as well as filling holes, pits and other depressions when unsuitable material has been removed.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02293 – Slope Contouring
- B. Section 0212 – Clearing, Grubbing and Stripping

PART 2 – PRODUCTS – Not Used

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Areas to receive compacted fill shall be stripped of all vegetation, organics and debris. Topsoil shall be stripped and stockpiled in an approved location. Any additional existing nonstructural fill materials and other unsuitable soils shall be excavated as directed by the City. All areas to receive compacted fill shall be observed by the City prior to placement of fill.
- B. Compacted fill soils shall consist of excavated on-site, non-expansive or blended soils, or imported soils approved by the City. All fill materials shall be free from organic matter and other deleterious material. All imported material shall be granular and nonexpansive with the liquid limit of the fines not exceeding 35 and the plastic index less than 15.
- C. Imported materials shall be evaluated and/or tested by the Engineer for conformance with the specifications prior to delivery to the site. The Contractor shall notify the City at least two working days prior to importing fill to the site.
- D. Do not disturb areas outside the limits established by environmental and silt fences without written approval. Submit a request in writing to the City.

3.02 EMBANKMENT

- A. Following the removal of unsuitable materials, subgrade soils surfaces that will receive compacted fill shall be scarified to a depth of at least 10-inches. The scarified soils shall be moisture-

conditioned to or slightly above optimum moisture content. Scarified soil shall be compacted to at least 90-percent relative compaction. Relative compaction is defined as the ratio of the in-place soil density to the laboratory maximum dry density as determined by the AASHTO T-180 test procedure.

- B. Compact the scarified subgrade to at least 90-percent of maximum laboratory density.
- C. In areas requiring embankment base stripping, the entire area receiving fill shall be stripped to the depth and limits shown in the Contract Documents. Once stripping is complete, the subgrade shall be scarified and compacted in accordance with Section 3.02.A.
- D. Spread embankment materials uniformly in layers not to exceed 10 to 12-inches (non-compacted) lifts and compact to at least 96-percent of maximum laboratory density before placing the next layer. Reduce the uncompacted fill thickness if tests shown unsatisfactory density.
- E. Pavement base and subbase materials shall be compacted to at least 96-percent of the AASHTO T-180 laboratory maximum density.
- F. All fill soils shall be compacted mechanically to the specified density.
- G. The City shall observe the placement of compacted fills and may conduct in-place field density tests periodically to verify compliance with these specifications.
 - 1. The Contractor shall provide level testing pads for the City to conduct field density tests on.
 - 2. The Contractor shall provide safe and timely access for the City's personnel throughout the project site for testing and observation purposes.
 - 3. Where compaction is not in compliance, appropriate steps shall be taken by the Contractor as necessary to bring the fill into compliance.
- H. At any location, where in the opinion of the City, an unstable condition is being created, the work shall not proceed until an investigation has been made and the grading plan revised, if necessary.
- I. Any rock or irreducible material 6-inches or larger shall not be placed in fills within 5 vertical feet of finished grade, within 10 horizontal feet of a slope face or near future utilities or underground construction. Disposal of the material shall be such that nesting does not occur and the material is completely surrounded by compacted fill.
- J. Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the Engineer indicate that the moisture content and density of the fill are as previously specified.
- K. Finish subgrade surface with 0.1-feet of line and grade.
- L. Route construction equipment uniformly over the layers to assist compaction.
- M. Do not use compacting equipment that causes shear failure in the embankment.
- N. Requirements for freezing or snowy conditions are as follows:
 - 1. Do not place embankment on frozen or snow covered areas.

2. Do not deliver or use frozen material in embankments.
3. The Contractor may remove snow and frozen material from embankments, foundations and borrow areas and furnish unfrozen embankment material that can be compacted to the specified density, but such work will be at the Contractor's expense. Remove, wastes and replace frozen material at no additional cost to the Contract.

3.03 DRAINAGE

- A. The Contractor shall grade and maintain the roadway to ensure adequate drainage
- B. Maintain pipe culverts and drainage ditches.
- C. Provide temporary facilities when interrupting irrigation systems, sewer, underdrainage, etc.
- D. Earth-moving and other construction operations shall be controlled to prevent water from running into excavated areas.
- E. Excess water shall be promptly removed and the site kept dry.

3.04 SUBSURFACE CONDITIONS

- F. In such case that the grading contractor encounters subsurface conditions at the site that are materially or otherwise different than those indicated in the Contract Documents, the grading contractor shall immediately notify the City or the City's representative verbally and in writing within 24 hours.

3.05 SUBDRAIN

- G. Subdrains shall be installed prior to fill placement.
- H. Subdrains shall be installed in canyons and ravines as shown in the Contract Documents.
- I. The clean-out and Subdrain area shall be observed and approved by the City prior to Subdrain installation. Subdrain installation may be modified by the City based on removal observations. Any modifications to the installation procedure or materials required shall constitute a change in scope in the Contact Documents.
- J. Discharge from subdrains shall be directed to a suitable nonerosive device. If the subdrain discharges into a storm drain, measures shall be taken to prevent storm drain water from backing up into the subdrain.

3.6 OVEREXCAVATION

- A. If clay or other unsuitable, expansive material is exposed once construction has begun, these materials shall be overexcavated 3-feet and replaced with compacted fill.

3.7 CUT/FILL TRANSITIONS

- A. Through all areas of cut/fill transitions, the entire cut portion of the cross-section shall be

overexcavated 3-feet below final grade and replaced with compacted structural fill to finish grade as shown in the Contract Documents.

3.08 CUT SLOPES

- A. The Engineer shall conduct geologic investigations and measurements of all cut slopes during excavation to observe if any adversely oriented planes of weakness are present.
- B. Use stabilization fills as directed by the Engineer to stabilize any adversely oriented planes of weakness.

3.09 FILL SLOPES

- A. In addition to normal compaction procedures, fill slopes should be properly compacted out to the slope face. To achieve this compaction, the Contactor may:
 - 1. Overbuild fill slopes and cut back to the compacted core, or
 - 2. Back-roll side slopes with sheepfoot rollers at increments of 2 to 3-feet in fill elevation gain, or
 - 3. Use other proven methods approved by the Engineer.
- B. Feathering of fills over the tops of slopes shall not be permitted.
- C. Keyways/Benching
 - 1. Where fills are placed on natural ground steeper than 5:1, the compacted fill shall be keyed and benched into firm material as indicated in the Contract Documents.
 - 2. The keyways shall be a minimum of 15-feet wide and at least 2-feet deep and shall carry a 2-percent slope from toe to heel.
 - 3. Benches shall be excavated into firm, competent soil to a depth of at least 4-feet. The Engineer shall approve all keyways and benches prior to fill placement.
- D. Backdrains
 - 1. At least one backdrain shall be placed at the heel of keyways where fill slopes exceed 25-feet vertically.
 - 2. Backdrains shall consist of 6-inch diameter (minimum) perforated pipe embedded in 3 cubic feet of gravel per linear foot of pipe, connected to a nonperforated outlet pipe.

3.10 STABILIZATION FILLS

- A. Need for stabilization fills will be determined by the Engineer during grading.
- B. Where required, stabilization fills shall be constructed as indicated in the Contract Documents. Existing slopes shall be cut back to 1:1. Normal fill procedures apply with a backdrain provided at the heel of the keyway, and every 25-feet vertically.
- C. Any stabilization fills that are required solely due to adversely oriented planes of weakness uncovered during excavation shall constitute a change in scope in the Contract Documents.

3.11 EROSION CONTROL

- A. Cut and fill slopes shall be graded and landscaped to reduce water-induced surficial erosion/sloughing. Permanent erosion control measures shall be implemented immediately after the completion of slope construction.
- B. All interceptor ditches, drainage terraces, down-drains and any other drainage devices shall be maintained and kept free of debris. Run-off shall be directed to a suitable nonerosive drainage device and shall not flow uncontrolled off-site.
- C. The Contractor shall implement additional short-term erosion control measures as directed by the Engineer to eliminate any observed significant erosion. Short-term non-plant erosion control measures shall be approved by the Engineer prior to installation.
- D. Erosion due to rodent burrowing, small concentrations of uncontrolled surface/subsurface water or poor compaction of utility trench backfill on slopes shall be repaired and controlled as soon as possible.
- E. All possible precautions shall be taken to maintain moderate, uniform soil moisture. Temporary irrigation systems shall be properly maintained and operated.
- F. If completion of new slopes occurs during the rainy season, contingency plans shall be developed to provide prompt temporary protection against any erosion or sloughing. Off-site improvements shall be protected from site run-off.
- G. Any erosion damage which occurs prior to the acceptance of the project shall be repaired by the Contractor.

*** END OF SECTION ***

SECTION 02293
SLOPE CONTOURING

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to excavate, blend and reshape the slopes as shown in the Contract Documents. The purpose of the slope contouring work is to create a blended and natural appearance on the finished slope that is similar to the adjacent and existing terrain.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02292 – Embankment Construction

PART 2 -- PRODUCTS – Not Used

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Use appropriate equipment to perform the work.
- B. Do not create unstable conditions as a result of the slope contouring.
- C. Reshape the slopes in designated areas prior to any topsoil placement.
- D. Coordinate slope-contouring work with the City. Make any adjustments necessary in equipment or methods that would minimize the work effort as directed by the City.

*** END OF SECTION ***

SECTION 02606

MANHOLES

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install precast manholes in the locations shown in the Contract Documents.
- B. This section covers the materials and installation of precast concrete manholes. Sizes and dimensions of manholes shall be as shown on the drawings. Refer to the Concrete Section for requirements of cast-in-place concrete bases for manholes.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03302 - Concrete
- B. Section 02204 - Earthwork
- C. Section 02667 - Hydraulic Structures and Pipeline Testing
- D. Section 02617 - Reinforced Concrete Pipe

1.03 REFERENCE DOCUMENTS

- A. City Storm Drainage and Flood Control Standards. Applicable requirements of appropriate subsections of the Draper City Storm Drainage and Flood Control Design and Construction Standards are hereby incorporated into these specifications:
- B. The requirements of this section are presented to supplement or supersede where noted the above listed subsections of the City Wastewater Standards. Except where it is noted that a particular requirement is superseded, cases where these specifications conflict with the incorporated City Wastewater Standards, the more stringent requirements providing for higher quality materials or workmanship, as interpreted by the Engineer, shall prevail.
- C. Commercial Standards.
 - ASTM C 478 Pre-cast Concrete Manholes
 - Federal Specification
 - SS-S-00210 Plastic Sealing Gasket

PART 2 -- PRODUCTS

2.01 PRECAST SECTIONS

- A. Manholes shall be constructed of precast concrete manhole rings set on a cast-in-place concrete base as shown. Precast concrete rings shall be manufactured by a process that will produce homogeneous

concrete ring meeting the requirements of the "Standard Specifications for Precast Reinforced Manhole Sections" (ASTM C 478-78). Manhole rings shall have a minimum wall thickness of 4-inches if steel reinforced and 6-inches if not reinforced. Cement used in manufacturing the rings shall be Type V as specified in the "Standard Specifications for Portland Cement" (ASTM C 150). Each ring shall have tongue-and-groove end sections cast into the top and bottom. The manufacturer of manhole rings shall be approved by the City.

- B. Frames and Covers. Castings for manhole frames and covers shall conform to the requirements of the "Standard Specifications for Gray Iron Castings", Class 35 (ASTM A 48). The bearing surfaces of the frames and covers shall be machined, and the cover shall seat firmly into the frame without rocking. Both frames and covers shall be dipped in commercial quality asphalt paint. Castings shall be marked to meet the Owner's requirements.

Manholes shall have watertight frames and bolt-down covers with stainless steel cap screws and a composition gasket. Watertight manhole frames and covers shall be Alhambra Foundry Company Model A-1254 B-6, or equal.

- C. Steps. Manhole steps, where specifically shown on the Drawings, shall be fabricated of 3/4-inch stainless steel or steel reinforced plastic, and internally cast into the manhole concrete sections. Maximum spacing between steps shall be 15-inches or as required by Cal OSHA or local codes.

2.02 INTERIOR COATING

- A. Manhole Interior Coating: Coating shall be a polymorphic resin as manufactured by Integrated Environmental Technologies or approved equivalent. Such coating system shall be as detailed in "Specification 3000" for "Manhole Renovation & Protection" as published by Integrated Environmental Technologies, a copy of "Specification 3000" is appended at the end of this specifications.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Precast manhole sections shall be installed as shown on the Plans. All manholes shall be installed to have watertight barrel sections and inlet-outlet connections. Manholes in areas subject to inundation shall have watertight frames and covers. Manhole rings shall be jointed together with a non-butyl bitumen sealant, which meets the requirements of AASHTO specification M198-75, Type R, such as Ram-Nek, as manufactured by K.T. Snyder and the joints shall be watertight. An enamel pore sealer such as Ram-Nek Primer, or equal, shall be applied to both the tongue and groove ends of each manhole ring before it is shipped from the factory. The non-butyl sealant shall be applied in sufficient volume such that when the mating surfaces are joined, visible evidence of sealant squeeze-out is observed continuously around the outside circumference of each joint. The first precast section shall be set on the cast-in-place monolithic base before the base has taken initial set, or the section shall be mortared into a suitably shaped groove formed in the top of the monolithic base. The first section shall be brought to true grade and alignment with all inlet pipes properly installed to form an integral, watertight unit.

Flow channels through the base of the manhole shall be made to conform accurately to the sewer grade, and alignment shall be merged smoothly with well-rounded junctions. Channel sides shall be brought vertically to the crown elevation, and the shelf shall be smoothly finished to the indicated slope.

Pipe connections to manholes shall be water tight and one of two types: (1) rigid, non-plastic pipe shall be cast into the base and shall be provided with flexible joints within 12 inches of the manhole wall, and such pipe connections within the manhole zone shall be bedded on a firm compacted foundation; (2) connections for flexible and semi-rigid plastic pipe shall be provided with a rubber water stop cast into the concrete base to form a water tight joint that permits longitudinal pipe movement. Drawings and samples of manhole water stops and gaskets for flexible pipe connections shall be submitted to the ENGINEER for review as required by the Section entitled "Contractor's Submittals." Installation of flexible pipe connection materials shall be per manufacturer's instructions.

Foundation bedding and backfill for manholes shall meet the most stringent requirements for those pipes entering the manhole as specified in Section 02200.

3.02 INTERIOR COATING

- A. Manhole Interior Coating. The interior of all new manhole sections shall be lined with a polymorphic resin coating system. The application of this coating system shall be as detailed in "Specification 3000" for "Manhole Renovation & Protection" as published by Integrated Environmental Technologies, a copy of "Specification 3000" is appended at the end of this specifications. The specified mechanical application of the coating system may be waived providing skilled workmen, with prior experience in applications of polymorphic resin coatings, by other means, are used Documentation of workmens' experience will be required.

3.03 TESTING

Manholes shall be tested as required in Section 02667.

*** END OF SECTION ***

SECTION 02617

REINFORCED CONCRETE PIPE

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish, install, and test all reinforced concrete culvert and storm drain pipeline, complete in place, including connection to existing and new structures, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Construction of catch basins and headwalls shall conform to the requirements of Section 03300 entitled, "Cast-in-Place Concrete," Section 03304 "Minor Concrete," and Section 03480 "Precast Concrete Specialties," as applicable.
- B. Trenching and backfilling shall conform to the requirements of Section 02200 "Earthwork."
- C. Manhole construction shall conform to the requirements of Section 03480 "Sewerage and Drainage System Appurtenances."
- D. Field testing shall conform to the requirement of Section 02750 "Storm Drainage System Testing."

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to or exceed the applicable requirements of the referenced standards; provided, that wherever the provisions of said publication are in conflict with the requirements specified herein, the more stringent requirement shall apply.

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall furnish certificates to the Engineer guaranteeing that the pipe furnished hereunder is in compliance with the requirements of these Specifications.
 - 1. Commercial Standards:
 - ASTM C33 Specifications for Concrete Aggregate
 - ASTM C76 Specification for Reinforced Concrete Culvert Storm Drain and Sewer Pipe
 - ASTM C150 Specifications for Portland Cement
 - ASTM C443 Specifications for Rubber Gaskets

PART 2 -- PRODUCTS

2.01 PIPE MATERIALS

- A. Reinforced Concrete Pipe: Reinforced concrete pipe shall conform to the requirements of ASTM Designation C 76-82b with Type V cement; provided that pipe shall have tongue and groove joint designated to be self-centering and to leave a recess on the inside of the pipe for pointing with mortar after jointing. Pipe shall be designated for an internal pressure of 25-feet of water, and an external load of 1500-D.
- B. Cement Mortar: Cement mortar shall consist of a mixture of portland cement, sand, and water. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.
- C. Cement mortar shall be designated by class and proportioned by loose volume in the proportion of 1 part cement and 2 parts sand.
- D. The quantity of water to be used in the preparation of mortar shall be only that required to produce a mixture sufficiently workable for the purpose intended.
- E. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Retempering of mortar will not be permitted.
- F. Cement, sand, and water for cement mortar shall conform to the requirements of Section entitled, "Cast-in-Place Concrete."
- G. Admixtures: No admixture shall be used in mortar unless otherwise specified or accepted by the Engineer.
- H. Quick Setting Grout: Quick setting grout shall be a high strength, non-staining grout approved by the Engineer prior to use. It shall reach an initial set within 90 minutes at 70 degrees F (21 degrees C) and shall reach minimum compressive strength of 2,500 psi (17mPa) within 24 hours. Shrinkage shall be less than 0.1 percent when tested, using the test procedures of ASTM C 596-82. The grout shall be mixed, handled, and placed in accordance with the manufacturer's written instructions.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. The pipe shall be placed with the minor axis of the reinforcement in a vertical position. Mortar for jointing pipe shall be composed of 1 part of cement and 2 parts of clean, well-graded sand of such size that all will pass a No. 8 sieve. The consistency of laying mortar shall be such that it will adhere to the ends of the pipe while being laid and be easily squeezed out of the joint when the pipe while being laid and be easily squeezed out of the joint when the pipe sections are pressed together. Pointing and bonding mortar shall be plastic and of such consistency that it will readily adhere to the pipe.

- B. In advance of jointing sections of concrete pipe, the ends of each section shall be washed clean with a wet brush and, immediately prior to placing mortar and jointing the sections, the ends shall be thoroughly wetted. After laying, the joints on the inside shall be swabbed smooth, and all excess mortar shall be removed from the pipe, after which backfilling shall be performed.
- C. Backfill over the pipe shall not be commenced within 16 hours of jointing pipe sections. Care shall be used to make sure that the bottom of the pipe is in contact with the bottom of the trench for the full length of each section.

*** END OF SECTION ***

SECTION 02667

HYDRAULIC STRUCTURES AND PIPELINE TESTING

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall perform all cleaning, flushing, and testing, including conveyance of test water from source to point of use, and including all disposal thereof, complete and acceptable, for hydraulic and appurtenant piping all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Testing of pipeline except appurtenant piping to the hydraulic structure(s) shall be tested according to the applicable provisions of the pipe schedule in the Drawings and by this reference thereto, said provisions shall be a part of this Section. The CONTRACTOR shall provide all temporary closure fittings necessary to test pipelines. This shall include plugs, bulkheads, valves, caps or welded plates on steel pipes.
- B. Repair of hydraulic structures, as required, shall conform to the provisions of Section entitled, "Cast-in-Place Concrete."

1.03 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit minimum 48-hour advance written notice of its proposed testing schedule for review and concurrence of the ENGINEER. The Contractor's proposed plans for water conveyance, control, and disposal shall also be submitted in writing.

PART 2 -- PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. Temporary valves, bulkheads, or other water control equipment and materials shall be as determined by the CONTRACTOR subject to the Engineer's review. No material shall be used which would be injurious to the construction or its future function.

PART 3 -- EXECUTION

3.01 GENERAL

- A. The CONTRACTOR shall make all necessary provisions for providing testing water for the project. CONTRACTOR shall also make all necessary provisions for conveying the water from

the source to points of use and for disposing of the water upon completion of testing.

- B. All hydraulic structures and appurtenant piping shall be tested. All testing operations shall be done in the presence of the ENGINEER.
- C. If industrial paint finishes or other protective coatings are to be applied to the surfaces of the hydraulic structure, such coatings shall be applied after all testing operations have been completed.
- D. Release of water from structures, after testing has been completed, shall be approved by the ENGINEER.

3.02 PRELIMINARY CLEANING AND FLUSHING

- A. Prior to testing, all hydraulic structures shall be cleaned by thoroughly hosing down all surfaces with high-pressure hoses and nozzle of sufficient size to deliver a minimum flow of 50-gpm.

3.03 TESTING OF HYDRAULIC STRUCTURES

- A. General. Testing shall be performed prior to backfilling, except where otherwise permitted by the ENGINEER. Testing shall not be performed sooner than 14 day after all portions of structure walls have been completed. The test shall consist of filling the structure with water to the maximum operating water surface. The rate of filling shall not exceed 24 inches of depth per day.
- B. Leakage Test and Repairs. After the structure has been filled, the leakage test shall be performed as follows: An initial water level reading shall be made. Seven days following the initial reading, a second reading shall be made. The structure shall be considered to have passed the test if water loss during the 7-day period, as computed from the 2 water level readings, does not exceed 0.7 percent of the total volume of water in the structure, after allowance is made for evaporation loss. Should the structure fail to pass the test, the test shall be repeated for up to 3 additional 7-day test periods. If at the end of 28 days, the structure still fails to pass the leakage test, the CONTRACTOR shall empty the structure as approved by the ENGINEER and shall examine the interior for evidence of any cracking or other conditions that might be responsible for the leakage. Any cracks shall be "vee'd" and sealed with rubber sealant in accordance with the manufacturer's recommendations. Any evidence of leakage through the joints shall be repaired. Following these operations, the CONTRACTOR shall again test the hydraulic structure.

3.04 TESTING OF APPURTENANT PIPING

- A. Piping appurtenant to hydraulic structures shall be tested as specified in the Piping Schedule in the Contract Documents.

*** END OF SECTION ***

SECTION 02710

TOE DRAIN

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to install all pipe, fittings, closure pieces, gaskets, jointing material, non-woven geotextile filter fabric, granular filter material and appurtenances as shown and specified and as required for a complete and workable toe drain system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02222 – Excavation and Backfill for Structures
- B. Section 02712 – Storm Drainage System

1.03 REFERENCES

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

AWWA M 23	Manual of Water Supply Practices – PVC Pipe – Design and Installation
ASTM D 422	Particle-Size Analysis of Soils
ASTM D 698	Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.5-kg) Rammer and 12-inch (305 mm) Drop
ASTM D 2321	Recommended Practice for Installation of Corrugated Polyethylene Pipe
ASTM D 3034	Standard Specifications for Sewer Pipe and Fittings
AASHTO M 252	Corrugated Polyethylene Drainage Tubing

1.4 SUBMITTALS

- A. Submittals required for pipe, filter fabric and granular filter material.

PART 2 – PRODUCTS

2.1 PIPING

- A. Perforated toe drainpipe shall be corrugated polyethylene pipe conforming to AASHTO M 252 with nominal perforations of 2-square inches per foot.

2.2 NON-WOVEN GEOTEXTILE FABRIC

- A. The geotextile filter fabric shall be Polyfelt TS 700 non-woven geotextile fabric manufactured by Polyfelt, Inc. or approved equal.

2.3 GRANULAR FILTER MATERIAL

- A. Granular filter material shall be free draining material, clean, hard, tough, durable and sound mineral aggregate that consists of crushed stone, or crushed gravel; free of deleterious and organic matter; and shall comply with the following:
1. Rodded weight: Not less than 75 pounds per cubic foot
 2. Material passing No. 40 sieve: Nonplastic
 3. Meet the following gradation as shown in the following table

GRANULAR FILER MATERIAL GRADATION	
SIEVE SIZE (Square Opening)	PERCENT BY WEIGHT PASSING SCREEN
2-inch	100
1 1/2 -inch	70-100
1-inch	60-90
3/4-inch	55-80
3/8-inch	20-60
No. 4	0-25
No. 8	0-5
No. 200	0-3

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Excavation shall be performed to the lines and grades indicated. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29 CFR 1926).
- B. Dewatering shall be accomplished in accordance with Section 01525 Temporary Construction Aid and Environmental Controls. The Contractor shall provide and maintain at all times, ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.
- C. The geotextile filter fabric shall be installed in the manner recommended by the manufacturer at the locations shown in the Contract Documents. A minimum of 12-inches of overlap shall be provided at seams. Fabric shall not be exposed to the sun for longer than 72 hours unless the filter fabric has ultraviolet inhibitors.
- D. The toe drainpipe shall be encased in granular filter material and installed in accordance with ASTM D 2321 Recommended Practice and as shown in the Contract Documents. The pipe shall be plugged at the end of each workday, or period of work suspension.

3.2 PRELIMINARY CLEANING AND FLUSHING

- A. The Contractor shall flush the toe drain as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipelines. If possible, the flushing shall be made with an open pipe end.

*** END OF SECTION ***

SECTION 02712

STORM DRAINAGE SYSTEM

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This section covers the work necessary to furnish, excavate, install, backfill and complete storm drain lines at the locations shown in the Contract Documents and as specified herein, to the lines and grades specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02222 – Excavation and Backfill for Structures
- B. Section 02712 – Storm Drainage System
- C. Section 02291 – Embankment
- D. Section 02710 – Toe Drain
- E. Section 02617 – Reinforced Concrete Pipe

1.03 REFERENCES

- A. Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

ASTM C 76	(1989) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM D 422	Particle-Size Analysis of Soils
ASTM D 698	Test Method of Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb (2.5-kg) Rammer and 12-inch (305 mm) Drop
ASTM D 2487	Classification of Soils for Engineering Purposes
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS

- A. The following submittals shall be submitted:
- 1. Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.

PART 2 – PRODUCTS

2.01 PIPE BACKFILL

- A. Selected backfill shall consist of granular material having stones no greater than 2-inches for bedding

concrete pipe and 1/2-inch for bedding polyvinyl chloride pipe. All backfill material shall be free of frozen material, organic material and debris.

- B. Backfill placed above 6-inches over the pipe up to the level of the embankment foundation shall be native material having no stone larger than 4-inches in diameter.

2.02 PIPE FOR STORM DRAIN

- A. Pipe for storm basin detention basin outlet shall be ASTM C76 Class III.

2.03 MISCELLANEOUS MATERIALS

- A. Concrete: Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 4,000 psi concrete under Section 03300 – Cast-in-Place Concrete.
- B. Manholes or clean-outs shall conform to Draper City standard drawings. In addition, clean-outs shall be provided with bolt and restraining strap system to withstand an upward surcharge pressure of 1,000 pounds.

PART 3 -- EXECUTION

3.01 EXCAVATION

- A. The toe drainpipe shall be encased in granular filter material and installed in accordance with ASTM D 2321 Recommended Practice and as shown in the Contract Documents. The pipe shall be plugged at the end of each workday, or period of work suspension.

3.02 SAFETY

- A. The Contractor shall flush the toe drain as the work progresses by a means in accordance with good practice to insure that sand, rocks, or other foreign material are not left in any of the pipelines. If possible, the flushing shall be made with an open pipe end.

3.03 TRENCH WIDTH

- A. The bottom of the trench shall have a minimum width equal to the outside diameter of the pipe plus 24-inches or as detailed on the drawings.
- B. The width of the trench shall be ample to permit the pipe to be laid and jointed properly and the backfill to be placed as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting and bracing and the handling of special units as necessary.

3.04 TRENCH PREPARATION

- A. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. The trench wall shall be so braced that the workmen may work safely and efficiently. All trenches

shall be drained so the pip laying may take place in dewatered conditions.

- B. The trench bottom shall be given a final trim using a string line, laser or other method approved by the City for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the joining to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding-laid pipe joint, without lifting the pipe above the grade and without exceeding the permissible joint deflection.
- C. Pipe shall be bedded a minimum of 6-inches with sand or gravel in unstable ground areas or through rock excavation as directed by the City.

3.05 REMOVAL OF WATER

- A. Dewatering shall be accomplished in accordance with Section 01525 - Temporary Construction Aids and Environmental Controls. The Contractor shall provide and maintain at all times ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.
- B. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. No water shall be drained into work built or under construction without prior consent of the City.
- C. Dewatering shall be accomplished by well points, sumping, or any other acceptable method, which will insure a dewatered trench. Any dewatering method shall be subject to the approval of the City.

3.06 LAYING JOINING CONDUIT

- A. Laying conduit: Provide proper facilities for lowering pipe sections into place. Dropping pipe will not be permitted. Place each section true to line and gradient in close and true contact with adjacent sections.
- B. Joining Conduit: Use methods of joining conduit sections insuring ends are fully entered and inner surfaces flush and even. The equipment used to force the joints together must be adequate to overcome the gasket pressure involved.

Just prior to joining the pipes, both spigot and bell ends shall be thoroughly cleaned with a wire brush to remove all foreign substances which may have adhered to the bell and spigot surfaces. All dust and dirt shall be removed with a clean rag. A lubricating solution, which is not injurious to the gasket or concrete, such as flax soap, or water glass, shall be liberally applied to the gasket groove and to the entire surface of belling ring. Following this operation, a thin film of lubricant shall be applied to the gasket which shall then be snapped into place in the groove, after which a small diameter smooth steel rod shall be inserted between the gasket and groove and run completely around the gasket to equalize the gasket tension.

In the event any foreign material becomes embedded in the lubricant, or the lubricant becomes contaminated by water or other substance before the joint is started, the area affected shall be re-

cleaned and new lubricant applied.

The pipe being jointed shall be carefully moved into position, line and grade checked and as the spigot end is started into the bell, or the section previously laid, the gasket shall be checked to insure uniform entry into the bell at all points.

3.07 PIPELINE TRENCH BACKFILL

- A. Pipeline trenches shall be backfilled to a level 6-inches above the top of pipe with select native material having stones no greater than 2-inches in diameter for concrete pipe or in accordance with manufacturer's recommendations, whichever is smaller. Such material shall be compacted to 95-percent of maximum Standard Proctor density (ASTM D698) in a maximum of 6-inch lifts.
- B. After the pipe has been installed and approved and the initial portion of backfill has been placed as specified above, backfilling of the remainder of the trench may proceed. Compaction shall be by mechanical tamping in 12-inch maximum lifts. All backfill material shall be free of frozen material, organic material and debris. Backfill placed above 6-inches over the pipe in unimproved areas shall be compacted to 90-percent of the maximum Standard Proctor density (ASTM D 698). No backfill material in the remainder of the trench shall have rocks larger than 4-inches in diameter.

3.08 MAINTENANCE OF BACKFILL

- A. All backfill shall be maintained in satisfactory condition, and all places showing signs of settlement shall be filled and maintained during the life of the contract and for a period of one year following the day of final acceptance of all work performed under the Contract Documents. When the Contractor is notified by the City or the Developer that any backfill is hazardous, the Contractor shall correct such hazardous condition at once. Any utility, road and/or parking surfacing damage by such settlement shall be repaired by the Contractor to the satisfaction of the Developer and City. In addition, the Contractor shall be responsible for the cost of such repair of all claims for damage filed with the Court; actions brought against the said Developer or City, for, and on account of such damage.

3.09 FINISH GRADING, CLEANUP

- A. The Contractor shall grade the trench line to a smooth grade to affect a neat and workmanlike appearance of the trench line.
- B. All tools, equipment and temporary structures shall be removed. The Contractor shall remove all excess dirt and rubbish from the site.

3.10 COMPACTION TESTS

- A. Field density tests shall be made in accordance with ASTM D 698.
- B. The cost of field density tests will be borne by the Contractor.

*** END OF SECTION ***

SECTION 02750

SANITARY AND STORM DRAINAGE SYSTEM TESTING

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall perform all pipeline flushing and testing, complete, for sanitary sewerage and storm drainage system piping as specified herein and in accordance with the requirements of the Contract Documents.
- B. The CONTRACTOR shall be responsible for conveying test water from the Owner-designated source to the point of usage and also for disposal, as required, of water used in the testing operations.

1.02 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit minimum 48-hour advance written notice of its proposed testing schedule for review and concurrence of the ENGINEER. The CONTRACTOR's proposed plans for water conveyance, control, and disposal shall also be submitted in writing.

PART 2 -- PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. Temporary valves, bulkheads, or other water control equipment and materials shall be as determined by the CONTRACTOR subject to the ENGINEER's review. No materials shall be used which would be injurious to pipeline structure and future function.

PART 3 -- EXECUTION

3.01 GENERAL

- A. Unless otherwise provided herein, water for testing will be furnished by the OWNER; however, the CONTRACTOR shall make all necessary provisions for conveying the water from the OWNER-designated source to the points of use.
- B. Release of water from pipelines, after testing has been completed, shall be performed as reviewed by the ENGINEER.
- C. All testing operations shall be performed in the presence of the ENGINEER.

3.02 TESTING OF PIPING

- A. General: All gravity sewer pipes and service laterals shall be tested for exfiltration and/or infiltration and deflection as specified herein. All manholes shall be tested for leakage as required herein. Manholes shall be tested prior to backfill placement, whereas all pipe shall be backfilled prior to testing. Any pipe, lateral or manhole found to be defective shall be repaired or replaced to the satisfaction of the ENGINEER.
- B. Leakage Tests: All gravity sewer pipes shall be tested for leakage by one of the following three test methods as directed by the ENGINEER and following the specific procedures outlined in the referenced sections of the "Standard Specification for Public Works Construction" (SSPWC) 1985 edition:
1. Water Exfiltration Test Section 306-1.4.2
 2. Water Infiltration Test Section 306-1.4.3
 3. Air Pressure Test Section 306-1.4.4
- C. Deflection Test: All flexible and semi-rigid pipe shall be tested for deflection, joint displacement, or other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30 days after completion of the trench backfill, but prior to any resurfacing. The mandrel test shall comply with the specific procedures required in Section 306-1.4.6 of the SSPWC, except for the additional provision that the mandrel shall be a full circle, solid cylinder, or a rigid, non-adjustable, odd-numbered leg (9 leg minimum) steel cylinder, approved by the ENGINEER as to design and manufacture.
- D. Manhole Leakage: Manholes shall be tested for leakage after installation, but prior to being backfilled. All pipes entering the manhole shall be sealed at a point outside the manhole walls so as to include testing of the pipe-manhole joints. The manhole shall be filled with water to a level 2 inches below the top of the frame. The water shall be allowed to equilibrate for 24 hours and then the level should be readjusted and marked. The water-filled manhole shall be allowed to sit for 3 days, after which the water level shall be measured. The water loss, adjusted for evaporative loss, shall not exceed 0.5 percent of the total volume. The exterior of the manhole shall be inspected daily during this period for visible evidence of leakage. Visible moisture, sweating, or beads of water on the exterior of the manhole shall not be considered leakage, but any water running across the surface will be considered leakage and shall be repaired to the satisfaction of the ENGINEER regardless of the volume of water lost.

*** END OF SECTION ***

SECTION 02771

HIGH DENSITY POLYETHYLENE LINER

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. This section covers the manufacture, supply, and installation of the 60 mil HDPE liner and SLT HDPE PolyLock materials.

1.02 RELATED WORK AND REFERENCES

- A. Section 02222 - Excavation and Backfill for Structures
- B. Section 02224 - Embankment
- C. Section 02710 - Toe Drain
- D. Section 03300 - Cast-In-Place Concrete

1.03 REFERENCES

- A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. American Society of Testing and Materials (ASTM)
 - ASTM D 638 Standard Test Method for Tensile Properties of Plastics
 - ASTM D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers By Impact
 - ASTM D 792 Standard Test Method for Specific Gravity and Density of Plastics by Displacement
 - ASTM D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
 - ASTM D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
 - ASTM D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastomer
 - ASTM D 1505 Test Method for Density of Plastic by the Density-Gradient Technique
 - ASTM D 1593 Specification for Nonrigid Vinyl Chloride Plastic Sheeting
 - ASTM D 1603 Test Method for Carbon Black in Olefin Plastics
 - ASTM D 1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
 - ASTM D 3015 Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds
 - ASTM D 4437 Practice for Determining Integrity of Field Seams Using Joining Flexible Polymeric Sheet Geomembranes
- C. Federal Test Method Standards
 - 101C Puncture Resistance.
- D. National Sanitation Foundation (NSF)

1.04 DEFINITIONS

- A. Batch: A quantity of resin usually the capacity of one rail car, used in the fabrication of high density polyethylene geomembrane roll. The finished roll will be identified by a roll number corresponding to the resin batch used.
- B. Bridging: When the geosynthetic is not in contact with the underlying material.
- C. Film Tearing Bond (FTB): A failure in the ductile mode of one of the bonded sheets by tearing prior to complete separation of the bonded area.
- D. Geomembrane Manufacturer: The party responsible for producing geomembrane rolls from resin, and for providing the materials warranty upon completion of the project.
- E. Geosynthetics Quality Assurance Laboratory (Testing Laboratory): Party responsible for conducting laboratory tests on samples of geosynthetics obtained at the site.
- F. Geomembrane Subgrade: Material surface upon which geomembrane will be placed.
- G. Installer: The party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining and anchoring (against wind) and other applied forces, and installing the geomembrane. The Installer is also the party responsible for testing, observation and reporting, and for providing the Installer's Warranty upon completion of the project.
- H. Panel: The unit area of geomembrane that will be seamed in the field. If geomembrane is not fabricated into panels in the factory, a panel is identified as a roll or portion of a roll that is larger than five (5) lineal feet.
- I. Quality Assurance (QA): The manufacturer's method of assuring quality in product manufacturing

1.05 LINER MANUFACTURER QUALIFICATIONS

- A. To demonstrate an ability to manufacture geomembrane sheeting, the HDPE Manufacturer shall submit to the engineer a list of at least five previous projects for which the manufacturer provided HDPE liner. For each project, the following information shall be provided; name and purpose of project, location, date, name of client, client contact, client phone number, installer, thickness of liner, and surface area. The above list shall be provided to the Engineer at the time of Bid Submittal.
- B. The following is a partial list of manufacturer for HDPE liner products
 - 1. SLT North America, Inc.
200 South Trade Center Parkway
Conroe, Texas 77385
1-800-231-1298
 - 2. Gundle Lining Systems, Inc.
19103 Gundle Road
Huston, Texas 77073
1-800-435-2008

3. Polyflex, Inc.
200 West Marshall Drive
Grand Prairie, Texas 75051
1-800-527-3322
4. National Seal Company
1245 Corporate Blvd.
Aurora, Illinois 60504
1-708-898-1161

1.06 LINER INSTALLER QUALIFICATIONS

- A. The geomembrane Installer shall be trained and qualified to install the type of HDPE geomembrane to be used for this project. The installer shall be an approved and/or licensed installer of the HDPE Manufacturer. A copy of the Manufacturer's approval letter or the Installer's license shall be submitted to the Engineer at the time of Bid.
- B. The Installer shall submit to the Engineer at the time of Bid a list of at least five previous installations. For each installation the following information shall be provided; name and purpose of project, location, date, name of client, client contact, client phone number, installer, thickness of liner, and surface area.
- C. To demonstrate the quality of the Installer's warranty, the Installer shall provide references for three previous projects that required warranty work. The list shall include the client's name, a client contact, and the client's contact phone number. This list shall be presented to the Engineer at the time of Bid.
- D. The Installer shall be approved by the Engineer prior to installation of any geomembrane materials.

1.07 LINER MANUFACTURER SUBMITTALS

- A. Resin Data:
 1. Manufacturers published material properties and QA specification requirements for resin materials.
 2. Quality Control/Quality Assurance Certificates shall be submitted for each lot of resin issued by the resin Supplier for the specific material for this project, and shall be submitted two (2) weeks prior to delivery of the geomembrane.
 3. Certification that all resin is from the same supplier and meets the manufacturers published material property and QA specification requirements as well as the specification requirements referenced herein, shall be submitted two (2) weeks prior to installation of any geomembrane.
- B. Geomembrane Rolls:
 1. Manufacturers published material properties and QA specification requirements for geomembrane products.
 2. One HDPE Roll Quality Control Certificate shall be provided if the rolls of material supplied to the project were produced consecutively. This certificate shall be supplied only for the individual HDPE rolls sampled and tested by the Manufacturer or his representative. An individual Quality Control Certificate shall be provided for each roll of HDPE material

provided to the project, which was not produced consecutively within a lot of twenty-five thousand (25,000) square feet. Quality Control Certificates shall be submitted two (2) weeks prior to installation of geomembrane and shall state that the geomembrane meets manufacturers published material properties and QA specification requirements as well as the specification requirements contained herein. The certificates shall include:

- a. Thickness
 - b. Tensile Strength at Yield
 - c. Tensile Strength at Break
 - d. Percent Elongation at Yield
 - e. Percent Elongation at Break
 - f. Carbon Black Content
3. HDPE material shall not be accepted and/or incorporated into the project without the approved quality control documentation.
 4. Certification stating that all geosynthetic rolls are furnished by one manufacturer and shall be submitted two (2) weeks prior to installation of geomembrane.
 5. Certification correlating resin to the individual HDPE rolls and extruded materials shall be submitted two (2) weeks prior to installation of geomembrane.
 6. Statement certifying that no reclaimed polymer is added to resin (product run may be recycled) shall be submitted two (2) weeks prior to installation of geomembrane.

C. Extruded Rods or Beads:

1. Statement certifying that all extrudate is from one Manufacturer, is the same resin type, and was obtained from the same resin supplier as the resin used to manufacture the geomembrane rolls.

1.8 LINER INSTALLER SUBMITTALS

A. Prior to Commencement of Work: The following pre-construction submittals shall be received by the Engineer a minimum of two (2) weeks prior to commencement of geomembrane installation.

1. Provide resumes of supervisor / field engineer, master welder, and all personnel performing field seaming operations a minimum of three (3) weeks prior to installation of the geomembrane.
 - a. Installation supervisor / field engineer shall have worked in a similar capacity on at least 2 jobs.
 - b. The master welder shall have completed a minimum of 5,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for use on this project.
 - c. Other welding technicians shall have installed a minimum of 1,000,000 square feet of geomembrane.
 - d. Installation personnel not meeting the above mentioned pre-qualifications may be used with the written authorization of the Engineer.
 - e. Statement from the manufacturer certifying that the HDPE liner material can be welded to the PolyLock material and provide welds of equivalent integrity to the welds between HDPE liner panels.

B. Submittals by Installer During Project:

1. Daily Quality Control documentation shall be legibly recorded by the Installer during installation of the HDPE and shall be submitted to the Engineer on a daily basis. The information to be recorded and provided to the Engineer shall include:
 - a. INSTALLER'S DAILY ACTIVITIES – List all liner placement activities and record defects discovered during handling and deployment of geosynthetics. Discuss problems encountered during installation and resolutions of the problems.
 - b. HDPE LINER INSTALLATION PRE-WELD TEST SEAM DATA – Include the time, welder's name, machine number, extrudate / tip temperature (°F), type of test, results and comments.
 - c. ROLL INSPECTION – Include roll number, inspection date of the deployed roll, results and comments.
 - d. SEAM INSPECTION – Include seam number and location, date welded, observed defects, corrective action and comments.
 - e. EXTRUSION WELD – Include seam number and location (or patch / cap number and location), date welded, welding machine number, welding technician and comments.
 - f. HOT WEDGE WELD – Include seam number and location (or patch / cap number and location), date welded, welding machine number, welding technician and comments.
 - g. NON-DESTRUCTIVE TESTING FOR EXTRUSION WELD (VACUUM TEST) – Include seam / panel number and location (or patch / cap number and location), test date, test results, corrective action and comments.
 - h. NON-DESTRUCTIVE TESTING FOR HOT WEDGE WELD (PRESSURIZED AIR CHANNEL TEST) – Include seam / panel number and location (or patch / cap number and location), test date, test results, corrective action and comments.
 - i. HDPE LINER – DESTRUCTIVE SEAM TESTING – Include sample number; seam number; location; weld date; machine number; type of test; test date and test results (for both field and lab testing), corrective actions and comments.
 - j. SUBGRADE SURFACE ACCEPTANCE – To be documented for each area to be covered by the lining system. Commencement of installation shall indicate Installer's acceptance and approval of existing surface conditions

C. Submittals by Installer Upon Completion of Project:

1. A complete copy of all quality control and quality assurance testing performed during installation of the geosynthetics.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Transportation: Transportation of the geomembrane rolls or panels shall be the responsibility of the liner Installer and / or Manufacturer.
- B. Delivery: Off-loading and storage of the geomembrane shall be the responsibility of the liner Installer. Off-loading of all geomembrane materials shall be performed in the presence of the engineer's representative. A complete inventory of materials will be performed by the Installer upon their receipt at the construction site, at which time all damaged rolls, and rolls which are not properly labeled will be separated from the undamaged rolls. Damage shall include, but shall not be limited to physical damage to the material resulting directly from equipment during the off-loading, site transportation, deployment processes, or indirectly from leakage or spillage of any fluids on the material. The installer shall be responsible for the replacement of damaged or

unacceptable materials at no additional cost.

- C. Storage of Materials: the Owner shall provide a storage area on site. The storage of HDPE materials shall be the complete responsibility of the Installer. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud mechanical abrasions, excessive heat or other damage. Rolls of HDPE materials shall be stored on a regular, flat, rigid prepared surface (not wooden pallets). The Installer shall be responsible for any damages to the materials resulting from improper storage.
- D. On Site Handling: The Installer shall use appropriate handling equipment to load, move or deploy geomembrane rolls. The Installer shall assume all responsibility to insure that all local, state rules and regulations are followed.
- E. Damaged Geomembrane: Damaged geomembrane shall be repaired, if possible, in accordance with these specifications, or shall be replaced at no cost to the Owner.

1.09 QUALITY ASSURANCE

- A. The owner may engage and pay for the services of a Quality Assurance Consultant to observe geomembrane installation.

1.11 WARRANTY

- A. Upon acceptable completion of the Work, warranties shall be provided and transferred to the Owner by both the manufacturer and the Installer, which shall warrant the quality of materials and workmanship for a minimum period of twenty (20) years. Without limiting the provisions of the Contract, the warranties shall warrant that:
 - 1. The HDPE materials supplied are suitable for the environmental conditions at the site and the service conditions as described in this specification.
 - 2. The HDPE material supplied meets or exceeds all published specifications as referenced by this performance specification.
 - 3. The HDPE materials supplied are free of defects in materials and workmanship.
 - 4. The Manufacturer and Installer warrant to repair and /or replace, without additional payments, all defects in the material and installation workmanship.
 - 5. The Installer warrants to repair, without additional payment, all detected leaks in seams (manufactured or field joined).

PART 2 -- PRODUCTS

2.01 MATERIALS

- A. HDPE Resin: The HDPE resin shall be manufactured of new, first quality resin and shall be compounded and manufactured specifically for producing HDPE geomembrane.
 - 1. Resin types shall not be mixed.
 - 2. Every batch of resin shall be sampled, tested, and certified by the Resin Manufacturer to have a minimum of two (2) weeks prior to installation of geomembrane.
 - 3. Resin Quality control Certificates shall be provided to the engineer a minimum of two (2)

weeks prior to installation of geomembrane.

4. The resin used in manufacturing the material for extrusion welding shall be the same as used in manufacturing the geomembrane.

B. HDPE Liner

1. HDPE liner shall be manufactured of new, first quality, high-density polyethylene materials.
2. The HDPE liner shall contain two to three (2-3) percent carbon black for ultra violet resistance.
3. Geomembrane shall be provided in rolls (folded geomembrane shall not be permitted).
4. The Surface of the HDPE liner shall not have striations, roughness, pinholes, or bubbles and shall be free of holes, thin spots, blisters, undispersed raw materials, or any contamination by foreign matter.
5. Each roll of HDPE liner shall be externally labeled or tagged to provide product identification sufficient for field identification as well as inventory and quality control purposes. Each roll shall be labeled with the name of manufacturer, roll number, batch or lot number, physical dimensions (length and width) and the material thickness. Any roll of HDPE liner from which the labeling has been removed or has become illegible, shall not be used, but shall be removed from the site and replaced at the expense of the Installer.
6. The HDPE liner shall be sampled, tested, and certified by the manufacturer for allowable thickness, carbon black content (ASTMD1603), carbon black dispersion (A / A-1 / 2, ASTM D3015), melt index (ASTM D1238 E), density (0.94 min., ASTM D1505), tensile strength at yield (ASTM D638 Type IV dumbbell @ 2ipm), tensile strength at break (ASTM D638 type IV dumbbell @ 2ipm), elongation at yield (ASTM D638 Type IV dumbbell @ 2imp), and dimensional stability (212 °F for 1 hour, ASTM D1204).

2.2 EXTRUDATE ROD OR BEAD

- A. Extrudate rod or bead shall be made from same resin as the geomembrane.
- B. Additives shall be thoroughly dispersed.
- C. All material shall be free of contamination, moisture or foreign matter.
- D. Extrudate rod or bead shall not be used until all of the requested documentation has been submitted to and approved by the Engineer.

2.03 POLYLOCK

- A. PolyLock manufactured by SLT North America, Inc. (phone (800) 231-1298) shall be installed in all concrete structures, which contact the HDPE liner.

2.04 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements.
 1. Equipped with gauges showing temperatures in apparatus (extrusion welder) or at wedge (wedge welder)
 2. Maintain adequate number of welding apparatuses to avoid delaying work.
 3. Use power source capable of providing constant voltage under combined line load.
 4. Provide protective pad large enough to catch spilled fuel under electric generator.

- B. Provide tensiometer capable of quantitatively measuring geomembrane seam strength of field specimens.
 - 1. Equipped with internal circuit to simulate load cell under load to verify calibration.
 - 2. Test specimens shall be cut using a coupon die cutter.

PART 3 -- EXECUTION

3.01 PLACEMENT AND COMPACTION OF THE EMBANKMENT MATERIAL

- A. The Contractor will perform placement and compaction of the embankment material. Upon acceptance of the embankment by the Engineer, the liner Installer may commence with construction of the HDPE liner.

3.02 TOPSOIL PLACEMENT

- A. The Contractor shall be responsible to place and compact acceptable top soil over the HDPE liner as shown on the construction drawings.

3.03 PRE-WELD SEAMS

- A. Pre-weld seams shall be made on geomembrane samples to verify welding equipment and performance seaming conditions. Pre-weld seams shall be made at the commencement of welding in both the morning and afternoon.
- B. Additional pre-weld seams shall also be required whenever the welding apparatus has been turned off for a period of time exceeding fifteen minutes, or due to drastic changes in weather conditions as determined by the Engineer.
- C. In addition, anytime a welder uses a welding machine that he has not used within two (2) days of welding, then in addition to the pre-weld seams, two (2) coupons shall also be cut from the first one hundred (100) feet of welding performed by the welder and shall be tested in peel and shear as part of these specifications.
- E. Pre-welds seams shall be performed for each technician-welding apparatus combination.
- F. The minimum overlap for all pre-welded seams shall be three (3) inches.
- G. Pre-weld seams shall be a minimum of ten (10) feet long for fusion welding and minimum of three (3) feet long for extrusion welding with the seam centered lengthwise. The Installer shall cut a minimum of two specimens, one from near each end of the pre-weld seam. The specimens shall be cut to a 1-inch width. Each specimen shall be tested for peel adhesion and then for bonded seam strength.
- H. The Installer shall test pre-weld seams.
- I. A pre-weld specimen shall pass when the following results are achieved for both peel and shear test.

1. The break, when peel testing, occurs in the liner material itself, not through peel separation. In the case of dual-track fusion welding, if either track fails through the weld, the pre-weld seam is considered to fail
 2. The break is ductile.
 3. The peel strength shall be based upon Film Tearing Bond criteria, to demonstrate that a homogenous bond has fused the sheets together.
 4. The shear strength is not less than 90% of the specified tensile yield strength of the geomembrane.
- J. In the event that any of the pre-weld seams fail, the entire pre-weld seam procedure shall be repeated after the appropriate adjustments to the welding apparatus have been made or the operator has made appropriate modifications. If a second pre-weld seam fails, the welding apparatus and / or the operator shall be rejected by the Engineer and shall not be used for seaming until such time as the deficiencies are resolved and verification of the resolution is provided by providing two (2) consecutive pre-weld samples which have passing results.
- K. The liner Installer shall be responsible to monitor all pre-weld seaming and to record the results of all pre-weld seaming on a daily basis. A copy of all pre-weld seaming results shall be provided to the Engineer on a daily basis, and upon completion of pre-weld seaming.
- L. No welding equipment or welder shall be allowed to perform production welds or repairs until they have acceptably completed a pre-weld seam as indicated above.

3.04 INSTALLATION

A. Deployment

1. Prior to deployment, the Installer shall inspect each roll of geomembrane to verify that the roll has a valid Quality Control Certificate, that the Engineer has previously approved it, and that the liner has the proper liner thickness. Geomembrane liner thickness shall be measured at five random points across the leading edge of the roll. The liner thickness shall be measured using a micrometer or other approved measuring device. Material, which fails to meet these criteria, shall not be deployed, but shall be removed from the project area at the contractor's expense.
2. Panels shall be positioned to minimize handling.
3. The Installer shall visually inspect the geomembrane during deployment for imperfections and mark faulty or suspected areas for repair.
4. The Installer shall not deploy more liner in one day than can be welded and properly secured during the same day.
5. After deployment, but prior to seaming, the Installer shall inspect each panel for damage caused by placement operations and / or wind. Damaged sections shall be marked and repaired, or removed and replaced by the Installer at no additional cost to the Owner.

B. Method of Placement

1. The liner Installer shall not be allowed to use equipment on the finished geomembrane subgrade during deployment and installation of the HDPE liner that will damage or alter the integrity of the subgrade. Damage caused to the subgrade by the Contractor, or his representatives, shall be repaired to the original specifications at the Contractor's expense.
2. Vehicular traffic shall not be allowed directly on the geomembrane.

3. The method used to unroll the HDPE liner shall not cause scratches or crimps in the geomembrane liner and shall not damage the support soil or underlying geosynthetics.
4. Personnel walking on the geomembrane shall not engage in activities or wear shoes that could damage the geomembrane.
5. Smoking shall not be permitted on the geomembrane.
6. The method used to place the HDPE liner shall minimize wrinkles and waves.
7. The liner Installer shall be responsible to provide adequate loading (e.g., sand bags or similar items that will not damage the HDPE liner) on the liner and along all exposed edges of the geomembrane liner to prevent uplift by the wind. Any damage to the geomembrane liner caused by wind or other weather related causes shall be repaired by the liner Installer, at the Contractor's expense.
8. Any damage caused by temporary loading on the HDPE liner or by permanent anchorage shall be repaired by and at the expense of the liner Installer.
9. The liner Installer shall recognize that the liner shall not be considered as permanently anchored until all liner trenches have been completely backfilled and the entire length of the HDPE liner has been covered with topsoil.
10. Folds in the geomembrane shall be removed at the time of deployment, and prior to seaming.

C. Panel Identification

1. Each panel shall be assigned a simple and logical identifying code, which indicates the layer and sequence of deployment.
2. The Installer shall be responsible for labeling each panel as it is deployed. The labels shall include, at a minimum, panel number, roll number from which the panel was obtained, and date the panel was deployed. Engineer reserves the right to refuse any panel, portion of panel, or roll, which is not correctly labeled.
3. The Installer shall be responsible to perform and document a panel inspection for each panel. The documentation shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work

3.05 FIELD SEAMING

A. Orientation and Location: Procedures for seam orientation and location are as follows:

1. The number of seams shall be minimized.
2. The minimum overlap before seaming shall be three (3) inches. The Installer shall indicate the lap by making reference marks prior to seaming at an interval not exceeding 50-feet.
3. Panels shall be placed such that the overlap of upslope panels overlies those down slope.
4. Seaming shall follow as close behind deployment as practical.
5. The liner Installer shall be responsible to inspect and document all seaming on a daily basis. The documentation shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work.

B Seaming Methods

1. Field seaming shall be performed using fusion and / or extrusion welding methods in accordance with the manufacturers recommendations.
2. Areas to be seamed shall be clean and free of grease, moisture, dust, debris, dirt, or any marking on the geomembrane.
3. Where required, a hard surface shall be placed directly under the seam overlap to achieve proper support.

4. The Installer shall protect the integrity of the HDPE liner during all seaming operations. HDPE liner which is damaged as a result of improper temporary bonding, seaming, or associated work shall be removed and / or repaired at the expense of the liner Installer.
5. The liner Installer shall be responsible to inspect and document seaming on a daily basis. The documentation shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work.

C. Extrusion Welding

1. Each welding unit shall include an electronic controller, which displays the temperature of the extrudate at the nozzle.
2. The minimum overlap before seaming shall be three (3) inches.
3. Hot-air bond adjacent panels together using procedures that do not damage geomembrane prior to seaming.
4. If the welding unit has not been used for more than 15 minutes, the unit shall be run for a minimum of two (2) minutes in order to purge the welding apparatus of heat-degraded extrudate before welding resumes.
5. Extrudate purged from the welding apparatus shall not be placed on liner subgrade.
6. The exposed edges of HDPE liner shall be cleaned of oxidation using a disc grinder or equivalent. Grinding shall be completed no more than fifteen (15) minutes prior to seaming.
7. Bevel top edges of geomembrane before extrusion welding.
8. Exposed grinding marks adjacent to an extrusion weld shall be minimized. In no instance shall exposed grinding marks extend more than 1/4 inch from the seamed area. The Installer shall be required to cover all abraded areas with extrudate.
9. Grind ends of all seams, which are more than five (5) minutes old, when restarting welding.
10. The liner Installer shall be responsible to inspect and document all extrusion welding on a daily basis. The documentation shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work.

3.06 WEATHER CONDITIONS

- A. The normal required weather conditions for seaming are as follows:
1. Seaming of the HDPE liner shall not be performed at ambient temperatures below forty (40) or above ninety-five (95) degrees Fahrenheit, unless other limits are approved, in writing, by the Engineer. The Engineer may require that additional pre-weld tests be performed by the Installer to verify that seaming conditions are adequate. The ambient temperature shall be measured at a point six (6) inches above the HDPE liner being deployed.
 2. Geomembrane seaming shall not be performed during precipitation events or during period of excessive humidity. In addition, welding shall not take place in an area of ponded water. Conditions of excessive humidity shall be determined based on welding performance and results.
 3. Geomembrane seaming shall not be performed during excessive winds, unless wind barriers are provided.

3.07 NON-DESTRUCTIVE FIELD TESTING

- A. All field seams shall be non-destructively tested and observed by the Installer over their full length using a vacuum test unit, air pressure test, or other method approved by the Engineer. Non-destructive testing shall be carried out as the seaming work progresses, not at the completion of

the seaming. Seams, which cannot be non-destructively tested, using either the vacuum test unit or air pressure test, may be non-destructively tested using the electric spark test method when approved by the Engineer.

B. Vacuum Testing: All seams welded using the extrusion process shall be tested using the Vacuum Test Method.

1. The equipment shall consist of the following:
 - a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and vacuum gauge.
 - b. A vacuum pump assembly equipped with pressure control.
 - c. A rubber pressure / vacuum hose with fittings and connections.
 - d. A soapy solution and an applicator.
2. Test procedures:
 - a. All areas tested shall be prewetted with a soapy solution immediately prior to testing.
 - b. Place vacuum box over the wetted seam area.
 - c. Ensure that a leak-tight seal is created.
 - d. Apply a minimum vacuum pressure of 5-psi gauge and examine the geomembrane through the viewing window for a minimum of fifteen (15) seconds.
 - e. All areas where leaks are detected shall be marked by the Installer, repaired, and retested at the expense of the Installer.
 - f. The liner Installer shall be responsible to inspect and document all non-destructive vacuum testing on a daily basis. The documentation shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work.

C. Air Channel Pressure Testing: Air channel pressure test shall be applicable for double track fusion welded seams.

1. The equipment shall consist of the following:
 - a. An air pump equipped with a pressure gauge capable of generating and sustaining pressure between twenty 24 and 30-psi
 - b. A rubber hose with fittings and connections.
 - c. A sharp, hollow needle, or other approved pressure feed device.
2. Test Procedures
 - a. Seal both ends of seam to be tested, insert air needle into the air channel and pressurize the air channel to between 27 and 30 phi.
 - b. Allow air channel pressure to stabilize for a period of two (2) minutes prior to performing the test. The test shall then be continued for a minimum of five (5) minutes.
 - c. If the loss of pressure exceeds 3-psi or does not stabilize, the source of the leak shall be located, the necessary repairs made, and the seam shall be retested in accordance with this specification.
 - d. Puncture the opposite end of seam to release air. If blockage is present, the blockage shall be located and the seam may be tested on either side of the blockage. The blocked area shall be repaired and tested using the vacuum test method.
 - e. If the seam strength is not adequate, the edge of the loose flap of the upper sheet (which extends beyond the outer track) shall be extrusion fillet welded to the bottom sheet. The repaired seam shall then be non-destructively tested using the Vacuum Test Method.

- f. The liner Installer shall be responsible to inspect and document all non-destructive air-channel testing on a daily basis. The completed form shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work.
- D. Electric Spark Testing: This method shall only be applied to extrusion-welded seams that cannot be accessed by the vacuum box.
 - 1. The equipment shall consist of the following:
 - a. Eighteen (18) gauge bar copper wire.
 - b. High voltage spark tester capable of operating in a range of 10 to 55 KV.
 - 2. Test Procedures:
 - a. Prepare the seam to be extrusion welded.
 - b. Insert an 18 gauge bare copper wire in the seam area, where it will appear at the bottom of the weld after the seam is welded, with one end of the wire left exposed.
 - c. Extrusion weld the seam.
 - d. After the weld has cooled, connect the exposed end of the copper wire to the ground terminal on the high voltage spark tester.
 - e. Turn the spark tester on and adjust the output voltage control to minimum. Hold the test probe on the spark tester near the exposed end of the copper wire and increase the output voltage until a spark can be obtained at least twice as long as the thickness of the material to be tested (or twice as thick as the weld).
 - f. Move the probe slowly along the length of the welded seam. Document and mark on the HDPE liner adjacent to the weld locations where sparking is observed, indicating the presence of leaks.
 - g. After testing of the seam is complete, verify that the length of the spark to the exposed end of the copper wire is still adequate before turning the machine off. If the spark is not adequate, readjust the voltage and retest the seam.
 - h. All areas where leaks are detected shall be marked by the Installer, repaired, and retested at the expense of the Installer.
 - i. The liner Installer shall be responsible to inspect and document all non-destructive vacuum testing on a daily basis. The documentation shall be provided to the Engineer on a daily basis, and within 24 hours of completion of the work.

3.8 DESTRUCTIVE SEAM TESTING

A. Location and Frequency of Testing

- 1. Destructive test sample locations shall be identified by the Engineer or his representative and cut from the HDPE liner by the Installer as the seaming progresses. Locations may be prompted by appearance of excess heating, contamination, offset welds, or suspected defects. Engineer shall not be required to notify Installer in advance of selecting locations where seam samples will be taken. Destructive samples shall not be cut from high stress areas or from welds to the PolyLock material.
- 2. The Installer shall provide to the Engineer destructive test samples at the following frequency:
 - a. Two (2) samples from the first 400 feet for each welder / apparatus combination used that day.
 - b. One (1) additional destructive test sample shall also be obtained if the welder or welding apparatus are changed.
 - c. One (1) additional destructive test sample shall be obtained for every additional 400 feet welded by a welder / apparatus combination.

3. The testing frequency may increase at the discretion of the Engineer.
- B. All destructive test samples shall be marked by the Installer with their sample number, roll and panel number, seam number, name of welder, welding machine number, and date of weld.
- C. Size of Samples: Destructive test samples shall be a minimum of thirty-eight (36) inches long by twelve (12) inches wide. A one-inch wide specimen shall be cut from each end of the seam destructive sample, and be tested in shear and in peel by the Installer in the field. If the destructive seam test sample passes the preliminary field-testing, then the remaining sample shall be divided into two portions for distribution as follows:
1. One portion for the Installers laboratory
 2. One portion for the Owner for archive storage.
- Failure of any of the test samples (laboratory or field) shall be reason to fail the entire destructive test sample. The liner Installer shall be required to repair the affected seams at no additional cost.
- D. Installer shall immediately repair all holes in the geomembrane resulting from destructive sampling in accordance with these specifications.
- E. The liner Installer shall be responsible to inspect and document all destructive seam testing. The documentation shall be updated continually and provided to the Engineer throughout the duration of the job and upon request. A finalized copy shall also be forwarded to the Engineer at the completion of the project.
- F. Laboratory Testing by Geosynthetic Installer Quality Assurance Laboratory
1. Test sample in peel and shear (ASTM D4437). The peel test criterion shall be the film tearing bond and the shear test criterion shall be 90% of the minimum tensile strength at yield for the sheet.
 2. Select specimens for each sample alternately for testing (i.e. peel, shear, peel, shear, etc.)
 3. Provide test results no more than 48 hours after cutting the destructive samples from the installed geosynthetics.
 4. In the case of dual-track fusion welding the seam to be tested in peel is the inner seam (i.e. the seam which cannot be seen from the top surface of the liner).
 5. All laboratory testing of geosynthetics by Installer's laboratory shall be the responsibility of the Contractor, and shall be provided at no additional expense to the Owner.
- G. Failed Seam Procedure
1. The Installer may choose to cap the entire days production for the technician and welding apparatus rather than perform additional destructive testing. Under this case, the cap becomes the primary seam and the procedures for destructive testing may apply at the discretion of the Engineer.
 2. If the Installer chooses not to cap the technicians entire days production, then the following procedure shall be used when there is a destructive test failure.
 - a. The Installer shall trace the weld in both directions from the location of the failed test at least 10 feet, or to where the seam ends. If the seam is less than 10 feet long, the Installer shall check the next seam welded, either direction, by the same welding device and technician.

- b. Obtain a one-inch sample at both locations for field-testing by the Installer.
 - c. If the field samples fail, then additional one-inch field samples shall be taken at a distance away from the failure, as directed by the Engineer. This process is repeated as necessary until the extent of the failed seam is identified.
 - d. When the extent of the defective seam has been identified, based upon field-testing, laboratory samples shall be taken as specified in paragraph 3.7 of these specifications.
 - e. If any of the laboratory samples fail, the process shall be repeated to determine the extent of the defective seam.
3. Once the extent of the defective seam is identified, and verified by laboratory results, the defective seam shall be repaired using one of the following methods:
- a. Each sample hole and destructive test sample hole shall be individually capped and non-destructively tested, after which the entire defective seam, including patches, shall be capped and non-destructively tested, or;
 - b. Each sample hole and destructive test sample hole shall be individually patched and non-destructively tested, after which the entire length of defective seam, between holes previously patched and vacuum tested, shall be capped and non-destructively tested, or;
 - c. If the seam was welded using the Hot-Wedge method, each sample hole and destructive test sample hole shall be individually patched and non-destructively tested. The loose flap of the upper sheet (which extends beyond the out track) shall then be extrusion welded to the bottom sheet over the entire length of the defective seam, between holes previously patched, and non-destructively tested.
4. All defective seam repairs may be destructively tested in accordance with these specifications at the discretion of the Engineer.

3.09 REPAIR PROCEDURES

- A. All seams and non-seam areas of the HDPE liner shall be observed for defects, holes, blisters, undispersed raw materials, improper welds, overgrinds, etc. The liner Installer shall have the option to either non-destructively test, or repair and then non-destructively test all suspected defect locations. Each location that fails the non-destructive testing shall be marked by the Installer, repaired, and retested in accordance with these specifications.
- B. The liner Installer shall remove damaged geomembrane and replace with acceptable geomembrane materials, if damage cannot be satisfactorily repaired in accordance with these specifications, at no additional cost to the Owner.
- C. The Installer shall repair any portion of the geomembrane exhibiting or failing a destructive or non-destructive test. Installer shall be responsible for repair of damaged or defective areas. Procedures available include:
 - 1. Patching: Blisters, pinholes, holes, tears, contamination by foreign matter, etc. shall be repaired by patching the affected area. Patches shall be round or oval in shape, made of the same HDPE liner as the liner to be repaired, and extend a minimum of six (6) inches beyond the edge of the defect. All patches shall have their top edge beveled with an angle grinder prior to placement of the patch, and shall be continuously welded.
 - 2. Abrading and re-welding: Extrusion spot welding shall be used to repair undispersed raw materials, minor localized flaws, where geomembrane thickness has been reduced by more than four (4) mills by over grinding, and seam sections (less than fourteen (14) inches).

3. Abrading and re-welding may also be used to repair seam sections less than fourteen (14) inches in length. Capping shall repair seams longer than 14-inches.
 4. A maximum of two (2) welding bead widths may be allowed to cover an area of excessive grinding or surface blemish. Beads shall not be placed adjacent to each other until the first bead has sufficiently cooled to avoid overheating of the geomembrane. If two (2) welding beads widths do not cover the defect area, a liner cap shall be placed over the defect area as described by these specifications.
 5. Capping: capping may be used to repair large lengths of failed seams. Caps shall be round at the ends, made of the same HDPE liner as the liner to be repaired, and extend a minimum of six (6) inches beyond the centerline of the failed seam. All caps shall have their top edge beveled with an angle grinder prior to placement of the cap, and shall be continuously welded and non-destructively tested using approved methods. Caps, which fail the non-destructive test, shall be repaired and retested until acceptable test results are obtained at the expense of the Installer.
 6. Fishmouths or wrinkles: "Fishmouths" or wrinkles shall be cut along the ridge of the fold to achieve a flap overlap and shall be seamed. All "fishmouths" and wrinkle repairs shall then be capped and non-destructively tested in accordance with these specifications.
 7. Removal of defective seam and replacing with new material.
- D. All repairs shall be non-destructively tested in accordance with these specifications. Repairs, which fail to meet the requirements of this section, shall be repaired and retested until acceptable results are obtained at the expense of the Installer.
- E. In addition the following procedures shall be observed.
1. Geomembrane surfaces to be repaired shall be abraded (extrusion welds only) no more than fifteen (15) minutes prior to the repair.
 2. All geomembrane surfaces shall be clean and dry at the time of repair.
 3. The repair procedures, materials, and techniques shall be approved in advance by the Engineer.
 4. Patches shall extend a minimum of six (6) inches beyond the defect, and all corners shall be rounded to a radius of at least three (3) inches.
- F. Repair Verification
1. Installer shall not cover the geomembrane at locations, which have been repaired until test results with acceptable passing values are available and approved by the Engineer.

3.9 GEOMEMBRANE ACCEPTANCE

- A. Installer retains all ownership and responsibility for the geomembrane until final acceptance by the Owner.
- B. Owner will accept geomembrane installation when:
1. All required documentation from the Manufacturer, Fabricator and Installer has been received and approved.
 2. The installation is completed.
 3. All liner installation documentation has been completed.
 4. All required repairs have been made and verification of the adequacy of all field seams and repairs, including associated testing is complete.

5. Warranties are received.

*** END OF SECTION ***

SECTION 02811

LANDSCAPE IRRIGATION SYSTEM

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall construct a multi-row automatic irrigation system, complete and operable, all in accordance with the requirements of the Contract Documents.
- B. Said irrigation system shall include but not be limited to all pipes, fittings, sprinklers, valves, automatic control valves, controllers, valve boxes, drain valves, hose bibb valves, operating wrenches, riser assemblies, direct burial wires, electrical connections, wiring and other appurtenances, piping, connections, testing, cleaning-up, maintenance and adjustments necessary for a complete operating system, ready for immediate use upon completion. Minor items necessary for proper construction and functional operation of this system, not specifically described in the Contract Documents, shall be included as a part of the work of this Section.
- C. All systems shall be designed and construction to meet current City of West Jordan water conservation measures outlined in the Municipal Code 16-10-060.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Landscaping and planting to which the irrigation system is appurtenant shall be constructed in accordance with the requirements of Section entitled, "Landscaping." The Contractor shall coordinate the work of constructing the irrigation system with the planting requirements.
- B. Electrical service shall conform to the requirements of Section entitled, "Electrical General Provisions." Connection to the controller shall be performed as a part of the work of this Section.
- C. Rough grading, final grading, excavation and backfill, and all trenching and trench backfill appurtenant to the installation of the landscape irrigation system shall be performed in accordance with the requirements of Section entitled "Earthwork."
- D. Concrete work as required herein shall be performed in accordance with the requirements of Section entitled, "Cast-in-Place Concrete" and "Minor Concrete," as applicable.
- E. PVC and galvanized steel pipe and fittings shall conform to the requirements of Section entitled "Piping Specialties."

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the specifications, all work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section.

- B. All work hereunder shall be in full accordance with the latest rules and regulations of the governing authorities, state "OSHA," the Uniform Plumbing Code published by the Western Plumbing Officials Association, and other applicable local codes and regulations. Nothing on the Drawings or in the Specifications shall be construed to permit work not conforming to these codes, rules, and orders.

1.04 CONTRACTOR SUBMITTALS

- A. Manufacturer's literature, samples (where requested by the ENGINEER), and installation instructions shall be submitted in accordance with Section entitled "Contractor Submittals."
- B. Record drawings, showing locations of all valves, pipes (lines) heads, dimensions, controllers, control lines, and electrical wires shall be submitted prior to final inspection.
- C. Controller literature, specifications, installation wiring diagram, and circuit breaker information shall be submitted to the ENGINEER for review prior to ordering.

1.05 QUALITY ASSURANCE

- A. In addition to other inspection, as provided by the ENGINEER, the CONTRACTOR shall give at least 72 hours notice to the ENGINEER for scheduling the following special inspections:
1. Layout of the system
 2. Inspection of trenches, backfilling, and equipment
 3. Pressure tests
- B. The CONTRACTOR shall notify the ENGINEER at least 72 hours prior to performing the tests. All tests shall be performed in the presence of the ENGINEER. Test requirements shall be as follows:
1. After assembly and installation, all water pipes, fittings, automatic equipment, and appurtenances shall be tested at a hydrostatic pressure of 150 psi at the lowest point of the system for not less than 60 minutes.
 2. The first test shall be made in such a manner that all valves in the new water pipe sprinkler lines will be tested for watertight closure. Valves may be tested in groups or singly while subjected to 150 psi water pressure for a period of not less than 60 minutes.
 3. The second test shall be made by forcing all air from the pipes with water and capping or plugging pipe risers. After the pipe risers have been plugged or capped, all line valves shall be fully opened and the pipe lines subjected the full static water pressure for a period of not less than 120 minutes. (Pressure pipelines 150 psi.)
 4. The third test requires that lateral lines be tested at 100 psi for 120 minutes.
 5. The fourth test requires that all pressure lines be tested at 120 psi for 24 hours.
 6. Water lines and valves which show evidence of leakage or fail to be watertight shall be repaired or replaced. After all repairs or replacements have been made, the above-required tests shall be performed again.

1.06 EXISTING UTILITIES AND CONDITIONS

- A. Prior to cutting into the soil, the CONTRACTOR shall locate all cables, conduits, sewers, septic tanks, and other such underground utilities, and shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the CONTRACTOR shall promptly notify the ENGINEER.

- B. The CONTRACTOR shall be responsible for coordinating its work with the operation of existing utilities and new utilities on the Project. The CONTRACTOR shall notify the ENGINEER or its representative when utilities which are in operation require shut-off.
- C. Due to the scale of Drawings, it is not possible to indicate all offset, fittings, etc., which may be required. The CONTRACTOR shall carefully investigate the structural and finished conditions affecting all its work, and plan its work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. The Contract Documents are generally diagrammatic and indicative of the work to be installed. The work shall be installed in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, structures, piping, and etc. will be avoided.

1.07 STORAGE OF MATERIALS

- A. The CONTRACTOR shall be responsible for storage of materials and for damage to the WORK covered by these Contract Documents before final acceptance of its work. The CONTRACTOR shall securely cover openings into the system, and shall cover all apparatus, equipment and appliances both before and after being set in place to prevent obstruction in the pipes and the breakage, misuse, or disfigurement of said apparatus, equipment, or appliances.

1.08 SCHEDULING AND COORDINATION

- A. The CONTRACTOR shall be responsible for making arrangements for the coordination of its construction operations with those of all others on the job. The CONTRACTOR shall permit others engaged in work to accomplish their portion of the WORK without undue interference or delay.
- B. The CONTRACTOR shall be responsible for the scheduling and coordination of the electrical and water connections and the installation of the piping and equipment in a manner that will effect the earliest completion of the WORK in conformance with the construction progress schedules of all traces and of the Contract Documents.

1.09 GUARANTEE/WARRANTY OF THE IRRIGATION SYSTEM

- A. The CONTRACTOR shall guarantee the complete irrigation system to be free from leaks or breakage due to defective material or workmanship for a period of one year from the date of acceptance of the complete work by the OWNER. Damage due to sabotage and/or vandalism are specifically excepted from this guarantee.
- B. Other items of the required guarantee shall be as specified in the Section entitled "Landscaping."
- C. The CONTRACTOR shall repair any settling of backfilling trenches occurring during a one-year period after final acceptance without expense to the OWNER including complete restoration of all damaged planting, paving, or other improvements of any kind.
- D. When defective material or workmanship is discovered which will require repair or replacement, all such repair work or replacement work shall be done by the CONTRACTOR at its own expense within 24 hours after written notification is given to the CONTRACTOR by the OWNER of such required repairs. However, if the CONTRACTOR fails to comply with the requirements of the

above guarantee within the 24 hours after notification is given, the OWNER shall proceed to have the repairs made by others at the CONTRACTOR's expense.

PART 2 -- PRODUCTS

2.01 GENERAL

- A. Brand names specified for materials are supplied for the purpose of describing the type, size, quality, and performance of materials. The CONTRACTOR may propose, as substitutions, other manufacturer's materials of equal quality and performance to the ENGINEER for review in accordance with Section entitled "Contractor Submittals."
- B. The CONTRACTOR shall furnish, at no additional charge, all samples necessary for testing as outlined in the Specifications or, when requested, certified evidence of off-site testing.

2.02 PLASTIC PIPE AND FITTINGS

- A. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name, nominal pipe size, PVC type, pressure rating, and extrusion date. Pipe shall conform to the ASTM Specification D-1784-60T.
- B. All plastic pipe for lateral lines shall be PVC (polyvinyl chloride) SDR 21, Class 200, NSF approved.
- C. All materials for pressure main lines shall be PVC (polyvinyl chloride) SDR 21, Schedule 40, NSF approved.
- D. All fittings shall be PVC (polyvinyl chloride) Schedule 40, Type II, NSF, or Schedule 80 as called for in the Contract Documents.
- E. Swing joint ells shall be Schedule 80 PVC.
- F. Pipe shall be 'snaked' in the trench to allow for expansion and contraction.
- G. All changes in direction of pipe shall be made with fittings, not by bending. Appropriate thrust blocks shall be installed per manufacturer's recommendations.

2.03 STEEL PIPE AND FITTINGS

- A. Steel pipe and fittings shall be American Standard Association's schedule 40 galvanized. Street elbows, bushings, and close nipples shall not be allowed.

2.04 COPPER TUBING AND FITTINGS

- A. Copper tubing and fittings shall be seamless annealed conforming to ASTM specifications B-88-58, Type K. Fittings shall be standard wrought copper fittings.

2.05 VALVES

- A. General: Hose bibb valves shall be of bronze construction, size 3/4-inch, angle pattern suitable for 250-psi working pressure as manufactured by Crane, American Standard, Kennedy, or equal, with permanent metal sign at noticeable locations. Signs shall be 5-inch x 3-inch in size and read as shown on the Drawings. The signs shall be permanently fastened to pipe, post, or wall at hose bibb.
- B. Main shut-off valves shall be bronze gate valve with positive seal conforming to AWWA Specifications, Class 150 or better.
- C. Isolation valves for main lines shall be bronze gate valves with wedge disc, Class 125, screwed ends and operating nut as manufactured by Rainbird, Buckner, or equal.

2.06 CONTROL WIRING

- A. Control wiring shall be Standard UF Direct Burial Copper Wire, Type UF Bearing, U/L approved for direct underground burial in National Electrical Code Class II circuits, AWG sizes.
- B. Conductor of electrical conductivity shall be grade copper meeting requirement of ASTM B 3-74 (1980).
- C. All splices shall be made with wire connectors, such as Rainbird Pen Tit, Scotch Lock, or equal. Contractor may splice in pull boxes but underground splices will not be allowed.
- D. Control wiring shall be installed underground in the mainline trench taped to the mainline at twenty foot intervals. Install wires under the main line. Where wires are separated from mainline, install in conduit. Provide a minimum loop of 18 inches at each valve, change or direction, every 500 feet, and at each controller.
- E. "Pulling-In" of wire for installation without trenching will not be allowed unless the wire is being pulled through conduit. All wire shall be laid in trenches and shall be carefully back-filled to avoid any damage to the wire insulation or wire conductors themselves. In rocky areas, the trench shall have a 6 inch layer of clean sand on the bottom of the trench before the wire is laid into the trench and back-filled. The wire shall have a minimum cover of 18 inches. Where wire passes under roadways, walls or any other paved areas, it shall be installed in PVC schedule 80 pipe sleeve of proper size required for the number of wires being placed in it. Maxi satellite control wire is permitted to be laid in the same trench with conduit. but must be physically separated from the conduit as much as possible by laying each in opposite sides of the trench.
- F. For cable/conduit systems, pull boxes are required to be placed at a maximum spacing of 250 feet.

2.07 PRESSURE VACUUM BREAKERS

- A. Pressure vacuum breakers shall be "FEBCO" Model 775, or approved equal. Pressure vacuum breaker assemblies shall consist of an approved body, check valve, vacuum relief, inlet and discharge shutoffs, and field test cocks. Vacuum relief shall have atmospheric opening of greater diameter than

IPS of unit. Vacuum relief shall be separate and independent from check valve member. All nipples or other fittings shall be red brass. The unit shall have a protective screen or strainer before the unit to eliminate insects or debris from entering. The breaker shall have approval of the State Division of Drinking Water. Flow loss at 100 gpm shall not exceed 4 psi. A 3/4-inch galvanized steel pipe in sleeve for irrigation blowout shall be provided as shown.

2.08 PVC SOLVENT CEMENT AND PRIMERS

- A. Solvent Cement shall be NSF approved and shall meet requirements of ASTM D 2564-80.
- B. Primer shall be NSF approved and shall be Weld-On, P-70 Industrial Polychemical Service, or equal.

2.09 WORM GEAR CLAMPS

- A. Worm-gear clamps shall be stainless steel.

2.10 VALVE AND CONTROLLER BOXES

- A. Boxes for valves and controllers shall be heavy duty fiberglass, PVC, or concrete and shall be complete with identification lid. Boxes shall be sized for equipment within box, depth of installation, and operation and maintenance space required.

2.11 SATELLITE CONTROLLERS

- A. The Contractor is to supply and install the necessary satellite controller as indicated in the Contract Documents listed under 'Irrigation Legend'. These controllers shall be state of the art, solid state electronic controllers as manufactured by Rainbird, Toro, or an approved equal.
- B. The electrical power source shall be provided by the City. The Contractor shall then be responsible for making the electrical connection to the controller.

2.12 OTHER MATERIALS

- A. Other materials required or necessary shall be as indicated on drawings and/or as required for best quality work.

PART 3 -- EXECUTION

3.01 GENERAL

- A. Installation of the irrigation system shall be performed after the finish grading but prior to landscaping.
- B. All valves, fittings, heads, and piping shall be installed as shown and all connections made to permit the irrigation system to function properly through its entire length.
- C. All materials and equipment shall be installed in strict accordance with manufacturer's written instructions and recommendations and all local and state codes, laws, ordinances, and regulations.

- D. Before proceeding with the installation of any section or unit of the irrigation system, the CONTRACTOR shall check and verify the correlation between ground measurements and drawings and shall advise the ENGINEER of any discrepancies.

3.02 EXCAVATION

- A. Trenches shall be dug as wide and as deep as necessary to properly install the irrigation lines.
- B. Pipe trenches shall be straight, or "snaked" slightly allowing for expansion and contraction of PVC pipe.
- C. Subsoil shall be kept separate from topsoil, where possible.
- D. Minimum cover depth shall be as follows:
 - 1. Supply pressure lines from water source to control valves: 24-inches unless otherwise indicated or noted.
 - 2. Lateral lines from control valves to sprinkler heads shall be 18-inches unless otherwise indicated or noted. Lateral lines under paving, roadways, and driveways shall have 24-inches of cover and be located in Schedule 40 PVC sleeves.
 - 3. Trenches for control wire only shall be 18 inches deep unless otherwise indicated or noted. Control wires under concrete walks and slabs, paving, roadways, and driveways shall be installed in Schedule 40 PVC sleeves.
- E. A trench of sufficient width shall be provided to allow for proper tamping around pipe.
- F. Rocks and other debris shall be removed or cut out to the width of the trench and to a depth of 6 inches below the trench bottom.
- G. Avoid cutting roots of existing trees. Notify the Landscape Architect if roots larger than 1-inch are encountered.

3.03 PIPING - GENERAL

- A. Piping shall be laid out and installed in accordance with manufacturer's printed recommendations and industry standards. Substantial support shall be provided at all points, and pipes shall be snaked slightly allowing for expansion and contraction.
- B. Minimum 1-inch vertical clearance shall be between lines crossing at angles greater than 45 degrees.
- C. Minimum 3-inches horizontal and vertical clearances shall be between all other lines.
- D. Teflon thread sealant 3/4-inch wide (tape or liquid), Rectorseal No. 5, or equal, shall be used at all threaded joints.
- E. Galvanized steel pipes shall have clean standard threads of standard lengths. Joints shall be made up with pipe compound applied to male threads only and not more than 2 threads shall show at the joints when connected.

- F. Pipe sleeves shall be provided under all paving and where necessary for passage under finish surface material, future replacement, and for protection of PVC piping and control wire.

3.04 PLASTIC PIPE

- A. The pipe shall be guaranteed by the manufacturer to be suitable to operation under the conditions of this installation and shall be guaranteed free from defects in workmanship and quality.
- B. The pipe shall be connected by O-ring type or by solvent-weld joints as outlined below. Joints shall be made in strict accordance with the manufacturer's printed recommendation.
- C. The plastic pipe sections shall be placed accurately to line and grade in the prepared trenches. The inside of all pipe shall be clean and free from foreign matter and shall be end-reamed to remove burrs and provide full inside diameter of the pipe end.
- D. Pipe assembly shall have a firm, uniform bearing for the entire length of each pipeline to prevent uneven settlement. All adjustments to grade shall be made by scraping away or filling in with clean earth backfill material, well compacted under the body of the pipe. Wedging of pipe will not be permitted. The inside of all pipe shall be clean and free from foreign materials before joints are assembled.
- E. Sealant tape shall be used on all threaded joints.
- F. All pipeline open ends upon which the WORK has been stopped shall be closed at the end of each day's construction work with a suitable temporary plug to prevent entrance of any foreign materials into the assembled pipeline.
- G. Pressure pipe shall be defined as all piping for this system.
- H. O-ring type flexible coupling pipe shall be used on pressure pipes 4-inch or larger.
- I. Pressure pipe fittings on the 4-inch main lines going to automatic control valves shall be O-ring type with 2-inch threaded outlet.
- J. Three-inch main lines and fittings of pressure piping shall be solvent weld type.
- K. Pressure piping shall be provided with portland cement concrete thrust blocks. Thrust blocks shall be constructed at the following places:
1. Where pipe changes direction at fittings.
 2. Where pipe changes size.
 3. Where line terminates.
 4. Around gate valves (bottom half of valve in concrete bolts exposed for change of top half).
- L. Thrust blocks shall be constructed of 2000-psi concrete, as follows:

THRUST BLOCKS				
Minimum Square Feet of Affected Area				
PIPE SIZE	DEAD ENDS,	90 DEGREE	45 DEGREE	22-1/2

	TEES OF VALVES	BENDS	BENDS	DEGREE OR LESS BENDS
3-inch	3.0 sq.ft.	4.0 sq.ft.	3.0 sq.ft.	3.0 sq.ft.
4-inch	3.0 sq.ft.	4.0 sq.ft.	3.0 sq.ft.	3.0 sq.ft.

- M. The areas given in the above table shall be measured in a place perpendicular to the longitudinal axis of the pipe or to the longitudinal axis of the thrust developed.

3.05 VALVES

- A. Piping systems shall be supplied with valves at all points as shown or specified herein so arranged to give complete regulating control throughout. Automatic control valves and gate valves shall be as detailed in the Contract Documents or as otherwise directed by the ENGINEER.
- B. Valves shall be the full size of the line in which they are installed unless otherwise indicated.
- C. Hose bibbs shall be installed as shown.
- D. Gate valves shall be line (pipeline) size, shall be installed where indicated on the Drawings, and shall be properly blocked to a cast-iron water works valve box. All gate valves shall be provided with 2-inch square operating nuts. One 5-foot wrench for each 3 gate valves shall be furnished.
- E. Quick-coupling valves shall be provided, located, and installed as shown in the Contract Documents. Quick-coupling valves shall be installed with one-inch swing joint. All quick-coupler lines shall be installed not less than 18 inches below grade.
- F. A main stop and drain valve shall be installed near the point of connection to the main line.
- G. Drain valves shall be installed at low points along the main. It shall be the CONTRACTOR's responsibility to see that the main drains properly.
- H. Gravel sumps 2-feet by 2-feet by 2-feet in size and filled with 3/4-inch to 1-inch size round gravel shall be provided at each manual drain valve and at low sprinkler head locations for drainage, (spray heads only).
- I. Double-check valve shall be installed as shown, with a boiler drain for winter blowout.

3.06 PRESSURE TYPE VACUUM BREAKER

- A. Installation of pressure-type vacuum breaker shall be at location shown and in accordance with manufacturer's printed recommendation and as detailed.

3.07 VALVE BOXES

- A. Valve boxes shall be set 1/2-inch above the designated finish grade in lawn areas and 2-inches above finish grade in ground cover areas.

- B. Valve boxes located near walks, curbs, and paving shall be installed in such a way as to allow for valve boxes to abut those items with top surface matching plane as items listed above.

3.08 WIRING AND ELECTRICAL WORK

- A. All electrical equipment and wiring shall comply with local and state codes and shall be installed by those skilled and licensed in the trade. Unless the governing codes specify otherwise, low voltage control wire may be installed by the CONTRACTOR when code allows. All 115- and 24-volt lines shall be installed. CONTRACTOR shall make necessary "Hot" connections.
- B. All 115-volt wire shall be installed in conduit and taken from appropriate sources as shown in the Contract Documents. CONTRACTOR shall coordinate supplier and installer.
- C. The CONTRACTOR shall provide low voltage, 24-volt direct burial wires. Wire size shall be as shown in the Contract Documents, but shall be not less than No. 14. Where sizes are not shown, they shall be sized per wire manufacturer's sizing charts and specifications.
- D. The CONTRACTOR shall provide all wiring, conduits, sleeves, and connection for the low voltage electrical system between controller and valves, and where else shown and necessary for a complete and operable irrigation system.
- E. Wires shall be color-coded as follows:
 - 1. Control wires shall be red.
 - 2. Ground (neutral) wire shall be white.
- F. All splices shall be moisture proof using specified electrical connectors.
- G. Wires shall be bundled together and wrapped with electrical tape similar to PVC at 5-foot intervals. They shall be buried in same trench as the pipe where possible.
- H. An expansion curl should be provided within 3-feet of each wire connection and at least every 100-feet of wire length on runs more than 100-feet in length. Expansion curls shall be formed by wrapping at least 5 turns of wire around a 1-inch pipe or more in diameter, then withdrawing pipe.
- I. All conduits and sleeves necessary for running wires under concrete, walks, and paving shall be furnished and installed before said concrete, walks, and paving work is constructed.
- J. Wire shall be continuous without splices and shall be routed in main line trench whenever possible.
- K. All wire under paving shall be encased in PVC pipe; changes in direction under paving shall be made with sweep ells.

3.09 PIPE TRENCH BACKFILL

- A. After pipe and wires have been installed, the trenches shall be backfilled. The backfill operation must provide a firm continuous support for the pipe.
- B. Backfill material shall be free of rocks and other materials that may damage the piping.

- C. Bottom of trenches shall be smooth and free of sharp rocks and other objects that may damage pipe.
- D. The initial backfill shall be accomplished by carefully tamping selected material (from material excavated from the trench) under the pipe and between the pipe and the trench walls.
- E. The pipes shall be filled with water and pressurized during backfilling operations if necessary, to prevent drainage to piping.
- F. The backfill shall be carefully installed around and over the pipe to approximately 10-inches of the ground surface, then water shall be allowed to flow in the trench. After this puddling operation has been completed and allowed to stand for 24 hours, the balance of the materials shall be placed in the trench to the sub-grade line (leaving room for topsoil). Rocks and other materials found in the backfill shall be removed. The backfill shall be compacted carefully and thoroughly.
- G. Couplings and fittings shall be left exposed until leakage tests have been completed, unless the ENGINEER orders otherwise.
- H. Topsoil shall be installed prior to planting.

3.10 TESTING AND ADJUSTMENTS

- A. The ENGINEER shall be notified by the CONTRACTOR prior to performing hydrostatic tests on the irrigation system in place. This test shall be done by the CONTRACTOR in the presence of the ENGINEER. With the risers capped, pressurize the system to two times the normal maximum site pressure. Pressure shall be maintained for 24 hour minimum. If leaks develop, repair and re-test until the irrigation system provides water tight. The test results will be acceptable to the ENGINEER when no leakage or loss of pressure is evident during the test period. Defects shall be detected and repaired prior to retesting.
- B. No debris, waste material, or rubbish shall be permitted to accrue on the site. Debris shall be removed on a daily basis and the entire work area returned to playable condition. As construction progresses and when work is completed in one area, debris, waste material, or rubbish shall be completely removed before the CONTRACTOR moves to another area.
- C. A coverage test shall be conducted to check all areas for complete coverage and adequate precipitation.
- D. The operation of all controllers and valves shall be demonstrated to the satisfaction of the Landscape Architect.

3.11 MAINTENANCE

- A. Water shall be applied as necessary to germinate seeds and prevent plant wilt. Automatic irrigation systems shall be operated by the Contractor per manufacturer's specifications and sprinkling program approved by the Landscape Architect.
- B. The Contractor shall continuously maintain all areas included in the contract during the progress of

the project until final acceptance of all work by the Landscape Architect and the City. The Contractor shall replace any plant material which dies or is damaged under his care within 48 hours.

- C. The Contractor shall protect his work from damage during the course of this project. Immediate repairs shall be made to areas damaged by vehicular, equestrian, or pedestrian traffic to restore the specified grades and plantings.
- D. Contractor shall exterminate pests or insects as necessary and repair or replace damaged areas and plantings.

*** END OF SECTION ***

SECTION 02902

REVEGETATION PLAN

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. All disturbed areas shall be graded as indicated in the Contract Documents, have topsoil respread thereon, and revegetated except road pavement and shoulders, riprap and cut slopes defined in this specification. Four habitat types, defined from moisture regimes (upland, dikes, fluctuating water table, and permanently wet) have the potential to be impacted during the construction of the project. This revegetation plan provides guidelines to reestablish the native vegetation in these different zones. This section includes soil preparation, weed control, erosion control, planting, watering, and plant establishment and maintenance.

1.02 SUBMITTALS

- A. Submit shop drawings and other items in accordance with the Contract Documents.

1.03 GUARANTEE

- A. In June or July of the summer following the fall plantings, the Construction Manager will determine if a satisfactory stand has been established. If not, the Construction Manager will notify the Contractor and reseeding efforts will be scrutinized and again implemented that fall, with associated monitoring the following summer.

1.04 OBSERVATIONS

- A. Request observation by the Construction Manager at least 48 hour in advance of the time observation is required.
- B. Observation will be required for the following parts of the work:
1. After completion of grading and soil preparation, and prior to reseeding and plant.
 2. Plant material when delivered to the project site.
 3. When planting and all other indicated or specified work has been completed.
 4. Upon completion of maintenance and plant establishment.

PART 2 -- PRODUCTS

2.01 TEMPORARY SEEDING

- A. Temporary seeding shall be used for disturbed areas where they will not be stabilized for long periods of time (over 45 days). Temporary seeding means the growing of a short term cover (plants) on a disturbed construction site that may be in danger of erosion from wind or water. The purpose of temporary seeding is to reduce erosion and sedimentation loss by stabilizing disturbed areas.

2.02 PERMANENT SEEDING

- A. General: The purpose of this practice is to establish perennial and permanent plant material for a site where development is complete or will have no further disturbance. This practice is to be used for areas that have been brought to final grade and will be to receive vegetative cover as a permanent method to control erosion from wind or water.
- B. Installation: The Contractor is to comply with the following directions in installing permanent seeding materials:
1. Install berms or swells to prevent concentrated flows from adjacent properties
 2. The prepared seedbed should be granular, loose, uniform grades to 2-4 inches in depth.
 3. Surface roughening - If rainfall causes the soil surface to become sealed or crusted, loosen it just prior to seeding by discing, harrowing, raking or other approved methods.
 4. Apply fertilizer as required to existing soil. If hydro-seeding methods are used, the fertilizer should be applied a minimum of 3 days after seed and mulch have been applied.
 5. Mulch - The seed supplier shall prepare written recommendations on how to ensure proper germination of seeds, which are to be followed by the Contractor.
- C. Seed Mix: The following seeds shall be included in the proposed seed mix.
1. Sodar Streambank Wheatgrass
 2. Agropyron, riparium

This is a native sod grass of the Northern Great Plains plant growth region and the western intermountain area. It tolerates drought and spreads rapidly to form a good ground cover. It appears early and resembles thick spike wheatgrass. It is used widely as a low-growing, low maintenance cover. This is useful for roadside seeding, recreation areas, disturbed areas, and other sites where a low maintenance turf is desired.

3. Neespar, Indian Ricegrass
4. Oryzopsis hymenoides

This grass is dense tufted perennial with upright stems. It is widely distributed over the west where it is one of the most drought-enduring native range grasses. It grows on semideserts, sand dunes, sandy plains, canyons, hillsides, foothills, exposed ridges, and dry, sandy, rocky, or granulated shale sites. It is one of the first species to become established on disturbed sandy sites. This species has excellent seedling vigor and is easily established. Birds, especially, mourning dove and pheasant and small rodents relish the plump nutritious seeds.

5. Vaughn, Sideoats Grama
6. Bouteloua Curtipendula

The primary use of sideoats Grama is in the Central and Northern Great Plains, but it grows in the Rocky Mountain area. This tolerates drought and has excellent seedling vigor. It is also a major warm-season, slightly spreading bunch grass.

7. Blue bunch Wheatgrass
8. Agropyron Spicatum

This is an important bunch grass of the intermountain region. However, the seed is generally available in limited quantities.

2.03 SEED MIXTURES

- A. The seeding mixture for each of these habitat types has been identified in the following tables. All seeding mixes and application rates have been derived from the Interagency Forage and Conservation Planting Guide for Utah (EC433). Seed mixes will be purchased through the USFS or an authorized supplier. All seeds will be furnished in standard containers labeled with seed names, lot numbers, percent species in the mix, net weight, percent purity, germination, and hard seed and maximum weed seed content.

UPLANDS				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses:				
Intermediate wheat	Elymus hispidus	15	3	1.10
Thickspike wheat	Elymus lanceolatus	10	2	0.73
Great Basin wildrye	Elymus cinereus	10	2	0.72
Letterman needle	Stipa letermanii	7	1.4	0.51
Western wheat	Elymus smithii	7	1.4	0.51
Slender wheat	Elymus trachycaulus	7	1.4	0.51
Big blue	Poa ampla	5	1	0.37
Mountain brome	Bromus carinatus	5	1	0.37
Forbs:				
White sweetclover	Melilotus alba	10	2	0.73
Chickpea milkvetch	Astragalus cicer	10	2	0.73
Small burnet	Sanguisorba minor	5	1	0.37
Palmer's penstemon	Penstemon palmeri	2	0.4	0.15
Lewis flax	Linum perenne/lewisii	2	.4	0.15
Shrubs:				
White Snowberry	Symphoricarpos albus	3	0.6	0.22
Bitterbrush	Purshia tridentate	2	0.6	0.15
Total:		100	20	7.35

DIKES				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses and Grasslikes:				
Streambank wheat	Agropyron riparium	36.6	3	1.10
Blue wildrye	Elymus glaucus	24.4	2	0.73
Western wheat	Agropyron smithii	24.4	2	0.73
Forbs:				
Western yarrow	Achillea millefolium	1.2	0.1	0.04
Northern sweetvetch	Hedysarum boreale	12.2	1	0.37
Pacific aster	Aster chilensis	1.2	0.1	0.04
Total:		100	8.2	2.98

FLUCTUATING WATER TABLE				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses and Grasslikes:				
Tufted hair	Deschampsia caespitosa	41.7	1	0.37
Baltic rush	Juncus balticus	4.2	0.1	0.04
American slough	Beckmannia syzygachne	12.5	0.3	0.11
Forbs:				
Rocky Mountain Iris	Iris missouriensis	20.8	0.5	0.18
Golden banner	Thermopsis montana	20.8	0.5	0.18
Total:		100	2.4	0.88

PERMANENTLY WET				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses and Grasslikes:				
Nebraska sedge	Carex nebrascensis	37.5	3	1.10
Beaked sedge	Carex rostrata	25	2	0.73
Baltic rush	Juncus arcticus	37.5	3	1.10
Forbs:				
Forb species not included since most will return naturally with proper care.				
Total:		100	2.4	0.88

2.04 HERBICIDE

- A. Prior to application of appropriate seed mix, a USDA Forest Service Pesticide-Use Proposal (Reference PSM 2150) will be filed with the Spanish Fork Ranger District for the application of herbicides for the control of noxious weeds.
- B. Herbicide shall be a Banvel 4-W.S. (4 pounds active ingredient per gallon [lbs ai/gal] and 2, 4-D Ester (4 lbs ai/gal) mixture will be used at 1 pint to 2 quarts Banvel/1-2 quarts 2, 4-D per 99 gallons and applied by backpack sprayer.

2.05 WOOD FIBER MULCH

- A. Use wood fiber mulch produced from whole wood chips which have been steamed and defibrated. Wood fiber mulch shall be free of germination or growth inhibiting substances and conform to the following:

Moisture content	15% maximum of oven dried weight of fibers
Organic matter	98% minimum of oven dried weight of fibers
Ash content	1% maximum of oven dried weight of fibers
pH range	4.0 to 6.0
Water holding capacity	10 times oven dried weight of fibers
Fiber length	30% minimum at least of 0.16-inches long, 50% minimum retained on 28 mesh screen

2.06 LIQUID TACKIFIER

- A. Use non-flammable concentrated liquid polymer emulsion with a minimum 60 percent solids. Tackifier should be non-toxic to plants and animals and shall allow water to penetrate soil.
- B. Chemical stabilization can be used as an alternative in areas where temporary seeding practices are applied.
- C. The application rates and procedures recommended by the manufacturer of a chemical stabilization product shall be followed to prevent the products from forming ponds and from creating large areas where moisture cannot get through.

2.07 HYDROSEEDING

- A. The hydroseed mix should be in a slurry having 60 pounds per acre (lb/acre) of tackifier and 400 lb/acre of wood fiber mulch. The tackifier will be derived from natural organic plant sources containing no growth- or germination-inhibiting materials, capable of hydrating in water.
- B. Wood fiber mulch will be processed wood fiber containing no growth- or germination-inhibiting materials, dyed a suitable color to ascertain material placement, and when hydraulically applied to the ground, will allow absorption and percolation of moisture.

2.08 PLANT MATERIAL

- A. Willow plugs are available at the Contractor's expense through the USFS Spanish Fork Ranger District's contracted supplier (Lone Peak Nursery) for native vegetation.

2.09 EROSION CONTROL (EXCELSIOR BLANKET)

- A. The excelsior blanket shall consist of a machine-produced mat of curled wood excelsior of 80 percent, 6-inch or longer fiber evenly distributed over the entire area of the blanket. Fiber dimensions shall be 0.21-inch by 0.42-inches. Average weight per square yard to be 0.08 pound at the time of manufacture.
- B. The top side of each blanket shall be covered with a biodegradable extruded plastic mesh. The blanket shall be made smolder-resistant without the use of chemical additives.
- C. The staples shall be made of wire, 0.091-inch in diameter or greater, "U" shaped with legs 6-inches in length and a 1-inch crown. Size and gauge of staples used may vary with soil conditions and shall be reviewed by the Owner's Representative.
- D. Excelsior blanket shall be by American Excelsior Company, 350 N. Redwood Road, North Salt Lake City, Utah, (801) 292-6060, or approved equal.

2.10 INLET SEDIMENT BARRIERS

- A. The Contractor shall install inlet sediment barriers as indicated on the Contract Documents. An inlet sediment barrier is a temporary barrier placed around a storm water catch basin.

- B. One of two types of inlet sediment may be required by the City. These two types are differentiated based on the surface around the catch basin; which can either be unimproved (dirt, etc.) or an improved area. In an unimproved area the inlet barrier is made of geotextile style silt fence. In an improved area such as paved areas, the inlet barrier is made of block and wire enclosed gravel. Bales of straw will not be allowed in either case.

2.11 MULCH

- A. Mulch is a temporary soil stabilization or erosion control practice where materials such as grass, hay woodchips, wood fibers, straw, or gravel are placed on the soil surface. The addition to stabilizing soils, mulching can reduce the speed of the storm water runoff over an area. The use of mulch can increase the result of seeding and seedling survival rates. Use of mulch may require a binder or netting to anchor the mulch to the ground.

TABLE 1 MULCH APPLICATION RATES			
TYPE OF MULCH	MULCH RATE (Tons per Acre)	LAND SLOPE (Percent)	SLOPE LENGTH LIMIT (Feet)
Straw	1.0	1-5	200
	1.0	6-10	100
	1.5	1-5	300
	1.5	6-10	150
	2.0	1-5	400
	2.0	6-10	200
	2.0	11-15	150
	2.0	16-20	100
	2.0	21-25	75
	2.0	26-33	50
	2.0	34-50	35
	2.0	34-50	35
Crushed Stone ¼ to 1 ½-inch	135	<16	200
	135	16-20	150
	135	21-33	100
	135	34-50	75
	240	<21	300
	240	21-33	200
	240	34-50	150
	240	34-50	150
Wood Chips	7	<16	75
	7	16-20	50
	12	<16	150
	12	16-20	100
	12	21-33	75
	25	<16	200
	25	16-20	150
	25	21-33	100
	25	34-50	75

Please Note: Slope Length Limit which is specified is the length of slope the Mulch rate specified is effective.

2.12 STRAW MULCH

- A. Material for straw mulching shall consist of the straw from oats, barley, wheat, or rye and shall be seed free or fumigated to prevent introduction of weeds. At least 50-percent of the mulch by weight shall be 10-inches or more in length. Old, dry straw which breaks and does not bend is unacceptable.

- B. Straw mulch is anchored or punched in by using a tracked construction vehicle. Straw mulch is to be applied at a rate of 2 ½-tons per acre. See Standard Drawing No. 5245 for additional information.
- C. Straw Mulch is to be anchored by the use of a photodegradable extruded plastic netting and stakes to anchored mulch to ground

2.13 HYDRO MULCH

- A. The manufacturer of Hydro mulch shall have recommended written application rates for the products. The recommendations shall address the following:
 - 1. Type of soil on slope to be protected.
 - 2. Percentage of slope.
 - 3. Application rate.

PART 3 -- EXECUTION

3.01 NOXIOUS WEED CONTROL

- A. Upland areas are defined as all areas 100-feet or more from rivers or other water sources; not shown as wetlands on the drawings.
- B. The disturbed upland areas will be sprayed primarily for the control of musk and Canada thistle. There will be two seasons of spraying; once in May as the thistle rosettes emerge, and once in July/August after bolt, but before seed set. All spraying activity will be coordinated with the Draper City and Salt Lake/Utah counties. Records will be kept indicating treatment rates, treatment locations, acres treated, etc.
- C. In all other areas of disturbance, two mechanical weed removal treatments will be used to control these noxious weeds; once in May as the thistle rosettes emerge, and once in July/August after bolt, but before seed set.

3.02 GROUND PREPARATION

- A. Perform rough grading on slopes to be reseeded to the lines and grades shown on the contract drawings except grading shall be approximately 6-inches below finished grade to allow for placement and spreading of topsoils. Slope ground to drain in agreement with contract drawings. Prepare ground surface for reseeded by restoring topsoils removed during clearing and grubbing and spreading them evenly over the areas to be hydro seeded to minimum depth of 6-inches.
- B. On all areas to be reseeded, roughen the soil surface immediately prior to reseeded. The intent is to create small ledges, cracks and crevices for the seeds to lodge in and reduce erosion. These created depressions and ledges will also provide shelter for small seedlings and increase water infiltration/retention and root penetration.
- C. On slopes steeper than 3:1, rake soils perpendicular to the slope or run bulldozer tracks up and down the slope to create small horizontal ledges for the seedbed. This final "pass" with the

dozer or rake is of critical importance in creating an adequate seedbed and controlling erosion. Where slopes are flatter than 3:1, use a disk or similar equipment to roughen the topsoil in furrows perpendicular to the slope.

3.03 AREAS NOT REQUIRING 6-INCHES OF TOPSOIL AND RESEEDING

- A. All areas disturbed by construction shall receive a 6-inch minimum thickness of topsoil (stockpiled during clearing and grubbing) and shall be reseeded with one of the four specified seed mixtures except in the areas listed below:
1. On the hard rock cut slopes list in paragraph 3.05.
 2. On road pavement and road shoulders to edge of shoulder.
 3. On minor approach roads to edge of shoulder.
 4. On riprap

3.04 REPLACEMENT OF HERBACEOUS SPECIES

- A. All reseeded efforts shall be conducted in November; later if snow conditions permit. On all upland areas, the areas to be reseeded will be prepared by mechanically disturbing the soil immediately before seeding. Additionally, after seeding, the soil shall be mechanically treated in the same fashion. Seeds shall be broadcast at rates as indicated in the tables.
- B. In all other habitat types, the areas will be reseeded without any seedbed preparation. At river crossings and at any areas within 100-feet of free water which may cause erosion, seeds will be hydro seeded. After application of seed hydro mix, another application will be made with slurry containing only tackifier (60 lb/acre) and wood fiber mulch (1,500 lb/acre).

3.05 INSTALLATION OF EROSION CONTROL (EXCELSIOR) BLANKET

- A. Areas to Receive Excelsior Blanket. Apply erosion control blanket on all disturbed slopes steeper than 2.5:1 except the hard rock road cut (not fill) slopes listed below by road station:

Station to Station	Cut Slope	Bedrock Material
R20+00 to R22+00	0.5:1	Sandstone
R141+00 to R145+00	0.5:1	Conglomerate
R185+00 to R195+00	1:1	Conglomerate
R207+00 to R214+00	1:1	Limestone
R215+50 to R229+00	1:1	Limestone

- B. Excelsior Blanket Installation. Complete all soil preparation and seeding in areas to receive erosion control blanket before placing blanket. Apply erosion control blanket within 5 calendar days after seeding and before precipitation falls. Install blanket per manufacturer's instructions with correct side up. Do not stretch the blanket. Allow it to lie loosely on the soil to achieve maximum soil contact. Horizontal seams within 15-feet of the top of the slope are not permitted. Do not tear or rip the blanket during installation. Staple the blanket per manufacturer's specifications. Staple requirements vary according to steepness and length of

slope. Place additional staples in areas such as swales, against rock outcroppings and as required to provide blanket to ground contact.

- C. Deliver all seed to the project site unmixed and in sealed containers. Label all seed according to state and federal seed laws with each container bearing the seed suppliers tags indicating the container weight, seed type (genus and species), seed purity percent, seed germination percent and date seed was tested. A sample of each seed type shall be collected at the time of delivery to the site by the Construction Manager. Samples will be tested to assure compliance with the seed specifications.
- D. Conduct all reseeding in the months of November or December to take advantage of winter moisture and assure the success of revegetation. Do not apply hydro seed during windy, rainy or snowy conditions or when the ground temperature is below 45-degrees Fahrenheit.

3.06 REPLACEMENT OF WOODY VEGETATION (WILLOWS)

- A. During construction through riparian areas with woody vegetation (especially willows), the vegetation and the soil in which the vegetation is growing will be removed by the backhoe and stockpiled. These clumps of woody vegetation will be incorporated into the revegetation of woody areas. If this is not feasible, new seedlings may be used.
- B. Following the application of erosion control material, either the large aggregates of woody vegetation and soil that were removed previously and temporarily stored in the shallows, or cuttings of Yellow willow (*Salix lutea*) and Coyote willow (*Salix exigua*) supplied by the USFS's contracted supplier, will be placed over the matting. Cuttings will be spaced on 6-foot centers and in all areas where woody vegetation grew prior to construction activities.

3.07 SITE PROTECTION

- A. Construct a 4-foot high fence built of 4-inch by 4-inch square wire and tuber pole mesh along all riparian areas, which have been revegetated. Additionally, a similar fence will be constructed along the pipeline in areas designated by the Construction Manager that may tempt vehicular exploration. Signs explaining the revegetation efforts will be erected.
- B. Remove all protective fencing following establishment of the reseeding effort, at the direction of the Construction Manager.

*** END OF SECTION ***

SECTION 02902A
REVEGATION PLAN

PART 1 – GENERAL

1.01 SCOPE

- A. All disturbed areas shall be graded as shown on the drawings, have topsoil respread thereon, and revegetated except road pavement and shoulders, riprap and cut slopes defined in this specification. Four habitat types, defined from moisture regimes (upland, dikes, fluctuating water table, and permanently wet) have the potential to be impacted during the pipeline construction and the road improvements activities proposed in Diamond Fork. This revegetation plan provides guidelines to reestablish the native vegetation in these different zones. This section includes soil preparation, weed control, erosion control, planting, watering, and plant establishment and maintenance.

1.02 SUBMITTALS

- A. Submit shop drawings and other items in accordance with the General Conditions.

1.03 GUARANTEE

- A. In June or July of the summer following the fall plantings, the Construction Manager will determine if a satisfactory stand has been established. If not, the Construction Manager will notify the Contractor and reseeding efforts will be scrutinized and again implemented that fall, with associated monitoring the following summer.

1.04 OBSERVATIONS

- A. Request observation by the Construction Manager at least 48 hour in advance of the time observation is required.
- B. Observation will be required for the following parts of the work:
1. After completion of grading and soil preparation, and prior to reseeding and plant.
 2. Plant material when delivered to the project site.
 3. When planting and all other indicated or specified work has been completed.
 4. Upon completion of maintenance and plant establishment.

PART 2 – PRODUCTS

2.01 SEED MIXTURES

- A. The Diamond Fork seeding mixture for each of these habitat types has been identified in the following tables. All seeding mixes and application rates have been derived from the Interagency Forage and Conservation Planting Guide for Utah (EC433). Seed mixes will be purchased through the USFS or an authorized supplier. All seeds will be furnished in standard containers labeled with seed names, lot numbers, percent species in the mix, net weight, percent purity, germination, and

hard seed and maximum weed seed content.

UPLANDS				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses:				
Intermediate wheat	Elymus hispidus	15	3	1.10
Thickspike wheat	Elymus lanceolatus	10	2	0.73
Great Basin wildrye	Elymus cinereus	10	2	0.72
Letterman needle	Stipa letermanii	7	1.4	0.51
Western wheat	Elymus smithii	7	1.4	0.51
Slender wheat	Elymus trachycaulus	7	1.4	0.51
Big blue	Poa ampla	5	1	0.37
Mountain brome	Bromus carinatus	5	1	0.37
Forbs:				
White sweetclover	Melilotus alba	10	2	0.73
Chickpea milkvetch	Astragalus cicer	10	2	0.73
Small burnet	Sanguisorba minor	5	1	0.37
Palmer's penstemon	Penstemon palmeri	2	0.4	0.15
Lewis flax	Linum perenne/lewisii	2	.4	0.15
Shrubs:				
White Snowberry	Symphoricarpos albus	3	0.6	0.22
Bitterbrush	Purshia tridentata	2	0.6	0.15
Total:		100	20	7.35
DIKES				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses and Grasslikes:				

Streambank wheat	Agropyron riparium	36.6	3	1.10
Blue wildrye	Elymus glaucus	24.4	2	0.73
Western wheat	Agropyron smithii	24.4	2	0.73
Forbs:				
Western yarrow	Achillea millefolium	1.2	0.1	0.04
Northern sweetvetch	Hedysarum boreale	12.2	1	0.37
Pacific aster	Aster chilensis	1.2	0.1	0.04
Total:		100	8.2	2.98

FLUCTUATING WATER TABLE				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
: Grasses and Grasslikes				
Tufted hair	Deschampsia caespitosa	41.7	1	0.37
Baltic rush	Juncus balticus	4.2	0.1	0.04
American slough	Beckmannia syzygachne	12.5	0.3	0.11
Forbs:				
Rocky Mountain Iris	Iris missouriensis	20.8	0.5	0.18
Golden banner	Thermopsis montana	20.8	0.5	0.18
Total:		100	2.4	0.88

PERMANENTLY WET				
Species Common Name	Species Latin Name	%/Total Seed Mix	Lbs/ Seed Acre	Oz/seed 1,000 sq/ft
Grasses and Grasslikes:				
Nebraska sedge	Carex nebrascensis	37.5	3	1.10
Beaked sedge	Carex rostrata	25	2	0.73
Baltic rush	Juncus arcticus	37.5	3	1.10
Forbs:				
Forb species not included since most will return naturally with proper care.				
Total:		100	2.4	0.88

2.02 HERBICIDE

- A. Prior to application of appropriate seed mix, a USDA Forest Service Pesticide-Use Proposal (Reference PSM 2150) will be filed with the Spanish Fork Ranger District for the application of herbicides for the control of noxious weeds.
- B. Herbicide shall be a Banvel 4-W.S. (4 pounds active ingredient per gallon [lbs ai/gal] and 2, 4-D Ester (4 lbs ai/gal) mixture will be used at 1 pint to 2 quarts Banvel/1-2 quarts 2, 4-D per 99 gallons and applied by backpack sprayer.

2.03 WOOD FIBER MULCH

- A. Use wood fiber mulch produced from whole wood chips which have been steamed and defibrated. Wood fiber mulch shall be free of germination or growth inhibiting substances and conform to the following:

Moisture content	15% maximum of oven dried weight of fibers
Organic matter	98% minimum of oven dried weight of fibers
Ash content	1% maximum of oven dried weight of fibers
pH range	4.0 to 6.0
Water holding capacity	10 times oven dried weight of fibers
Fiber length	30% minimum at least of 0.16-inches long, 50% minimum retained on 28 mesh screen

2.04 LIQUID TACKIFIER

- A. Use non-flammable concentrated liquid polymer emulsion with a minimum 60 percent solids. Tackifier should be non-toxic to plants and animals and shall allow water to penetrate soil.

2.05 HYDROSEEDING

- A. The hydroseed mix should be in a slurry having 60 pounds per acre (lb/acre) of tackifier and 400 lb/acre of wood fiber mulch. The tackifier will be derived from natural organic plant sources containing no growth- or germination-inhibiting materials, capable of hydrating in water.
- B. Wood fiber mulch will be processed wood fiber containing no growth- or germination-inhibiting materials, dyed a suitable color to ascertain material placement, and when hydraulically applied to the ground, will allow absorption and percolation of moisture.

2.06 PLANT MATERIAL

- A. Willow plugs are available at the Contractor's expense through the USFS Spanish Fork Ranger District's contracted supplier (Lone Peak Nursery) for native vegetation.

2.07 EROSION CONTROL (EXCELSIOR BLANKET)

- A. The excelsior blanket shall consist of a machine-produced mat of curled wood excelsior of 80 percent, 6-inch or longer fiber evenly distributed over the entire area of the blanket. Fiber dimensions shall be 0.21-inch by 0.42-inches. Average weight per square yard to be 0.08 pound at the time of manufacture.
- B. The top side of each blanket shall be covered with a biodegradable extruded plastic mesh. The blanket shall be made smolder-resistant without the use of chemical additives.
- C. The staples shall be made of wire, 0.091-inch in diameter or greater, "U" shaped with legs 6-inches in length and a 1-inch crown. Size and gauge of staples used may vary with soil conditions and shall be reviewed by the Owner's Representative.
- D. Excelsior blanket shall be by American Excelsior Company, 350 N. Redwood Road, North Salt Lake City, Utah, (801) 292-6060, or approved equal.

2.08 STRAW MULCH

- A. Material for straw mulching shall consist of the straw from oats, barley, wheat, or rye and shall be seed free or fumigated to prevent introduction of weeds. At least 50 percent of the mulch by weight shall be 10-inches or more in length. Old, dry straw which breaks and does not bend is unacceptable.

PART 3 -- EXECUTION

3.01 NOXIOUS WEED CONTROL

- A. Upland areas are defined as all areas 100-feet or more from rivers or other water sources; not shown as wetlands on the drawings.
- B. The disturbed upland areas will be sprayed primarily for the control of musk and Canada thistle. There will be two seasons of spraying; once in May as the thistle rosettes emerge, and once in July/August after bolt, but before seed set. All spraying activity will be coordinated with the Spanish Fork Ranger District and Utah County. Records will be kept indicating treatment rates, treatment locations, acres treated, etc.
- C. In all other areas of disturbance, two mechanical weed removal treatments will be used to control these noxious weeds; once in May as the thistle rosettes emerge, and once in July/August after bolt, but before seed set.

3.02 GROUND PREPARATION

- A. Perform rough grading on slopes to be reseeded to the lines and grades shown on the contract drawings except grading shall be approximately 6-inches below finished grade to allow for placement and spreading of topsoils. Slope ground to drain in agreement with contract drawings. Prepare ground surface for reseeded by restoring topsoils removed during clearing and grubbing and spreading them evenly over the areas to be hydroseeded to minimum depth of 6-inches.
- B. On all areas to be reseeded, roughen the soil surface immediately prior to reseeded. The intent is to create small ledges, cracks and crevices for the seeds to lodge in and reduce erosion. These created depressions and ledges will also provide shelter for small seedlings and increase water infiltration/retention and root penetration.
- C. On slopes steeper than 3:1, rake soils perpendicular to the slope or run bulldozer tracks up and down the slope to create small horizontal ledges for the seedbed. This final "pass" with the dozer or rake is of critical importance in creating an adequate seedbed and controlling erosion. Where slopes are flatter than 3:1, use a disk or similar equipment to roughen the topsoil in furrows perpendicular to the slope.

3.03 AREAS NOT REQUIRING 6-INCHES OF TOPSOIL AND RESEEDING

- A. All areas disturbed by construction shall receive a 6-inch minimum thickness of topsoil (stockpiled during clearing and grubbing) and shall be reseeded with one of the four specified seed mixtures except in the areas listed below:
 - 1. On the hard rock cut slopes list in paragraph 3.05.
 - 2. On road pavement and road shoulders to edge of shoulder.
 - 3. On minor approach roads to edge of shoulder.
 - 4. On riprap.

3.04 REPLACEMENT OF HERBACEOUS SPECIES

- A. All reseeding efforts shall be conducted in November; later if snow conditions permit. On all upland areas, the areas to be reseeded will be prepared by mechanically disturbing the soil immediately before seeding. Additionally, after seeding, the soil shall be mechanically treated in the same fashion. Seeds shall be broadcast at rates as indicated in the tables.
- B. In all other habitat types, the areas will be reseeded without any seedbed preparation. At river crossings and at any areas within 100-feet of free water which may be erosional, seeds will be hydroseeded. After application of seed hydromix, another application will be made with slurry containing only tackifier (60 lb/acre) and wood fiber mulch (1,500 lb/acre).

3.05 INSTALLATION OF EROSION CONTROL (EXCELSIOR) BLANKET

- A. Areas to Receive Excelsior Blanket. Apply erosion control blanket on all disturbed slopes steeper than 2.5:1 except the hard rock road cut (not fill) slopes listed below by road station:

Station to Station	Cut Slope	Bedrock Material
R20+00 to R22+00	0.5:1	Sandstone
R141+00 to R145+00	0.5:1	Conglomerate
R185+00 to R195+00	1:1	Conglomerate
R207+00 to R214+00	1:1	Limestone
R215+50 to R229+00	1:1	Limestone

- B. Excelsior Blanket Installation. Complete all soil preparation and seeding in areas to receive erosion control blanket before placing blanket. Apply erosion control blanket within 5 calendar days after seeding and before precipitation falls. Install blanket per manufacturer's instructions with correct side up. Do not stretch the blanket. Allow it to lie loosely on the soil to achieve maximum soil contact. Horizontal seams within 15-feet of the top of the slope are not permitted. Do not tear or rip the blanket during installation. Staple the blanket per manufacturer's specifications. Staple requirements vary according to steepness and length of slope. Place additional staples in areas such as swales, against rock outcroppings and as required to provide blanket to ground contact.
- C. Deliver all seed to the project site unmixed and in sealed containers. Label all seed according to state and federal seed laws with each container bearing the seed suppliers tags indicating the container weight, seed type (genus and species), seed purity percent, seed germination percent and date seed was tested. A sample of each seed type shall be collected at the time of delivery to the site by the Construction Manager. Samples will be tested to assure compliance with the seed specifications.
- D. Conduct all reseeding in the months of November or December to take advantage of winter moisture and assure the success of revegetation. Do not apply hydroseed during windy, rainy or snowy conditions or when the ground temperature is below 45 degrees Fahrenheit.

3.06 REPLACEMENT OF WOODY VEGETATION (WILLOWS)

- A. During construction through riparian areas with woody vegetation (especially willows), the vegetation and the soil in which the vegetation is growing will be removed by the backhoe and stockpiled. These clumps of woody vegetation will be incorporated into the revegetation of woody areas. If this is not feasible, new seedlings may be used.
- B. Following the application of erosion control material, either the large aggregates of woody vegetation and soil that were removed previously and temporarily stored in the shallows, or cuttings of Yellow willow (*Salix lutea*) and Coyote willow (*Salix exigua*) supplied by the USFS's contracted supplier, will be placed over the matting. Cuttings will be spaced on 6-foot centers and in all areas where woody vegetation grew prior to construction activities.

3.07 SITE PROTECTION

- A. Construct a 4-foot high fence built of 4-inch by 4-inch square wire and tuber pole mesh along all riparian areas which have been revegetated. Additionally, a similar fence will be constructed along the pipeline in areas designated by the Construction Manager that may tempt vehicular exploration. Signs explaining the revegetation efforts will be erected.
- B. Remove all protective fencing following establishment of the reseeding effort, at the direction of the Construction Manager.

*** END OF SECTION ***

SECTION 02925

TOPSOIL

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to strip topsoil from designated areas and place in a stockpile. Work shall also include spreading of topsoil from the stockpiles onto prepared areas.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02933 – Seeding.

PART 2 -- PRODUCTS

2.01 TOPSOIL

- A. Obtain from on-site locations.

PART 3 -- EXECUTION

3.01 STANDARD PROCEDURES

- A. Place topsoil just before seeding when possible.
- B. Do not place topsoil if it cannot be seeded within the seeding window specified in the Contract Documents.
- C. Do not strip or handle topsoil when wet or frozen.
- D. Work topsoil only when it can be left in a friable, loose and crumbly state.

3.02 STRIP AND STOCKPILE TOPSOIL

- A. Strip topsoil only from areas identified on the plans and approved by the Engineer.
- B. Remove vegetation greater than 2-inches in diameter and taller than 4-feet and rocks larger than 2-inches in diameter from the area to be stripped.
- C. Strip the topsoil along with the remaining vegetation to a depth of 12-inches except in drainage basins where topsoil is expected to be 2 to 3 feet thick.
- D. Remove and dispose of any roots larger than 2-inches in diameter or longer than 12-inches.
- E. Stockpile topsoil in approved locations per the Contract Documents.
- F. Grade to minimize any erosion on and around the stockpiles.

*** END OF SECTION ***

SECTION 02933

SEEDING

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment as required to apply seed. This includes but is not limited to preparing ground, sowing, seeds and other management practices on areas shown on the project drawings and in accordance with this specification.

1.02 RELATED WORK AND REFERENCES

- A. Section 02925 – Topsoil

1.03 DEFINITIONS

- A. A *sandy* soil is one with a USDA soil texture classification of any of the following: sand, loamy sand, sandy clay loam, or a sandy clay.
- B. A *non-sandy* soil is one with a USDA soil texture classification of any of the following: loam, silt loam, silt, clay loam, silty clay loam, silty clay, or clay.

PART 2 -- PRODUCTS

2.01 SEED

- A. Supply seed on a pure live seed (PLS) basis.
- B. Meet the Utah Seed Act.
- C. Provide inoculated legume seed.
- D. Each variety of seed shall be furnished and delivered in separate bags or containers. Provide germination or tetrazonlium test data for each variety of seed. Date of tests shall be within nine months of the time of seeding.

2.02 EROSION CONTROL MULCH AND MAT

- A. Straw mulch – Straw mulch shall be oat, wheat or rice straw. The straw mulch shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.
- B. Erosion control mat – Provide as described in Section 02272 – Fabric, Erosion Control Mats and Geotextiles.

PART 3 -- EXECUTION

3.01 GENERAL

- A. Do not use wet, moldy or damaged seed.
- B. Notify City two working days prior to seeding.
- C. Complete all seeding on or before September 15 of the year in which the seeding is to be completed.

3.02 SECURE SEED

- A. Submit seed certification based on PLS and results of germination tests. The purchase order should list the common and botanical name for each seed species.
- B. Place and compact the entire width of the berm in accordance with Section 02292.

3.03 SEED SUBSTITUTIONS

- A. Before requesting a seed substitution, contact the major seed companies in the state to verify that the seed is unavailable.
- B. Have the Engineer contact the Landscape Architect, who developed the seed mix, to verify the seed is unavailable and to recommend a seed substitution.
- C. Replacement seed shall be of equal or greater function to the originally specified seed.
- D. Place drains at maximum intervals of 1,000-feet along a continuous slope.

3.04 MIXING SEED

- A. Mix and bag the different varieties of seed in the presence of the City.
- B. Obtain the seed from the same lots from where it was sampled.
- C. Mix the different seed varieties to provide an even blend.
- D. Bag the mixed seed and label and seal the container.

3.05 SEED APPLICATION RATES PER ACRE

- A. Seed all areas using the appropriate seed mix listed in the following tables according to location and/or soil conditions. The rates listed in the table are for broadcast seeding. For drill seeding, reduce the rates by 1/3.

DITCH SEED MIX - ALL SOILS			
<i>Common Name</i>	<i>Botanical Name</i>	<i>Form</i>	<i>Rate (lbs/acre, PLS)</i>
Ephraim Crested Wheatgrass	Agropyron cristatum	Slightly Rhyzomatous	8.0
Sodar Streambank Wheatgrass	Bromus inermis		16.0
Western Wheatgrass	Elymus smithii	Strongly Rhyzomatous	6.0
Covar Sheep Fescue	Festuca ovina	Bunch	6.0
Perennial Ryegrass	Lolium perenne		4.0
Total =			40 lbs/acre

SEED MIX - SANDY SOILS			
<i>Common Name</i>	<i>Botanical Name</i>	<i>Form</i>	<i>Rate (lbs/acre, PLS)</i>
Crested Wheatgrass "Hycrest"	Agrophron cristatum	Bunch	5.0
Bluebunch Wheatgrass "Secar"	Elymuss spicatus	Bunch	3.5
Western Wheatgrass	Elymus smithii	Stongly Rhyzomatous	3.5
Sheep Fescue "Covar"	Festuca ovina	Bunch	2.5
Indian Ricegrass	Stipa hymenoides	Bunch	2.5
Intermediate Wheatgrass "Tegmar"	Elymus hispidus	Mild sod forming	4.5
Thickspike Wheatgrass	Elymus lanceolatus	Sod forming	2.5
Great Basin Wildrye	Elymus cinereus	Slightly spreading	2.5
Blue Flax	Linum perenne	Wildflower	1.5
Light Evening Primrose		Wildflower	0.5
California Poppy	Eschscholzia californica	Wildflower	1.0
			Total = 29.5 lbs/acre

SEED MIX - NON-SANDY SOILS			
<i>Common Name</i>	<i>Botanical Name</i>	<i>Form</i>	<i>Rate (lbs/acre, PLS)</i>
Crested Wheatgrass "Ephraim"	Agrophron cristatum	Slightly Rhyzomatous	4.5
Smooth Brome	Bromus inermis	Soil forming	4.5
Intermediate Wheatgrass "Tegmar"	Elymus hispdus	Mild sod forming	4.5
Great Basin Wildrye	Elymus cinereus	Slightly spreading	2.5
Russian Wildrye	Elymus junceus	Bunch	3.5
Western Wheatgrass	Elymus smithii	Strongly Rhyzomatous	2.5
Slender Wheatgrass	Elymus trachycaulus	Bunch	2.5
Utah Sweet Vetch		Spreading (legume)	2.0
Blue Flax	Linum perenne	Wildflower	1.5
Light Evening Primrose		Wildflower	1.0
California Poppy	Eschscholzia californica	Wildflower	1.0
			Total = 30.0 lbs/acre

3.06 SEED BED PREPARATION

- A. Do not work topsoil or seed when the soil is saturated or frozen.
- B. If a crust has formed on the topsoil, loosen the ground surface to a depth of one-inch.
- C. If the topsoil has produced weeds, remove them before seeding.
- D. Prior to seeding, moisten the soil to a depth of 6 to 8-inches.

3.07 METHODS

A. Drill seeding

1. Use the drill method of seeding accessible slopes 3:1 and flatter. Use a rangeland type drill equipped with a depth band, seed box agitator, seed metering device, furrow opener and packer wheels.
2. Calibrate the drill using the manufacturer's directions in the presence of the City.
3. Meet the specified application rate.
4. Space drill rows 6 to 8-inches and drill seeds 3/8-inch to 1/2 -inch in depth.
5. Drill along the contour of the slope.
6. Maintain the drill at the calibrated setting throughout the seeding operation.

B. Broadcast seeding

1. Use the broadcast method of seeding on all areas that were not drill seeded.
2. If seed is to be hand broadcast, it shall be broadcast in two directions at right angle to each other.
3. Rake seed into the soil perpendicular to the slope.

3.08 EROSION CONTROL MULCH

- A. On slopes of 3:1 and flatter, apply straw mulch with a minimum stalk length of 8-inches and a minimum rate of 3,000-pounds per acre.
- B. The moisture content of the straw shall not be greater than 20-percent.
- C. Anchor the straw mulch into the soil by the crimping method.

3.09 TIMING

- A. All seeding and slope stability measures shall be in place no later than 3 weeks after topsoil has been placed to finished grade.

3.10 INSPECTION

- A. Following the completion of the initial revegetation, the City will inspect the work to be certain that installation is as per supplier and/or manufacturer's recommendations.
- B. If the work is not approved, the Contractor shall replant and/or reseed and/or stabilize all areas within the initial area of disturbance and take all other actions reasonably necessary as directed by the City to provide erosion control and slope and/or area stabilization within the initial area of disturbance.

3.11 WARRANTY PERIOD

- A. A 36-month warranty period (the "Warranty Period") shall commence after the City approves work. At the end of the warranty period, the City will make an inspection to determine whether or not the revegetation growth has taken hold and the disturbed areas are established and stabilized, i.e. lack of rill or gully erosion.
- B. The technical procedure in determining if the vegetation has been established enough to stabilize the soils against either rill or gully erosion, is the quadrant frame method, or the step transect method. Both methods are a way of comparing plant production, biomass cover and erosion in the revegetated

area with the same in an adjacent undisturbed and/or native site. Either method will be performed at several randomly selected locations at the project.

- C. If, at the end of the warranty period, the City determines that the vegetation is unsatisfactory, the Contractor shall install new measures or repair the old measures as directed by the City.

*** END OF SECTION ***

SECTION 03100A
CONCRETE FORMWORK

PART 1—GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all materials for concrete formwork, bracing, shoring, and supports and shall design and construct all falsework, all in accordance with the provisions of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 - Contractor Submittals
- B. Section 03200 - Reinforcement Steel
- C. Section 03300 - Cast-in-Place Concrete
- D. Precast Concrete Specialties. 03480

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Codes:
- 1. The Building Code, as referenced herein, shall be the Uniform Building Code (UBC), as specified in section entitled, "Reference Standards." 01090
- B. Government Standards:
- 1. PS 1-74 U.S. Product Standard for Concrete Forms, Class I.
- C. Commercial Standards:
- 1. ACI 347-78 Recommended Practice for Concrete Formwork.

1.04 CONTRACTOR SUBMITTALS

- A. Falsework Calculations and Drawings: The Contractor's attention is directed to the provisions of Section 1717 of the Division of Industrial Safety, Construction Safety Orders, as revised November 1973, which requires that all falsework or vertical shoring installations where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a civil engineer, registered in the State of Utah; provided further, that a copy of the falsework plan or shoring layout shall be available on the job site at all times.
- B. The CONTRACTOR shall, in accordance with the requirements in Section entitled "Contractor Submittals," 01300 submit detailed plans of the falsework proposed to be used. Such plans shall be in sufficient detail to indicate the general layout, sizes and members, anticipated stresses, grade of materials to be used in the falsework, and typical soil conditions.

1.05 QUALITY ASSURANCE

- A. **Tolerances:** The variation from established grade or lines shall not exceed 1/4-inch in 10-feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the "Suggested Tolerances" specified in Section 203 of ACI 347.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Except as otherwise expressly accepted by the ENGINEER, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:
1. Walls - Steel or plywood panel
 2. Columns - Steel, plywood or fiber glass plywood
 3. Roof and floor slabs - Plywood
 4. All other work - Steel panels, plywood or tongue and groove lumber

2.02 FORM AND FALSEWORK MATERIALS

- A. Materials for concrete forms, formwork, and falsework shall conform to the following specifications:
1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20.
 2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured, especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.
 3. Form materials shall be plywood or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line and grade as shown. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Exterior Grade.
- B. Unless otherwise shown, exterior corners in concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.
- C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 30 psf minimum.

2.03 FORM TIES

- A. Form ties with integral water stops shall be provided with a plastic cone or other suitable means of forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable for-tie fasteners having a circular cross-section, shall not exceed 1-1/2-inches; and all such fasteners shall be such as to leave holes of regular shape for reaming.
- B. Form ties for water-retaining structures shall have integral water stops. Removable taper ties may be

used when approved by the ENGINEER. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

PART 3 -- EXECUTION

3.01 GENERAL

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the work and replaced at the Contractor's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state, and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the ENGINEER and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.
- B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

3.02 FORM DESIGN

- A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to stuffing of the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of the wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of finds and paste during placement and vibration of concrete. Such gasket may be a 1 to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable the ENGINEER.

3.03 CONSTRUCTION

- A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of

comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the ENGINEER. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties:

1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section entitled "Cast-in-Place Concrete." 03300 Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face of faces of the concrete.
2. Removable Ties: Where taper ties are approved for used, the larger end of the taper tie shall be on the wet side of walls, in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plumb shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls, which are dry on both sides. Exposed faces of walls shall have the outer 2-inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

3.04 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to the ENGINEER. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces, which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the ENGINEER.

3.05 REMOVAL OF FORMS

- A. Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28-day strength specified in Section entitled, "Cast-in-Place Concrete"; 03300 provided, that no forms shall be disturbed or removed under an individual panel or unit before the concrete in the adjacent

panel or until has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the ENGINEER who will make several test cylinders for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7-day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls and columns shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the WORK not specifically mentioned herein shall remain in place for periods of time as determined by the ENGINEER.

3.06 MAINTENANCE OF FORMS

- A. Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a non-staining mineral oil or other lubricant acceptable to the ENGINEER. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the CONTRACTOR shall perform the oiling at least two weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.07 FALSEWORK

- A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, the requirements of the Construction Safety Orders of the California Division of Industrial Safety, and the requirements specified herein.
- B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.
- C. Falsework shall be placed upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall not exceed 20 tons. When falsework is supported on any portion of the structure, which already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

*** END OF SECTION ***

SECTION 03102

GENERAL CONCRETE CONSTRUCTION

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. This section includes materials, installation, and testing of formwork, reinforcing steel, joints, concrete, insulation, and finishing and curing for general concrete construction.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 09820 - Crystalline Waterproofing
- B. Section 09900 - Painting and Coating
- C. Section 15142 - Wall Pipes, Seep Rings, and Penetrations

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the Contract Documents.
- B. Submit manufacturer's catalog data and descriptive literature for form ties, spreaders, corner forms, form coatings and curing compound, bond breakers, joint sealant, backing rod, joint filler, control joints, epoxy bonding compound, and floor hardener.
- C. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.
- D. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, or roof slabs) including dowels and corner bars. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as specified.
- E. Submit concrete mix design at least 15 days before placing concrete.
- F. Submit insulation manufacturer's product data sheets confirming compliance with the physical properties specified herein, CFC compliance certification and 15-year limited thermal warranty certificate, samples of specified insulation, and adhesive manufacturer's product information confirming compatibility with polystyrene insulation.

PART 2 -- PRODUCTS

2.01 FORMWORK

- A. Design forms according to ACI 347.
- B. Class I Forms. Use steel forms, ply form, or smooth-surface plywood 3/4-inch minimum thickness for straight surfaces and 1/2-inch minimum thickness for curved surfaces.
- C. Class II Forms. Use plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue and groove or ship lap joints. Forms shall be oiled.
- D. Class II forms may be used for exterior concrete surfaces, which are 1-foot, or more below finished grade. Use Class I forms for all other surfaces.

2.02 BOND BREAKER

- A. Bond breaker shall be a nonstaining type which will provide a positive bond prevention, such as Williams Tilt-Up Compound, as manufactured by Williams Distributors, Inc., Seattle, Washington; Silcoseal 77, as manufactured by SCA Construction Supply Division, Superior Concrete Accessories, Franklin Park, Illinois; or approved equal.

2.03 FORM RELEASE AGENT

- A. Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agency shall be nonstaining and nontoxic after 30 days.
- B. For steel forms, release agent shall prevent discoloration of the concrete due to rust.

2.04 REINFORCING STEEL

- A. Reinforcement shall conform to ASTM A615, Grade 60.
- B. Fabricate reinforcing in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.
- C. Deliver reinforcing steel to the site bundled and tagged with identifying tags.

2.05 WELDED WIRE FABRIC

- A. Welded wire fabric shall conform to ASTM A185.

2.06 TIE WIRE

- A. Tie wire shall be 16-gauge minimum, black, soft, annealed.

2.07 BAR SUPPORTS

- A. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized and plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.08 BAR COUPLERS

- A. Reinforcing steel bar splicing couplers shall be a mechanical type as manufactured by Dayton Barsplice Inc. or approved equal. Use couplers, which do not reduce tensile or ultimate strength of bars.

2.09 JOINT SEALANT

- A. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall be RC 270 of Products Research and Chemical Corporation, Mameco International Vulkem 227, Multi-Chem Mc287, or approval equal.

TECHNICAL REQUIREMENTS	
Consistency	Gun grade
Tack free time	24-hours at 75 degrees F and 50% R.H.
Pot life	1 to 3 hours
Hardness	35 Shore A,5
Elongation	700%
Tensile strength, ASTM D412	300 psi
Peel strength on concrete	No loss of bond after 24 hours at 150% elongation
Temperature service range	-40 degrees F to +175 degrees F
Immersion in water	Continuous

2.10 BACKING ROD FOR EXPANSION JOINTS

- A. Backing rod shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethafoam SB, as manufactured by Dow Chemical Company, Midland, Michigan; or approved equal. The rod shall be 1/4-inch larger in diameter than the joint width. Where possible, provide full-length sections for the joint; minimize splices. Apply backup rod and bond breaker tape in expansion joints.

2.11 BOND BREAKER TAPE

- A. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape, which will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.12 PREFORMED CONTROL JOINT

- A. Preformed control joint shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip, KSF-150-5--5-, manufactured by Vinylex Corp., Knowville, Tennessee, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, California, or approved equal. Provide the preformed control joint material in full-length unspliced pieces.

2.13 PREMOLDED JOINT FILLER

- A. Joint filler shall be preformed, nonextruded type constructed of closed-cell neoprene conforming to ASTM D 1752, Type I, as manufactured by W.R. Grace Company of Cambridge, Massachusetts; W.R. Meadows, Inc., Elgin, Illinois; or equal.

2.14 STEEL EXPANSION JOINT DOWELS

- A. Steel expansion joint dowels shall conform to one of the following:
 - 1. Epoxy coated steel bar dowels with a 12-mil coating thickness. Steel bar dowels shall conform to ASTM A 36 or ASTM 615, plain rounds, Grade 40. Epoxy coating shall be in conformance with ASTM A 775; or approve equal.
 - 2. Stainless steel bar dowels conforming to ASTM A 276, Type 302.
- B. Exposed portion of expansion joint dowels shall be thoroughly greased prior to casting or adjoining wall or slab.

2.15 CEMENT

- A. Cement shall conform to ASTM C150, Type II, with maximum tricalcium aluminate not to exceed 8 percent and shall be from a prequalified producer of cement (Corps of Engineers specifications). The maximum percent alkalis shall not exceed 0.6 percent.

2.16 AGGREGATES

- A. Aggregates shall comply with ASTM C33 and shall contain less than 1 percent asbestos by weight or volume and be free from any substances, which will react with cement alkalis.

2.17 CONCRETE ADMIXTURES

- A. Concrete shall contain an air-entraining admixture. Admixture shall conform to ASTM C260, except it shall be nontoxic after 30 days and shall contain no chlorides. Admixtures shall be Master Builders MB-AE 10, Sika AER (Sikamix 104), or approved equal.

- B. Concrete shall contain a water-reducing admixture. The admixture shall conform to ASTM C494, Type A or D except it shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixtures shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete (Sikamix 160) Normal Set, Sika Chemical Corporation, or approved equal.
- C. Do not use any admixture, which contains chlorides or other corrosive elements in any concrete.

2.18 GROUT

- A. Nonshrink grout shall conform to the Corps of Engineers Specification for Nonshrink Grout, CRD-C621-83, and to these specifications. Use a nongas-liberating type, cement base, premixed product requiring only the addition of water for the required consistency. Grout shall be UPCON High Flow, Master Flow 713, or approved equal. Components shall be inorganic.
- B. Ordinary type grout (dry pack) shall consist of one part portland cement to two parts sand (100 percent passing a No. 8 sieve). Add sufficient water to form a damp formable consistency.
- C. Expansive Grout. Premixed, cementations mixture with a minimum 28-day strength of 3,500 psi. Provide air-entraining content as recommended by the manufacturer.
- D. Epoxy Grout.
1. Mix the two components of epoxy bonding compound in compliance with the manufacturer's instructions.
 2. Use sand, which is oven dry and meets the following gradation requirements for epoxy grout:

Sieve Size	No. 8	No. 50	No. 100
% Passing	100	30-15	55

2.19 MORTAR

- A. Mortar or grout placed on horizontal construction joints shall be a mixture of cement, sand, and water in the same proportions used in the concrete but with coarse aggregate omitted.
- B. Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

2.20 BONDING COMPOUND

- A. Epoxy bonding compound shall be Concessive 1001 LPL, Adhesive Engineering Company, San Carlos, California; Sikadur Hi-Mod (Sikastix 370), Sika Chemical Corporation, Lyndhurst, New Jersey; Epoxtile 2391 by W.R. Grace and Company; Euco Epoxy 463 by Euclid Chemical Company; or approved equal.

- B. Nonepoxy bonding compound shall be Weldcrete by Larsen Products Corporation, Link by Sta-Dry Manufacturing Corp., Euco Weld by Euclid Chemical Company, or approved equal. The compound shall be rewettable for up to two weeks.

2.21 CONCRETE MIX DESIGN

- A. Conform to ASTM C94, except as modified by these specifications.
 B. Air content as determined by ASTM C231 shall be 4 percent to 1 percent.
 C. Maximum water-cement ratio for Class A concrete shall be equal to 0.45 by weight.
 D. Use classes of concrete as described in the following table:

Class	Type of Work	28-Day Compressive Strength (psi)	Minimum Cement Content (lbs/c.y.)
A	Concrete for all structures and concrete not otherwise specified. Concrete fill at structure foundations, cradle, supports across pipe trenches.	4,000	564
B	Pavement	3,000	500
C	Floor grout, miscellaneous unreinforced concrete.	2,000	376

- E. Measure slump in accordance with ASTM C143. Slump shall be as follows:

Slab on grade or heavy sections wider (in plan view) than 3-feet	3-inches max.
Footings, walls, suspended slabs, beams, and columns	4-inches max.
Pavement	2-inches max.

Proportion and produce the concrete to have a maximum slump as shown. A tolerance of up to 1-inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

- F. Aggregate size shall be 3/4-inch maximum for slabs and sections 8-inches thick and less. Aggregate size shall be 1-inch maximum for slabs and sections greater than 8-inches and smaller than 17-inches. Aggregate size shall be 1 1/2 inches maximum for all larger slabs and sections.
- G. Combined aggregate grading shall be as shown in the following table:

	Maximum Aggregate Size		
	1 1/2-inch	1-inch	3/4-inch
Aggregate Grade per ASTM C33	467	57	67

- H. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.

2.22 CONCRETE TESTS

- A. Perform concrete quality testing on the concrete as follows:
1. **Frequency of Sampling.** Cast four concrete test cylinders from each 50 cubic yards of concrete, or fraction thereof, of each class of concrete placed in any one day. Sampling and curing of cylinders shall conform to ASTM C 31.
 2. **Strength Testing.** Test cylinders in accordance with ASTM C 39. Test one cylinder at 7 days for information; test two cylinders at 28 days for acceptance; and hold one cylinder for verification. Strength acceptance will be based on the average of the strengths of the two cylinders tested at 28 days. If one cylinder of a 28-day test manifests evidence of improper sampling, molding, or testing, other than low strength, discard it and use the fourth cylinder for the test result.
 3. Determine concrete slump by ASTM C 143 with each strength test sampling and as required to establish consistency.
 4. Determine air content of the concrete using ASTM C 231 to verify the percentages of air in the concrete immediately prior to depositing in forms.
 5. The average value of concrete strength tests shall be equal to or greater than the specified 28-day strength. Non-test shall be less than 90-percent of the specified 28-day strength.
 6. If the 28-day strength tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one set of three cores from each area may be taken as selected by the Construction Manager and in accordance with ASTM C42. If the average compressive strength of the set of three concrete cores fails to equal 90-percent of the specified minimum compressive strength or if any single core is less 75-percent of the minimum compressive strength, the concrete will be considered defective. The Owner may require additional coring, nondestructive load testing, or repair or removal of defective concrete. Costs of coring, testing of cores, load testing, and required repairing pertaining thereto shall be paid by the Contractor at no extra cost to the Owner.
- B. To facilitate any Construction Manager-concrete sampling and testing;
1. Furnish labor to assist the Construction Manager in obtaining and handling samples at the project site.
 2. Advise the Construction Manager in advance of concrete placing operations to allow for scheduling and completion of quality testing.
 3. Provide and maintain facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C31.

2.23 CURING COMPOUND

- A. Curing compound shall conform to ASTM C309, Type 1 or 1-D, Class B.
- B. Curing compound shall be compatible with required finishes and coatings.

2.24 RIGID INSULATION

- A. The insulation shall be 2-inch thick, HCFC-blown, extruded polystyrene with an R-value of 5-hour foot squared degree F/BTU per inch. The insulation shall meet ASTM C578, Type IV (25 psi). Insulation shall be STYROFOAM brand Square Edge insulation as manufactured by Dow Chemical, or approved equal.
- B. The insulation shall be manufactured with a blowing agent, which provides at least 90-percent reduction in ozone depletion potential compared to standard CFC blowing agents. Other insulations are not acceptable.
- C. The insulation shall be new, free from defects, and of uniform color.
- D. The insulation shall have a limited thermal warranty stating that the R-value will not deviate more than 10-percent from its published value for a period of 15 years from the manufacturing date printed on the insulation boards.

2.25 ADHESIVE

- A. Adhesive shall be as recommended by insulation manufacturer for use with polystyrene foam. Adhesive shall be formulated specifically to bond insulation to steel and concrete surfaces.

PART 3 -- EXECUTION

3.01 FORM TOLERANCES

- A. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.
- B. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum

	Tolerance
Sleeves and inserts	+1/4" -1/4"
Projected ends of anchors	+1/4" -1/4"
Anchor bolt setting	+1/4" -1/4"
Finished concrete, all locations	+1/4" -1/4" in 10-foot max., 1" in total length

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts:	Centerline of sleeve or insert.
Projected ends of anchors:	Plane perpendicular to the end of the anchor as located on the drawings.
Anchor bolt setting:	Centerline of anchor bolt.
Finish concrete:	The concrete surface as located on the drawings.

Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.

3.02 FORM SURFACE PREPARATION

- A. Clean form surfaces to be in contact with concrete of foreign material prior to installation.
- B. Coat from surfaces in contact with concrete with a release agent prior to form installation.

3.03 FORM REUSE

- A. Reuse only forms, which provide a uniform surface texture on exposed concrete surfaces. Apply light sanding or other surface treatment between uses for uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms, do not use metal patching discuss on Class I forms.

3.04 REMOVAL OF FORMS

- A. Forms and shorting for elevation structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed.

Sides of footings and encasements	24 hours
Walls, vertical sides of beams, girders, columns, and similar members not supporting loads	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slabs, beams, and girders	Until concrete strength reaches specified 28-day strength
Wall bracing	Until to or roof slab concrete reaches specified 28-day strength

- B. Do not remove forms from concrete, which have been placed with outside air temperature below 50 degrees F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.05 FORMED OPENINGS

- A. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure water tightness. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2-inches clear from the opening surfaces and encased items.

3.06 EMBEDDED ITEMS

- A. Set anchor bolts and other embedded items accurately and hold securely in position until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to concreting.

3.07 BEVELED EDGES (CHAMFER)

- A. Form 3/4-inch beveled edges on exposed concrete edges and corners, beam soffit corners, and where indicated on the drawings. Reentrant corners in concrete members shall not have fillets, unless otherwise shown in the drawings. The top edges of slabs, walkways, beams, and wall may be beveled with an edging trowel in lieu of using chamfer strips.

3.08 CONSTRUCTION JOINTS

- A. Provide construction joints in accordance with the following:
1. Slabs. Maximum spacing of 40-feet on center in each direction in plan.
 2. Retaining Walls. Maximum spacing of 50-feet on center (vertical joints).

3. Box-Shaped (in plan) Structure (not culverts). Maximum total length of wall without construction joints is 80-feet.
4. Box Culverts. Maximum spacing of 50-feet for wall and slab joints transverse to the longitudinal axis of the culvert.

For purposes of maximum spacing requirements, expansion joints are considered to be construction joints.

- B. Layout of construction joints shall be shown in the drawings and according to the following guidelines:
 1. Provide horizontal construction joints at top of foundation members and slabs-on-grade and at the soffit of supported slabs and beams.
 2. Space the construction joints at a maximum horizontal distance of 25-feet and a maximum vertical distance of 16-feet.
 3. Space the corner vertical construction joints between 4 and 8-feet from the corner of walls or wall intersections.
 4. Space horizontal construction joints at least 8-inches below bottom of slabs.
- C. Construction joints shall be keyed, unless otherwise detailed. Form keyways by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown on the drawings or specified, keyways shall be at least 1 1/2-inches in depth over at least 25-percent of the area of the section.
- D. When it is necessary to make a joint because of an emergency, furnish and place reinforcing dowels across the joint. Embed dowels 48 bar diameters each side of the joint. Size and number of dowels shall match reinforcing in the member. Furnishing and placing such reinforcing steel shall be at the Contractor's expense.
- E. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. Cover horizontal construction joints with mortar, spread uniformly and work thoroughly into all irregularities of the surface. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed, and the consistency of the mortar shall be suitable for placing and working.
- F. In case of emergency, place additional construction joints. (An interval of 45 minutes constitutes cause for an emergency construction joint.)

3.09 EXPANSION JOINTS

- A. Provide expansion joints with continuous edge reservoirs, which shall be filled with a joint sealant. Leave the material used for forming the reservoirs in place until immediately before the grooves are cleaned and filled with joint sealant. After removing edge forms from the reservoir, remove grout, loose concrete, and fill; then sandblast the slots. Allow the reservoir to become thoroughly dry; then flow out the reservoir and immediately prime and fill with the expansion joint sealant and backup materials. The primer used shall be supplied by the same manufacturer supply the joint sealant.

3.10 TIME BETWEEN CONCRETE POURS

- A. At least 2-hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise indicated on the drawings.

3.11 INSTALLATION OF PREMOLDED JOINT FILLER

- A. Install in joint accurately as shown. Attach to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.

3.12 INSTALLATION OF JOINT SEALANTS

- A. Install in joint accurately as shown. Attached to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.
- B. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.
- C. Apply masking tape along the edges of the exposed surface of the exposed joints. Trowel the joints smooth with a tuck-pointing tool wiped with a solvent recommended by the sealant manufacturer.
- D. After the sealant has been applied, remove the masking tape and any sealant spillage.

3.13 INSTALLATION OF STEEL EXPANSION JOINT DOWELS

- A. Install parallel to wall or slab face, perpendicular to the joint face, and in true horizontal position. Secure tightly in forms with rigid ties, Orient dowels to permit joint movement.

3.14 PLACING REINFORCEMENT

- A. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.
- B. Place reinforcing in accordance with the following, unless otherwise indicated:
 - 1. Reinforcement indicated on the drawings is continuous through the structure to the farthest extent possible. Terminate bars 2-inches clear from faces of concrete.
 - 2. Splices may be used to provide continuity due to bar length limitations. Minimum length of bars spliced for this reason is 40 feet. Splicing of reinforcement, which is detailed to be continuous on the drawings, is not permitted.
- C. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale and from any coatings, which may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, or dirt to remove materials, which may

reduce the bond.

- D. Do no straighten or rebend reinforcing steel in the field.
- E. Position reinforcing steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms to provide the specified concrete coverage. Bars additional to those shown on the drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided by the Contractor at his own expense.
- F. Place reinforcement a minimum of 2-inches clear of any metal pipe or fittings.
- G. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.
- H. Roll wire mesh used for reinforcement flat before placing concrete. Support and tie wire mesh to prevent movement during concrete placement.
- I. Position dowels for masonry walls to occur at reinforced block cells.

3.15 SITE MIXED CONCRETE

- A. Conform to ACI 304.

3.16 READY-MIXED CONCRETE

- A. Conform to ASTM C94.

3.17 PLACING CONCRETE

- A. Conform to ACI 304.

3.18 PUMPING CONCRETE

- A. Conform to ACI 304.2R-71.

3.19 WEATHER REQUIREMENTS

- A. Conform to ACI 305 for placing during hot weather.
- B. Conform to ACI 306 for placing during cold weather.

3.20 BONDING TO OLD CONCRETE

- A. Coat the contact surfaces with epoxy bonding compound. The method of preparation and application of the bonding compound shall conform to the manufacturer's printed instructions and recommendations for specific application for this project.

3.21 BACKFILL AGAINST WALLS

- A. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.
- B. Do not backfill the walls of structures, which are laterally restrained or supported by, suspended slabs or slabs on grade until the slab is poured and the concrete has reached the specified compressive strength.
- C. Do not use heavy equipment to compact backfill within 5-feet of vault walls. Compact by hand or other means which will not impose significant loads on the walls.

3.22 CONCRETE FINISHES

- A. Complete concrete surfaces in accordance with the following schedule:

Finish Designation	Area Applied
F-1	Beams, columns, and exterior walls not exposed to view.
F-3	Beams, columns, and walls of structures exposed to view. Underside of formed floors or slabs.
F-4	Exterior and interior surfaces to be coated.
S-1	Slabs and floors to be covered with concrete or grout.
S-4	Slabs and floors of structures exposed to view.
E-1	Exposed edges. EXCEPTION: edges normally covered with earth.
E-2	Top of walls, beams, and similar unformed surfaces.

- B. Finish F-1. Repair defective concrete, fill depressions deeper than 1/2-inch, and fill tie holes.
 - 1. Finish F-3. In addition to Finish F-1, remove fins, fill depressions 1/4-inch or deeper, fill depressions and air holes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and 1 1/2 parts sand by damp loose volume, over the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
 - 2. Finish F-4. Repair defective concrete, remove fins, fill depressions 1/16-inch or deeper, fill tie holes, remove mortar spatter, and remove bulges higher than 1/16-inch.
 - 3. Finish S-1. Screed to grade without special finish.
 - 4. Finish S-4. Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

5. Finish E-1. Provide chamfer or beveled edges.
6. Finish E-2. Strike smoothly and float to an F-3 or F-4 finish.

3.23 CURING CONCRETE

- A. Conform to ACI 308.
- B. Water cure with burlap mats unless optional curing methods are permitted.
- C. Do not use curing compound on surfaces, which are to be coated in accordance with Section 09820 and 09900.
- D. It is the responsibility of the Contractor to select the appropriate curing method in response to climatical and/or site conditions occurring at the time of concrete placement. Take appropriate measures as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.

3.24 REPAIR OF DEFECTS

- A. Do not repair defects until concrete has been reviewed by the Construction Manager.
- B. Surface Defects. Repair surface defects, which are smaller than 1-foot across in any direction and are less than 1/2-inch in depth.

Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges perpendicular to the surface and at least 3/8-inch deep, thoroughly dampen the surface, work into the surface a bonding grout (one part cement to one part fine sand), fill the hole with mortar, match the finish on the adjacent concrete, and cure as specified.

- C. Severe Defects. Repair severe defects which are larger than surface defects but do not appear to affect the structural integrity of the structure.

Repair by removing the honeycombed and other defective concrete down the sound concrete, make the edges of the hole perpendicular to the surface, sandblast the surface, coat the sandblasted surface with epoxy bonding compound, place nonshrink grout, match the finish on the adjacent concrete, and cure as specified.

- D. Major Defects. If the defects are serious or affect the structural integrity of the structure or it patching does not satisfactorily restore the quality and appearance to the surface, the Construction Manager may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

3.25 REPAIR OF CRACKS

- A. Repair cracks in structures which are wider than 1/10-inch in width by cutting out a square edged and uniformly aligned joint 3/8-inch wide by 3/4-inch deep, preparing exposed surfaces of the joint, priming the joint, and applying polyurethane joint sealant.
- B. If the cracks are serious or affect the structural integrity or function of the element, the Owner's Representative may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

3.26 CONCRETE SURFACES TO BE COATED

- A. See Sections 09820 and 09900.

3.27 ALUMINUM SURFACES IN CONTACT WITH CONCRETE

- A. See Section 09900

3.28 RIGID INSULATION

- A. Install the insulation on the vault wall, roof slab, and access hatch with lemon-sized gobs of compatible adhesive or with non-corroding washers. Space the attachments on 22-inch centers in both directions. Fasteners on 24-inch centers in the joints are acceptable if they have 2-inch washers. Run the insulation to the line shown on the plans. Keep all joints and abutments tight. Do not apply adhesive to insulation, which will deleteriously affect it in any way.
- B. Follow manufacturer's instructions on storing and handling the insulation.
1. Shield the insulation with an opaque, light-colored tarp if it will be store in direct sunlight.
 2. Protect insulation from open flames and from heat sources over 165 degrees F.
 3. Avoid contact with petroleum-based solvents or with molten asphalt or tar.

*** END OF SECTION ***

SECTION 03200

REINFORCEMENT STEEL

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish, fabricate, and place all concrete reinforcement steel, couplers, and concrete inserts for use in reinforced concrete and masonry construction and shall perform all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories, all in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 - Contractor Submittals
- B. Section 03300 - Cast-in-Place Concrete
- C. Section 03100 - Concrete Formwork
- D. Section 04232 - Reinforced Concrete Block Masonry
- E. Section 03400 - Precast Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Codes:
- 1. The Building Code, as referenced herein, shall be the Uniform Building Code (UBC), as specified in section entitled, "Reference Standards." 01090
- B. Commercial Standards
- | | |
|---------------|---|
| ACI 315-80 | Details and Detailing of Concrete Reinforcement. |
| ACI 318-77 | Building Code Requirements for Reinforced Concrete. |
| | WRI Manual of Standard Practice for Welded Wire Fabric |
| AWS D1.4-79 | Structural Welding Code - Reinforcing Steel. |
| ASTM A 82-79 | Specification for Steel Wire, Plain, for Concrete Reinforcement. |
| ASTM A 185-79 | Specification for Welded Steel Wire Fabric for Concrete Reinforcement. |
| ASTM A 615-82 | Specification for Deformed and Plain Billet-Steel Bards for Concrete Reinforcement. |

1.04 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall furnish shop bending diagrams, placing lists, and drawings of all reinforcement steel prior to fabrication in accordance with the requirements of section entitled, "Contractor Submittals." 01300
- B. Details of the concrete reinforcement steel and concrete inserts shall be submitted by the CONTRACTOR at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. The shop bending diagrams shall shown the actual

lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams, which clearly indicate the dimensions of each bar splice.

- C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, the CONTRACTOR shall submit manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which shown the location of each coupler with details of how they are to be installed in the formwork.
- D. If reinforced steel is spliced by welding at any location, the CONTRACTOR shall submit mill test reports, which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The CONTRACTOR shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding, merely a statement that AWS procedures will be followed is not acceptable.

1.05 QUALITY ASSURANCE

- A. If requested by the ENGINEER, the CONTRACTOR shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing. The OWNER will pay costs of initial tests. The CONTRACTOR shall pay costs of additional tests due to material failing initial tests.
- B. If reinforcement steel is spliced by welding at any location, the CONTRACTOR shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such qualifications shall be as specified in AWS D1.4.
- C. If requested by the ENGINEER, the CONTRACTOR shall provide samples of each type of welded splice used in the work in a quantity and of dimensions adequate for testing. At the discretion of the ENGINEER, radiographic testing of direct butt-welded splices will be performed. The CONTRACTOR shall provide assistance necessary to facilitate testing. The CONTRACTOR shall repair any weld, which fails to meet the requirements of AWS D1.4. The OWNER will pay the costs of testing; except, the CONTRACTOR shall pay the cost of all tests, which fail to meet specified requirements.

PART 2 -- PRODUCTS

2.01 REINFORCEMENT STEEL

- A. All reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:
 - 1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, or as otherwise shown on the drawings.
 - 2. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and the details shown; provided, that welded wire fabric with longitudinal wire of W9.5 size wire shall be either furnished in flat sheets or in rolls with a core diameter not less than 10-inches; and

provided further, that welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

3. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

B. Accessories:

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Slab bolsters shall have gray plastic-coated legs.
2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

2.02 MECHANICAL COUPLERS

- A. Mechanical couplers shall be provided where shown and where approved by the ENGINEER. The couplers shall develop a tensile strength, which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice.
- B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.
- C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection.
- D. Couplers, which are located at a joint face, shall be a type, which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement past from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs, which have an O-ring seal.
- E. Hot-forged sleeve type couplers shall not be used.

2.03 WELDED SPLICES

- A. Welded splices shall be provided where shown and where approved by the ENGINEER. All welded splices of reinforcement steel shall develop a tensile strength, which exceeds 125 percent of the yield strength of the reinforcement bars, which are connected.
- B. All materials required to perform the welded splices to the requirements of AWS D1.4 shall be provided.

PART 3 – EXECUTION

3.01 GENERAL

- A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated, and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.02 FURNISHINGS

- A. All reinforcing steel shall be furnished, fabricated, and installed by the CONTRACTOR. The CONTRACTOR shall also furnish all the wires, metal supports, clips, spacers, and other appurtenances necessary to fulfill the requirements of the Contract Documents.
- B. Welded wire fabric, where required, shall be furnished as specified herein and where placed over the ground and shall be supported on wired concrete spacers or block supports spaced not more than 3-feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

3.03 FABRICATION

- A. **General:** Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2 inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2 inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the minimum thickness, except for bars larger than 1-inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.
- B. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the CONTRACTOR as specified under Section entitled "Contractor Submittals." 01300
- C. **Fabricating Tolerances:** Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:
 - 1. Sheared length: ± 1 -inch
 - 2. Depth of truss bars: $+0, - 1/2$ -inch
 - 3. Stirrups, ties, and spirals: $\pm 1/2$ -inch
 - 4. All other bends: ± 1 -inch

3.04 PLACING

- A. **Placing:** Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without

settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties, which are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

- B. The portions of all accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8-inch minimum thickness of plastic which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
- C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.
- D. Bars additional to those shown which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.
- E. Placing Tolerances: Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.
- F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the ENGINEER.
- G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters having gray, plastic-coated standard type legs as specified in Paragraph B herein. Slab bolsters shall be spaced not less than 30-inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane shown.
- H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3-feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

3.05 SPACING OF BARS

- A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall not be less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.
- B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall not be less than one inch.
- C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.
- D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

3.06 SPLICING

- A. **General:** Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to the ENGINEER.
- B. **Splices of Reinforcement:** The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318, Section 12.15.1 for a class C splice.
- C. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.
- D. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.
- E. **Bending or Straightening:** Reinforcement shall not be straightened or rebent in a manner, which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the ENGINEER. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the ENGINEER.

3.07 CLEANING AND PROTECTION

- A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.
- B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

*** END OF SECTION ***

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, all in accordance with the requirements of the Contract Documents.
- B. The following types of concrete shall be covered in this Section:
1. Structural Concrete: Concrete to be used in all cases except where noted otherwise in the Contract Documents.
 2. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise shown.
 3. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are detailed on the Drawings as unreinforced. Concrete to be used as protective cover for dowels intended for future connection.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 - Contractor Submittals
B. Section 03100 - Concrete Formwork
C. Section 03200 - Reinforcement Steel
D. Section 03290 - Joints in Concrete
E. Section 03315 - Grout
F. Section 03480 - Precast Concrete Specialties
G. Section 07920 - Sealants and Caulking
H. Section 16050 - Electrical General Provisions

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of these Specifications, all work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of this Section; provided, that for Building Codes, the latest edition of the Code, as adopted as of the date of award by the agency having jurisdiction, shall apply to the WORK.
1. Codes and Standards: The Building Code, as referenced herein, shall be the Uniform Building Code (UBC), of the International Conference of Building Officials (ICBO). 01090
 2. Federal Specifications: UU-B-790A (Int. Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).
 3. Commercial Standards:

ACI 214-77	Recommended Practice for Evaluation of Strength Test Results of Concrete.
ACI 301-79	Specifications for Structural Concrete for Buildings.
ACI 315-80	Details and Detailing of Concrete Reinforcement.
ACI 347-78	Recommended Practice for Concrete Formwork.
ASTM C156-80a	Test Method for Water Retention by Concrete Curing Materials.
ASTM C31-84	Methods of Making and Curing Concrete Test Specimens in the Field.
ASTM C33-84	Specification for Concrete Aggregates.
ASTM C39-83b	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C94-83	Specification for Ready-Mixed Concrete.
ASTM C114-83b	Method for Chemical Analysis of Hydraulic Cement.
ASTM C136-84a	Method for Sieve Analysis of Fine and Coarse Aggregate.
ASTM C143-78	Test Method for Slump of Portland Cement Concrete.
ASTM C150-84	Specification for Portland Cement.
ASTM C157-80	Test Method for Length Change of hardened Cement Mortar and Concrete.
ASTM C192-81	Method of Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C260-77	Specification for Air-Entraining Admixtures for Concrete.
ASTM C311-85	Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
ASTM C494-82	Specification for Chemical Admixtures for Concrete.
ASTM C618-85	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
ASTM D1751-83	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
ASTM E119-83	Method for Fire Tests of Building Construction and Materials.

1.04 CONTRACTOR SUBMITTALS

- A. Mix Designs: Prior to beginning the WORK, the CONTRACTOR shall submit to the ENGINEER, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete specified herein in accordance with the Section entitled "Contractor Submittals." 01300 The mix designs shall be designed by an independent testing laboratory acceptable to the ENGINEER. All costs related to such mix design shall be borne by the CONTRACTOR.

- B. Certified Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

- C. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for

concrete both with and without the admixture.

- D. The CONTRACTOR shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these Specifications, together with all supporting test data prior to the use of the fly ash the sample represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.
- E. The CONTRACTOR shall submit to the ENGINEER for review the design mix for fly ash concrete together with the design mix for portland cement (non-fly ash) concrete as specified in this Section.

1.05 QUALITY ASSURANCE

- A. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.
- B. The cost of all laboratory tests on cement, aggregates, and concrete, will be borne by the OWNER. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications.
- C. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the OWNER and the CONTRACTOR shall provide assistance to the ENGINEER in obtaining samples, and disposal and cleanup of excess material.
- D. Field Compression Tests:
 - 1. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the ENGINEER to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.
 - 2. Compression test specimens for concrete shall be made in accordance with ASTM C 31. Specimens shall be 6-inch diameter by 12-inch high cylinders.
 - 3. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder will be tested at 7 days and 2 at 28 days. The remaining cylinder will be held to verify test results, if needed.
- E. Evaluation and Acceptance of Concrete
 - 1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 4 "Concrete Quality," and as specified herein.
 - 2. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi.
 - 3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
 - 4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the specified compressive strength is 1 in 100. The required

average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.

5. All concrete which fails to meet the ACI requirements and these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.

F. Shrinkage Tests:

1. Drying shrinkage tests will be made by the ENGINEER for the trial batch specified in Paragraph 2.07, herein, and during construction to insure continued compliance with these Specifications.
2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157 modified as follows: Specimens shall be removed from molds at an age of 23 ± 1 hours after trial batching, shall be placed immediately in water at $70 \text{ degrees F} \pm 3 \text{ degrees F}$ for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at $73 \text{ degrees F} \pm 3 \text{ degrees F}$. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at $73 \text{ degrees F} \pm 3 \text{ degrees F}$ and 50 percent ± 4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as specified in Paragraph 2.08, herein.

- G. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the specifications, permissible deviations will be in accordance with ACI 347.

- H. The following construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

ITEM	TOLERANCE
Variation of the constructed linear outline from the	In 10-feet: $\frac{1}{4}$ -inch, In 20-feet or more: $\frac{1}{2}$ -inch

established position in plan	
Variation from the level or from the grades shown on the drawings	In 10-feet: ¼-inch, In 20-feet or more: ½-inch
Variation from the plumb	In 10-feet: ¼-inch In 20-feet or more: 1/2-inch
Variation in the thickness of slabs and walls	Minus ¼-inch; plus ½-inch
Variations in the locations and sizes of slab and wall openings	Plus or minus ¼-inch

- I. For each class of fly ash, all testing and sampling procedures shall conform with these Specifications and ASTM C 311, including the restriction that one sample weighing 4 pounds shall be taken from at least each 200 tons of fly ash supplied.
- J. Separate storage facilities shall be provided for fly ash. Fly ash shall be stored in such a manner as to permit ready access for the purpose of inspection and sampling and suitably protected against contamination or moisture. Should any fly ash show evidence of contamination or moisture or be otherwise unsuitable, the ENGINEER may reject it and require that it be removed from the site. Each class of fly ash used in concrete for this project shall be from the same source.

PART 2 -- PRODUCTS

2.01 CONCRETE MATERIALS

- A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.
- B. All materials furnished for the work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.
- C. Storage of materials shall conform to the requirements of Section 205 of ACI 301.
- D. Materials for concrete shall conform to the following requirements:
 1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type V. Portland cement shall contain not more than 0.60 percent alkalis. The term "alkalis" referred to herein is defined as the sum of the percentage of sodium oxide and 0.658 times the percentage of potassium oxide ($\text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}$). These oxides shall be determined in accordance with ASTM C 114. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the ENGINEER if requested regarding compliance with these Specifications.
 2. Water shall be potable, clean, and free from objectionable quantities of silty organic matter,

alkali, salts and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/1 TDS) shall not be used.

3. Aggregates shall be obtained from pits acceptable to the ENGINEER, shall be non-reactive and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as specified in Paragraph 2.05B. Lightweight sand for fine aggregate will not be permitted.
 - a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete the two size groups shall be combined. See Paragraph 2.07A for the use of the size groups.
 - b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable.
 - c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.
 - d. When tested in accordance with "Potential Reactivity of Aggregates (Chemical Method)" (ASTM C289), the ration of silica released to reduction in alkalinity shall not exceed 1.0.
 - e. When tested in accordance with "Organic Impurities in Sands for Concrete" (ASTM C40), the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.
 - f. When tested in accordance with "Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine" (ASTM C131), the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.
 - g. When tested in accordance with "Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate" (ASTM C88), the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.
4. Ready-mix concrete shall conform to the requirements of ASTM C94.
5. Air-entraining agent meeting the requirements of ASTM C 260 shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 5 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 7 percent. The OWNER reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.
6. Admixtures: Admixtures shall be required at the Engineer's discretion or, if not required, may be added at the Contractor's option to control the set, effect water reduction, and increase workability. In either case, the addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the ENGINEER. Concrete containing an admixture shall be first placed at a location determined by the ENGINEER. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.
 - a. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F,

a set retarding admixture such as Sika Chemical Corporation's Plastiment, Master Builder's Pozzoloth 300R, or equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture such as Sika Chemical Corporation's Plastocrete 161 EL, Master Builder's Pozzoloth 50C, or equal shall be used.

- b. Low range water reducer shall conform to ASTM C 494, Type A. It shall be either a hydroxylated carboxylic acid type or a hydroxylated polymer type. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.
- c. High range water reducer shall be sulfonated polymer conforming to ASTM C 494, Type F or G.

If the high range water reducing agent is added to the concrete at the batch plant, it shall be second generation type, Daracem 100, as manufactured by W.R. Grace & Co.; Pozzoloth 430R, as manufactured by Masterbuilders; or equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.

If the high range water reducer is added to the concrete at the job site, it shall be used in conjunction with a low range water reducer and shall be Pozzoloth 400N and Pozzoloth MBI.82, as manufactured by Masterbuilders; WRDA 19 and WRDA 79, as manufactured by W.R. Grace & Co.; or equal. Concrete shall have a slump of 3 inches $\pm$ 1/2-inch prior to adding the high range water-reducing admixture at the job site. The high range water-reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

- 7. Calcium Chloride: Except as otherwise provided in Paragraph 3.08B, calcium chloride will not be permitted to be used in concrete.
- 8. Fly ash/pozzolan shall conform to ASTM C 618, including the requirements of Table 1A, therein, and the following supplementary requirements:
 - a. Class C fly ash
 - Loss on ignition, maximum 1 percent
 - S03 content, maximum 4 percent
 - Moisture content, maximum 1 percent
 - $R = (CaO - 5\%)/(Fe_2O_3)$, maximum 4.5
 - b. Class F fly ash
 - Loss on ignition, maximum 1 percent
 - S03 content, maximum 3 percent
 - Moisture content, maximum 1 percent
 - $R = (CaO - 5\%)/(Fe_2O_3)$, maximum 1.5

2.02 CURING MATERIALS

A. Materials for curing concrete as specified herein shall conform to the following requirements:

1. Concrete curing compound shall be MB 429 as manufactured by Masterbuilders, Cleveland, OH; Hunt Process Clear ARB as manufactured by Hunt Process Co., Santa Fe Springs, CA; Select Cure CRB as manufactured by Select Products Co., Upland, CA; or equal. The curing compound shall contain a fugitive dye so that areas of application will be readily distinguishable.
2. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 gram per square centimeter of surface.
3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C-156, shall not exceed 0.055 gram per square centimeter of surface.
4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.
5. Curing mats for use in Curing Method 6 as specified in Paragraph 3.09G herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.
6. Evaporation retardant shall be used after initial screeding and floating when temperature, wind, and humidity condition may cause drying shrinkage cracks in slab and shall be a material such as Confilm as manufactured by Masterbuilders, Cleveland, OH; or equal.

2.03 NON-WATERSTOP JOINT MATERIALS

- A. Materials for non-water stop joints in concrete shall conform to the following requirements:
 1. Preformed joint filler shall be a non-extruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.
 2. Elastomeric joint sealer shall conform to the requirements of Section entitled "Sealants and Caulking." 07920
 3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the ENGINEER.

2.04 MISCELLANEOUS MATERIALS

- A. Floor sealer/hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluosilicate or of sodium silicate, and shall be as manufactured by Master Builders Company, W.R. Grace Co., or equal. The solution shall be delivered ready for use in the manufacturer's original sealed containers. Each gallon of the fluosilicate solution shall contain not less than 2 pounds of crystals.

- B. Damp-proofing agent shall be an asphalt emulsion, such as Sonneborn Hydrocide 660, Flintkote C-13-E Foundation Coating, or equal.
- C. Epoxy adhesives shall be the following products for the applications specified:
1. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur Hi-Mod Epoxy Adhesive, as manufactured by Sika Chemical Corporation; Concrevice 1001-LPL, as manufactured by Adhesive Engineering Company; or equal.
 2. For bonding hardened concrete or masonry to steel, Colma-Dur Gel, Sikadur Hi-Mod Gel, or equal.

2.05 CONCRETE DESIGN REQUIREMENTS

- A. General: Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. Mix designs with more than 41 percent of sand of the total weight of fine and coarse aggregate shall not be used. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the OWNER. All changes shall be subject to review by the ENGINEER.
- B. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

TYPE OF WORK	MIN. 28-DAY COMPRESSIVE STRENGTH (psi)	MAX. SIZE AGGREGATE (in.)	MIN. CEMENT PER CU.YD. (sacks)	MAX. W/C RATIO (hy.wt.)
<u>Structural Concrete:</u> Walls, slabs on grade and footing and all other concrete items not specified elsewhere	4,000	1-1/2	6.0	0.50
<u>Structural Concrete:</u> Roof, floor slabs,	4,000	1	6.0	0.50

columns, sections 10-in. and less in thickness, and sections which require special placement due to shape or density of reinforcing or embedded items				
Sitework Concrete	3,000	1	5.0	0.50
Lean Concrete	2,000	1	4.0	0.60

*Note: One sack of cement equals 94 lbs.

- C. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the CONTRACTOR shall be entitled to no additional compensation because of such changes.
- D. At the Contractor's option, fly ash/pozzolan may be used as a partial cement replacement in concrete as follows:
1. Fly ash shall replace not more than 15 percent by weight of the portland cement in the design mix. The design mix shall contain a minimum of 6 sacks of cement per cubic yard before the replacement is made.
 2. Fly ash for hydraulic/liquid containing structures shall be Class C fly ash. Fly ash concrete for all other structures shall be Class C or F fly ash.

2.06 CONSISTENCY

- A. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature of moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

PART OF WORK	SLUMP (in.)
Footings and slabs	3-inches +1/2-inches, -1-inch
Other work	3 inches $\pm$ 1 inch
With high range water reducer added	8-inches max.

2.07 TRIAL BATCH AND LABORATORY TESTS

- A. Before placing any concrete, a testing laboratory designated by the ENGINEER shall prepare a trial batch of each class of concrete having a 28-day strength of 4,000 psi or higher, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the properties in Paragraph 2.05A. If one size range produces an acceptable mix, a second

size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the CONTRACTOR. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractor's preliminary mix design, or whether the proportions have been adjusted during the trial batch process.

The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 6 compression test specimens from each batch. The cost of not more than 3 laboratory trial batch tests for each specified concrete strength will be borne by the OWNER but the CONTRACTOR shall furnish and deliver the materials in steel drums at no cost. Any additional trial batch testing required shall be performed at the expense of the CONTRACTOR.

- B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.
- C. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve.

2.08 SHRINKAGE LIMITATION

- A. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age (as specified in Paragraph 2.07), shall be 0.036 percent or 0.043 percent, respectively. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements.
- B. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirements by more than 25 percent.
- C. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions, at no additional cost to the OWNER, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content, washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.09 MEASUREMENT OF CEMENT AND AGGREGATE

- A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the ENGINEER; provided that, where batches are so proportioned as to contain an integral number of conventional sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 pounds.

2.10 MEASUREMENT OF WATER

- A. The quantity of water entering the mixer shall be measured by a suitable water meter or other

measuring device of a type acceptable to the ENGINEER and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete, and the meter shall include a set-back register with a readily visible vertical face and double hands indicating in cubic feet and decimals thereof. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed.

2.11 READY-MIXED CONCRETE

- A. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the supplementary requirements specified in Paragraphs 2.12B through 2.11F, herein.
- B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within 75 minutes after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather, or under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 60 minutes.
- C. Truck mixers shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
- D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
- E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the specified slump is 3 inches or less, or if they differ by more than 2 inches when the specified slump is more than 3 inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.
- F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a certified weighmaster delivery ticket furnished to the ENGINEER in accordance with Paragraph 1.04B, herein.
- G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted.

Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the ENGINEER.

PART 3 -- EXECUTION

3.01 PROPORTIONING AND MIXING

- A. **Proportioning**: Proportioning of the concrete mix shall conform to the requirements of Chapter 3 (Proportioning" of ACI 301; provided, that the maximum slump for any concrete shall not exceed 4 inches except when the use of high range water reducer is permitted which increases the maximum slump to 8 inches.
- B. **Mixing**: Mixing of concrete shall conform to the requirements of Chapter 7 of said ACI 301 Specifications.
- C. **Slump**: Maximum slumps shall be as specified in Paragraph 2.06A, herein.
- D. **Retempering**: Retempering of concrete or mortar which has partially hardened will not be permitted.

3.02 PREPARATION OF SURFACES FOR CONCRETING

- A. **General**: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud and debris at the time of placing concrete.
- B. **Joints in Concrete**: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.
- C. After the surfaces have been prepared all approximately horizontal construction joints shall be covered with a layer of mortar approximately one-inch thick. The mortar shall have the same proportions of cement and sand as the regular concrete mixture. The water-cement ration of the mortar in place shall not exceed that of the concrete to be placed upon it, and the consistency of the mortar shall be suitable for placing and working in the manner hereinafter specified. The mortar shall be spread uniformly and shall be worked thoroughly into all irregularities of the surface. Wire brooms shall be used where possible to scrub the mortar into the surface. Concrete shall be placed immediately upon the fresh mortar. When casting deep walls (more than 6-feet high) over slabs or footings, in lieu of the one-inch thick mortar, a 6-inch lift of a rich pea gravel mix with the same water-cement ration as the wall concrete shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.

- D. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the ENGINEER.
- E. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the ENGINEER at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
- F. All inserts or other embedded items shall conform to the requirements herein.
- G. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the ENGINEER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.
- H. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting (exposing aggregate) prior to the application of an epoxy bonding agent.
- I. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.
- J. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.
- K. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.
- L. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.
- M. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.03 HANDLING, TRANSPORTING, AND PLACING

- A. General: Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section.
- B. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the CONTRACTOR.
- C. Unauthorized Placement: No concrete shall be placed except in the presence of duly authorized representative of the ENGINEER. The CONTRACTOR shall notify the ENGINEER in writing of at least 24 hours in advance of placement of any concrete.
- D. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, whether reinforcement is present or not, causing separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour.
- E. Casting New Concrete Against Old: An epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where water stop is installed, see Section entitled, "Water stop Joints in concrete." 03290
- F. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the Contractor's conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the ENGINEER. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.
- G. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

- H. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.
- I. Cold Weather Placement: Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

3.04 PUMPING OF CONCRETE

- A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.
- C. The minimum diameter of the hose (conduits) shall be 4 inches.
- D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.
- E. Aluminum conduits for conveying the concrete will not be permitted.
- F. Proportioning: Minimum compressive strength, cement content, and maximum size of aggregates shall be as specified in Paragraph 2.05, herein.
- G. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.
- H. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.
- I. Water and slump requirements shall conform to Paragraphs 2.01D.2 and 2.05B for water and 2.06A for slump.
- J. Cement and admixtures shall conform to Paragraph 2.01D, herein.

- K. Field Control: Concrete samples for slump per ASTM C 143 and test cylinders per ASTM C 31 and C 39 will be taken at the placement (discharge) end of the line.

3.05 ORDER OF PLACING CONCRETE

- A. The order of placing concrete in all parts of the work shall be acceptable to the ENGINEER. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 14 days.
- B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4 of an inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2 of an inch above the underside of the strip. About one hour after the concrete is placed the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.06 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high-speed power vibrators (8000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.
- B. Care shall be used in placing concrete around water stops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type water stops are placed horizontally, the concrete shall be worked under the water stops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the water stops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the water stops in the concrete.
- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 FINISHING CONCRETE SURFACES

- A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from

plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified in Paragraphs 1.05G and 1.05H, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

- B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as specified in Section 3.08 herein, and as shown on the exterior elevations.
- C. **Unformed Surfaces:** After proper and adequate vibration and tamping all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:
1. **Finish U1** - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
 2. **Finish U2** - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the ENGINEER.
 3. **Finish U3** - After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
 4. **Finish U4** - Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.

D. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE	
AREA	FINISH
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs that are water bearing with slopes 10 percent and less	U3
Sloping slabs that are water bearing with slopes greater than 10 percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U2

E. Floor Sealer Hardener (Surface Applied):

1. Floors to receive hardener shall be cured, cleaned, and dry with all work above the completed. Apply zinc and/or magnesium fluosilicate evenly using 3 coats, allowing 24 hours between coats.
2. The first coat shall be 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength. Each coat shall be applied so as to remain wet on the concrete surface for 15 minutes. If sodium silicate is used, it shall be applied evenly, using 3 coats, allowing 24 hours between coats, and the material shall be applied full strength at the rate of one gallon per 300 square feet. Approved proprietary hardeners shall be applied in conformance with the manufacturer's instruction. After the final coat is completed and dry, surplus hardener shall be removed from the surface by scrubbing and mopping with water.
3. Floor hardener shall be applied where shown.

3.08 ARCHITECTURAL FINISH

- A. Smooth Concrete Finish: Immediately after the forms have been stripped, the concrete surface shall be inspected and any poor joints, voids, rock pockets, or other defective areas shall be repaired and all form-tie fastener holes filled as required in Paragraphs 3.12 and 3.13, herein.
- B. After the concrete has cured at least 14 days, the surface shall be wetted, and a grout shall be applied with a brush. The grout shall be made by mixing one part portland cement and one part of fine sand that will pass a No. 16 sieve with sufficient water to give it the consistency of thick paint. The cement used in said grout shall be 1/2 gray and 1/2 white portland cement, as determined by the ENGINEER. White portland cement shall be Atlas white, or equal, furnished by the CONTRACTOR. Calcium chloride in the amount of 5 percent by volume of the cement shall be used in the brush coat. The freshly applied grout shall be vigorously rubbed into the concrete surface with a wood float filling all small air holes. After all the surface grout has been removed with a steel trowel, the surface shall be allowed to dry and, when dry, shall be vigorously rubbed with burlap to remove completely all surface grout so that there is no visible paint-like film of grout on the concrete. The entire cleaning operation for any area shall be completed the day it is started, and no grout shall be left on the surface overnight.
- C. Surface Overnight: Cleaning operations for any given day shall be terminated at panel joints. It is essential that the various operations be carefully timed to secure the desired effect, which is a light-colored concrete surface of uniform color and texture without any appearance of a paint or grout film.
- D. In the event that improper manipulation results in an inferior finish, the CONTRACTOR shall rub such inferior areas with carborundum bricks.
- E. Before beginning any of the final treatment on exposed surfaces, the CONTRACTOR shall treat in a satisfactory manner a trial area of at least 200 square feet in some inconspicuous place selected by the ENGINEER and shall preserve said trial area undisturbed until the completion of the job.
- F. All architecturally treated concrete surfaces shall conform to the accepted sample in texture, color, and quality. It shall be the Contractor's responsibility to maintain and protect the concrete finish.

3.09 CURING AND DAMPPROOFING

- A. General: All concrete shall be cured for not less than 14 days after placing, in accordance with the methods specified herein for the different parts of the work, and described in detail in the following paragraphs:

SURFACE TO BE CURED OR DAMPPROOFED	METHOD
Unstripped forms	1
Wall sections with forms removed	6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this paragraph	4
Floor slabs on grade in hydraulic structures	5
Roof and slabs not on grade	6
Exterior buried surfaces of roof slabs	7

- B. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 6, Paragraph 3.09G, herein.
- C. Method 2: The surface shall be covered with burlap mats, which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.
- D. Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.
- E. Method 4: The surface shall be sprayed with a liquid curing compound.
1. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film, which will seal thoroughly.
 2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
 3. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
 4. Where curing compound is specified, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied.

When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

- F. Method 5: Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks.
1. Immediately after each square foot of the concrete has been finished, it shall be given a coat of curing compound in accordance with Method 4, Paragraph 3.09E, herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.
 2. The curing blankets shall be left in place during the 14-day curing period. A portion of the curing blankets may be temporarily removed for a maximum of 4 hours to allow placing of adjacent concrete work. The exposed slab shall be wetted with water delivered through a fog nozzle prior to placing the removed curing blankets back to the slab as specified in Section 3.09.F.1. Should the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.
- G. Method 6: Concrete slabs shall be treated with an evaporation retardant as specified in Method 5. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has been placed or forms removed. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes. Until the concrete surface is covered with the curing medium the entire surface shall be kept damp by applying water-using nozzles that atomize the flow so that the surface is not marred or washed. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed and curing compound immediately applied in accordance with Method 4, Paragraph 3.09E, herein. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the work.
- H. Method 7:
1. Method 6 shall be used for curing.
 2. Immediately after completion of curing the surface shall be sprayed with a damp proofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to 1/2 strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an

application of the specified material, undiluted, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Damp proofing material shall conform to the requirements of Paragraph 2.04B, herein.

3. As soon as the asphalt emulsion, applied as specified herein, has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used which produces a uniformly coated white surface and which so remains until placing of the backfill. Should the whitewash fail to remain on the surface until the backfill is placed, the CONTRACTOR shall apply additional whitewash.

3.10 PROTECTION

- A. The CONTRACTOR shall protect all concrete against injury until final acceptance by the OWNER. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring. Immediately following the first frost in the fall, the CONTRACTOR shall be prepared to protect all concrete against freezing. After the first frost, and until the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed.

3.11 CURING IN COLD WEATHER

- A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.
- B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.
- C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
- D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.12 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.
- B. Defective surfaces to be repaired as specified in Paragraph 3.12A, shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.
- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.
- D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of Paragraph 3.08 or 3.09, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.
- E. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as shown and filled with sealant conforming to the requirements of Section entitled "Joints in Concrete." 03290 This repair method shall be done on the water-bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

3.13 PATCHING HOLES IN CONCRETE

A. Patching Small Holes

- 1. Holes that are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.
- 2. Small holes in members which are water-bearing or in contact with soil or other fill material, shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall

then be patched according to Paragraph 3.12B herein.

3. Small holes through all other concrete members shall be filled with non-shrink grout, with exposed faces treated as above, or completely filled according to Paragraph 3.12B.

B. Patching Large Holes

1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as specified herein.
2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless shown.
3. Large holes in members which are water bearing or in contact with soil or other fill, shall have a bentonite type water stop material placed around the perimeter of the hole as specified in the Section entitled "Joints in Concrete," 03290 unless there is an existing water stop in place.

3.14 CARE AND REPAIR OF CONCRETE

- A. The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the OWNER. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

*** END OF SECTION ***

SECTION 03480

PRECAST CONCRETE SPECIALTIES

PART 1 -- GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall construct all manholes, catch basins, neutralization pits, cleanouts, and other appurtenances complete and in accordance with the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02200 – Earthwork
- B. Section 02617 – Reinforced Concrete Pipe
- C. Section 02630 - Ductile Iron Pipe
- D. Section 02655 - Vitrified Clay Pipe
- E. Section 02720 – Appurtenances
- F. Section 03305 – Minor Concrete

1.03 REFERENCED SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality or other requirements of these Specifications, all work specified herein shall conform to or exceed the applicable requirements of the referenced standards; provided, that wherever the provisions of said publication are in conflict with the requirements specified here, the more stringent requirement shall apply.
 - 1. Commercial Standards:
 - ASTM A478 – Specification for Precast Reinforced Concrete Manhole Sections

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit drawings of precast concrete manhole sections showing details of reinforcement and joints in accordance with Section 01300 – Contractor Submittals.

PART 2 -- PRODUCTS

2.01 PRECAST CONCRETE MANHOLE SECTIONS

- A. Precast concrete sections, 600 mm and larger, in diameter, used as manhole sections shall conform to ASTM C478, Class IV, Wall C. Sections shall have rebate joints. Top sections shall be of the shape as indicated in the Contract Documents. Design and manufacture shall be based on H-20 loading. Precast manhole shall be equal in all respects to those manufactured by Associated Concrete Products, or centrifugally spun manhole units as manufactured by Ameron, or approved equal.

2.02 JOINT SEALANT

- A. The joint sealant compound shall be Quik-seal, a pre-formed, cold-applied, ready-to-use plastic joint sealing compound as supplied by Quickset Utility Vaults, Santa Ana, California, Ram-Nek by K.T. Snyder Company, or approved equal.

2.03 NON-SHRINK GROUT

- A. Grout, where required, shall be of the non-shrink type. The Contractor shall use non-shrink grout, which produces a void filling action that counteracts shrinkage occurring in both the plastic and hardening states. Grout shall be proportional with and in accordance with the manufacturer's instruction for the use intended.

2.04 MANHOLE STEPS

- A. Manhole steps shall be ½-inch steel reinforced, plastic steps as manufactured by M.A. Industries, Inc.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Precast concrete manhole sections shall be set so as to be vertical with sections and ladder rungs in true alignment. The joint of previously set section shall be covered with mortar and joint sealant before the new section is placed. Before the mortar is set, joints shall be pointed and exterior joints thoroughly tooled so as to be slightly concave with a hard polished surface free of cracks. Interior joints shall be tooled flush in a similar manner.
- B. Connections to manhole structure shall be made by casting sections of pipe into the base, by using non-shrink grout as indicated in the Contract Documents, and/or using an approved resilient connector.

3.02 CONCRETE CATCH BASINS

- A. Concrete catch basins shall be of the type and sizes at the locations as indicated in the Contract Documents.

*** END OF SECTION ***

SECTION 4201

BRICK MASONRY

PART 1 -- GENERAL

1.01 SCOPE

- A. The work of this Section includes the construction of [brick paved landscaped areas, brick wall,] and all appurtenant work, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete underbed for the brick paved areas shall conform to the applicable requirements of Section entitled, "Cast-in-Place Concrete." Reinforcing steel for the work specified herein shall conform to the applicable requirements of Section entitled, "Concrete and Masonry Reinforcement."

1.03 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Without limiting the generality of other requirements of these specifications, all work specified herein shall conform to or exceed the requirements of the Building Code and the applicable requirements of the referenced documents to the extent that the provisions of such documents are not in conflict with the requirements of said code.
- B. Reference herein to "Building Code" shall mean the Uniform Building Code as defined under "Reference Standards and Specifications" in Section entitled, "General Requirements."

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit 6 samples of brick to be used, showing true color and finish, for the approval of the Engineer as specified in Section entitled, "Contractor Submittals."

1.05 QUALITY ASSURANCE

- A. It is required that all masonry wall construction specified in this Section shall be subject to inspection and control by a Registered Construction Inspector licensed by the State of California as a Division III Specialty Inspector for Masonry, and no work hereunder shall be scheduled or performed without making prior arrangements to have said Registered Inspector present during all construction operations hereunder. [Both State Reg. & local Deputy]

1.06 QUALITY ASSURANCE

- A. It is required that all masonry wall construction specified in this Section shall be subject to inspection and control by a Registered Construction Inspector licensed by the State of Utah. No work hereunder shall be scheduled or performed without making prior arrangements to have said Special Inspector present during all construction operations hereunder. [Local Deputy Inspector only]

1.07 QUALITY ASSURANCE

- A. It is required that all masonry wall construction specified in this Section shall be subject to inspection and control by a person who is designated by the local public agency having jurisdiction as a Deputy Special Inspector for Masonry under the provisions of Section 305 of the Uniform Building Code, and no work hereunder shall be scheduled or performed without making prior arrangements to have said special inspector present during all construction operations hereunder.
- B. No special inspection will be required for construction of the brick paved landscape areas.

PART 2 -- PRODUCTS

2.01 MASONRY MATERIALS

- A. All brick paver materials shall conform to the following requirements.
1. Paving brick shall conform to the requirements of ASTM Designation C 62-69, Grade SW, Type 1 building brick. Size of brick shall be modular 3-3/8 inch by 3-inch by 11-3/8 inch. Overall dimensions shall not differ more than 1/8-inch from standard (nominal) dimensions. Paver brick shall be [Higgins "Flashed", brick in brown to red to tan range colors as selected by the Engineer, as manufactured by [Higgins Brick and Tile Company or an approved equal manufactured by Pacific Clay Products Company.] Color of mortar shall be [natural gray].
 2. Brick curb materials shall conform to the requirements of ASTM Designation C 216-71, Grade SW, Type FBX facing brick. Size of brick shall be modular 3-3/8 inch by 3-inch by 11-3/8 inch. Overall dimensions shall not differ more than 1/8-inch from standard (nominal) dimensions. Curb brick shall be [Higgins "Modular", size face brick in brown to red to tan range colors as selected by the Engineer, as manufactured by [Higgins Brick and Tile Company or approved equal manufactured by Pacific Clay Products Company]. Color of mortar shall be [natural gray].
 3. Brick Wall shall be burnt clay hollow masonry units conforming to ASTM Designation C 62-69. Brick units shall be ["Royale", 7-5/8 inch by 5-1/2 inch by 15-1/2 inch, with wire cut surfaces, as manufactured by Davidson Brick Company or an approved equal manufactured by Pacific Clay Products Company.] Color of brick shall be ["Standard Brick Red."] Color of mortar shall be [natural gray].
 4. Portland Cement shall conform to the requirements of ASTM Designation C 150-74, Type II, low alkali.
 5. Hydrated lime shall conform to the requirements of ASTM Designation C 207-74, Type S.
 6. Sand shall conform to the requirements of ASTM Designation C 144-70; except, that not less than 5 percent shall pass a No. 100 sieve.
 7. Water shall be clean and free of injurious amounts of deleterious substances.
 8. Vertical reinforcing steel for brick wall shall conform to requirements specified in Section entitled "Concrete and Masonry Reinforcement."
 9. Horizontal reinforcing steel for brick wall shall be 9 gauge steel wire in the form of a stirrup conforming to the requirements of ASTM Designation A 82-72.

PART 3 -- EXECUTION

3.01 MORTAR

- A. Proportioning: Mortar shall conform to the requirements of ASTM Designation C 270-73 and to the following requirements. Mortar shall be composed of one part white portland cement to not more than 1/4 part of hydrated lime. The volume of the damp, loose sand shall be not less than 2-1/2 times nor more than 3 times the sum of the volumes of the cement and limes used. Minimum strength shall be 2,000 psi at 28 days. The color of the mortar shall be as selected by the Engineer.
- B. Mixing: Mortar shall be mixed in a mechanically-operated mortar mixer for at least 3 minutes after all ingredients are in the drum, and at least long enough to make a thorough, complete, intimate mix of the materials.
- C. Tempering: The consistency of mortar shall be adjusted to the satisfaction of the mason, and water may be added as is necessary or convenient in using the mortar. This shall be done by forming a basin in the mortar, adding water and mixing it into the mortar mix, not by splashing water over the surface.

3.02 HANDLING AND STORAGE

- A. All materials shall be delivered, stored, and handled in a manner to prevent damage by breakage, water or moisture, or the inclusion of foreign particles. No materials shall be dumped or stored on the ground. Materials shall be stored on a clean surface or platform as required and shall be protected from deterioration and foreign matter.

3.03 ENVIRONMENTAL CONDITIONS

- A. Brick masonry work shall not be performed when the temperature is below 40 degrees F.

3.04 WETTING

- A. All brick shall be wetted until they have an initial absorption rate not exceeding 0.25 ounce per square inch per minute as determined under the provisions of ASTM Designation C 67-73. When being laid, the brick shall have suction sufficient to hold the mortar and to delete the excess water from the mortar and grout. The brick shall be sufficiently damp so that the mortar will remain plastic enough to permit the brick to be leveled and plumbed immediately after being laid, without destroying bond.

3.05 LAYING

- A. All brick shall be clean and free of dust, dirt, or other foreign materials before laying.
- B. Before starting, brick paving pattern shall be laid out in both directions on full length boards, so that courses, bonding, jointing and termination of concrete borders will be pre-determined to result in a uniform installation. Approval of layout shall be obtained from the Engineer.
- C. Brick pavers and brick curb shall be laid in running bond pattern with struck joints as indicated on the drawings. Brick wall shall be running bond with toothed joints.

- D. All brickwork shall be plumb, level, and true to line, and all corners and angles shall be square unless otherwise indicated on the drawings.
- E. All courses shall be laid and worked out to properly coincide and align with adjacent work. No fractional parts of bricks will be permitted.
- F. All bed and joints shall be filled solid with mortar or grout. All mortar joints shall be straight, clean, and of uniform width of approximately 3/8-inch. All exposed joints shall be finished flush, struck flush or tooled as specified herein, before the mortar hardens.
- G. All unfinished brick paving shall be protected from rain water by using water-proof covering securely held in place. Brick paving shall be kept moist for a period of 3 days, by using a nozzle regulated to fog spray sufficient only to moisten the top surface but not of such quantity to cause water to soak through the paving.
- H. The brick wall shall be constructed in accordance with applicable requirements of the Building Code and as indicated on the drawings.

3.06 PROTECTION OF OTHER SURFACES

- A. Brick paving including adjacent work of other trades affected by this work shall be properly protected from damage or staining during construction operations.

3.07 PATCHING

- A. All holes or defective mortar joints in exposed work shall be pointed. Where necessary, defective joints shall be cut out and repointed.

3.08 SANDBLASTING

- A. After brick has been laid and mortar has cured sufficiently, the brick shall be lightly sandblasted to produce desired affect approved by Engineer. A portion of each brick application, brick pavers, brick curb and brick wall shall be erected and sandblasted to become representative samples of the brick work and upon acceptance by the Engineer may become as part of the completed brick work. During sandblasting the Contractor shall protect adjacent materials as may be required.

3.09 CLEANING

- A. Exposed work shall be protected against staining from grouting or other sources and excess mortar shall be cleaned off the surfaces as the work progresses.
- B. At the completion of the work, all exposed work shall be cleaned.
- C. If ordinary cleaning is not adequate, special methods such as sandblasting or chipping shall be used to clean the surfaces upon direction of the Engineer.

*** END OF SECTION ***

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 -- GENERAL

1.01 SCOPE

- A. This section covers concrete unit masonry materials and construction as shown on the drawings and as specified herein.
- B. All materials shall comply with the current edition of the Uniform Building Code as adopted by the City.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Cement and reinforcing steel shall conform to the requirements of Section 03301, General Concrete, and the requirements herein.

1.03 REFERENCE DOCUMENTS

- A. Commercial Specifications.
 - ASTM C90 Concrete Masonry Units
 - ASTM C144 Masonry Mortar
 - ASTM C207 Hydrated Lime
 - ASTM C404 Aggregate

1.04 CLEAN UP

- A. Cleaning. Extreme care shall be taken to keep all exposed block clean and free from mortar. All exposed block in addition shall be cleaned by light sandblasting.

PART 2 -- PRODUCTS

2.01 MATERIALS

- A. Concrete Block and Slump Block. Concrete masonry units shall conform to the requirements of ASTM C90, Grade N-1 and shall be of the type and size indicated. Slump block units shown on the drawings shall be slumped units as defined by the Concrete Masonry Association of California and Nevada and shall be colored as approved by Owner.
- B. Mortar shall be composed of one part Portland cement and not less than two and one-half parts nor more than three parts of sand, based on dry loose volumes and not less than one-fourth part and not more than one-half part lime putty or hydrated lime. Mortar shall be colored as approved by Owner.
- C. Grout shall consist of one part Portland cement to not more than three parts sand and not less than one part nor more than one part pea gravel based on dry loose volume. The combined mix shall be

proportioned to make a workable mix. Sufficient water shall be added to cause it to flow into all joints of the masonry. Grout shall develop a minimum compressive strength of 2,500 psi in 28 days.

- D. Mortar and Grout Materials. Cement shall conform to the requirements set forth for Portland cement in Section 03302, General Concrete.
- E. Sand for use in masonry mortar shall conform to ASTM C144.
- F. Hydrated lime for use in masonry mortar shall conform to ASTM C207.
- G. Aggregates for use in masonry grout shall conform to ASTM C404.
- H. An expanding, water-reducing, retarding high lift grouting aid as manufactured by Sika shall be added to grout in accordance with the manufacturer's recommendations.
- I. Block Sealer. Acrylic block sealer and clear acrylic block finish shall be specifically formulated for masonry and shall be as manufactured by Porter International, Koppers or Tnemec.

2.02 MEASUREMENTS

- A. Materials for mortar and grout shall be accurately measured in suitably calibrated devices. Shovel measurements will not be acceptable. One sack of Portland cement (94 lbs.) shall be considered as one cubic foot. When sand is damp, allowance for bulking shall be made.

PART 3 -- EXECUTION

3.01 MIXING MORTAR AND GROUT

- A. One half the sand and water shall be placed in the operating mixers, after which the cement, lime and remainder of the sand and water shall then be placed into the mixer in order named. After all materials are in the mixer, mixing shall continue as long as required to secure uniform blending of the ingredients, but in no case for less than three minutes.
- B. Equipment for mixing and handling mortar and grout shall be acceptable to the Owner. Mixers of at least one-sack capacity shall be used. Batches requiring fractional sacks will not be permitted unless the cement is weighed for each such batch.
- C. Retempering of mortar shall be done only by adding water into a basin made with the mortar and the mortar carefully worked into it. Retempering by dashing water over the mortar shall not be permitted. Any mortar or grout which is unused within one hour after initial mixing shall be removed from the work. Mortar shall be mixed and maintained on the boards to a slump of 2-3/4" plus or minus 1/4" using a truncated cone 4" to 2", 6" high.

3.02 CONSTRUCTION

- A. All cells and coarses containing reinforcement, or designated to be filled in the plane, shall be filled

with grout. Concrete masonry shall be built to maintain the unobstructed vertical continuity of the cells to be filled. The vertical alignment of cells to be filled shall provide a clear unobstructed vertical flue not less than 3" by 3". Maximum height of grout pour shall be 4 feet. Beams shall be filled in one pour. Grout shall be consolidated by rodding before initial set occurs.

- B. Reinforcing steel shall be in accordance with the subsection entitled "Reinforcing Steel" and shall be straight except as shown or required for placement, and shall be lapped 36 diameters at splices. Steel at splices shall be wired together or separated by one bar diameter. Horizontal reinforcing shall be laid in the webs of bond beam or channel block, and solidly grouted in place.
- C. Where grouting is stopped for one hour or longer, a horizontal construction joint shall be formed by stopping the grout pour one and one-half inches below the top of the filled blocks.

3.03 SEAL COATING

- A. All interior and exterior wall surfaces of the building shall receive one coat of block sealer and one coat of clear finish in accordance to the manufacturer's recommendations.

*** END OF SECTION ***

SECTION 11231

FLAP GATES

PART 1 -- GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install flap gates in the locations shown, complete and operable, including frames, wall thimbles, bracing, mountings, sealant, coatings, etc. as specified herein, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 11290 - Hydraulic Gates and Valves, General

PART 2 -- PRODUCTS

2.01 FLAP GATES

- A. Design: Flap gates and frames shall be of cast iron construction, shall have fully-adjustable, top pivot points, and shall be provided with bronze sealing surfaces. Gate frames shall have flat backs for attachment to wall thimbles. Flap gates shall open with a differential pressure of one foot of water or greater on the upstream side and shall shut and seal with a differential pressure of 6-inches of water column or greater.
- B. Sealant: The elastomeric sealant shall be Rubber Caulk Sealer as manufactured by Products Research Company, Los Angeles, or approved equal.
- C. Suppliers, or equal:
1. Hydro Gate Corp., Model 20C or 10C for round openings.
 2. Rodney Hunt Model No. FV-AC.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Flap gates shall be installed in strict accordance with the manufacturer's printed recommendations and the requirements herein.
- B. Just prior to setting each gate, a 1/8-inch thick layer of mastic grade polysulfide elastomeric sealant shall be applied to the back of the gate frame. After setting the gate, the nuts shall be run down on the anchor bolts just far enough to make them snub and to cause the rubber sealant to begin to come out, but not far enough to produce any significant stress in the frame. Any excess sealant at the edges shall be removed. The sealant shall be allowed to cure for at least 7 days, after which the anchor bolt nut shall be tightened to their final positions.

*** END OF SECTION ***

SECTION 11232
SLIDE/STOP GATES

PART 1 -- GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install slide/stop gates in locations shown, complete and operable, including manual and electric operators, bracing, frames, mountings, etc. as specified herein, all in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 11290 - Hydraulic Gates and Valves, General
B. Section 15101 - Valve Operators

1.03 QUALITY ASSURANCE

- A. The leakage allowance for slide gates shall not exceed 0.1 gpm per foot of seating perimeter under 20 foot of seating head, and 0.2 gpm per foot under 20 foot of unseating head.

PART 2 -- PRODUCTS

2.01 MATERIALS

- A. All plastic and fiberglass items shall be manufactured of material suitable for potable water and shall be certified for such use on the shop drawings. Bolts, anchor bolts, nuts, washers and supports shall be provided for all plastic and fiber glass items in accordance with the requirements of the manufacturers of the plastic and fiber glass items. All bolts, anchor bolts, washers and supports required in connection with the plastic or fiberglass items shall be of Type 316 stainless steel.
- B. All gates shall be new and of current manufacture, and adequately braced to prevent warpage and bending under the intended use. Where designated, gates shall be furnished with electric operators provided by the gate manufacturer. All operators of a given type shall be furnished by the same manufacturer.

2.02 ALUMINUM SLIDE GATES

- A. Aluminum slide gates shall be self-contained, hand crank-operated, with Type 316 or other approved stainless steel operating stems.
- B. Suppliers, or Equal:
1. Rodney Hunt;
 2. Hydro Gate Corp.;
 3. Washington Aluminum Company, Inc. (WACO).

2.03 FIBER GLASS STOP GATES

- A. Stop gates shall be as shown and shall be of fiberglass, with fiberglass surface-mounted guide frames of a size to allow hand operation. Mounting hardware, if required, shall be of Type 316 stainless steel.

PART 3 -- EXECUTION

3.01 INSTALLATION

- A. Slide/stop gates shall be installed in strict accordance with the manufacturer's printed recommendations and the requirements herein.

*** END OF SECTION ***

Appendix C

Land Disturbance Ordinance

TITLE 81

LAND DISTURBANCE

81-1	ADMINISTRATION
81-2	LAND DISTURBANCE PERMIT
81-3	LAND DISTURBANCE REGULATIONS
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Chapter 81-1 ADMINISTRATION

81-1-010	Short Title.
81-1-020	Authorization to Adopt Standards.
81-1-030	Purpose.
81-1-040	Definitions.
81-1-050	Administration
81-1-060	Conflict.

81-1-010 Short Title.

This Title is to be known as the "Land Disturbance Ordinance" of the City and may be so cited.

81-1-020 Authorization to Adopt Standards

The City Manager is hereby authorized to adopt these standards pursuant to this Title.

81-1-030 Purpose.

The purpose of this Title is to establish minimum requirements and procedures for conducting land disturbance activities within the City. It is the intent of this Title to protect the health, safety and welfare of the public against inadequate, unwarranted, or unsafe land disturbance activities during all aspects of land disturbance activities, including, but not limited to the following:

(a) To establish processes, procedures and standards for land disturbance activities such as clearing, grubbing, grading, excavating, filling, dredging, and other land disturbance related activities, to minimize hazards to life and limb, protect against erosion and sedimentation, maintain the natural environment, protect the safety, use, and stability of public rights-of-way and drainage facilities, and provide for restoration of the land through revegetation and landscaping.

(b) To assure that projects approved under this Title, as well as neighboring and downstream properties, will be free from harmful effects of new land disturbance activities with regard to runoff, including inundation, flooding, erosion, air pollution, and sedimentation.

(c) To ensure proper restoration of vegetation and soil systems disturbed by land disturbance activities, to maintain an attractive and healthy landscape, and to control against dust and erosion and their consequent effects on soil structure and air and water quality during and after excavation.

(d) To provide processes and standards in compliance with State and Federal requirements regarding pollution, environmental quality, and storm water discharge.

81-1-040 Definitions.

As used in this Title, the following words and phrases shall have the meanings given in this Section:

(a) Applicant: Any person who submits an application for a permit pursuant to the Land Disturbance Ordinance.

(b) Best Management Practice (BMP): Practices, procedures or designs used as a standard for a given industry. In this specific case, these “practices” are for the erosion control industry’s Best Management Practices (BMPs) for controlling nonpoint sources of pollution are the methods, measures, practices, or a combination of practices determined to be the most effective and practicable means (including technological, economic, and institutional considerations) to control nonpoint pollutants at levels compatible with environmental quality goals. As used in the document, BMPs are synonymous with erosion and sediment control measures.

(c) Building Envelope: The area within the lot which will be used to construct the building, landscaped areas, retaining walls, fences, porches, patios, decks, swimming pools, driveways, parking areas, or any other permanent feature which is appurtenant to the building.

(d) Buttress Fill: A buttress fill is a designed compacted earth fill used for providing lateral support to an unstabilized earth or rock mass.

(e) City: City of West Jordan, Utah.

(f) City Engineer: City Engineer shall mean the City Engineer of City of West Jordan, or the person(s) engaged by the City and authorized to perform the duties assigned to the City Engineer, and shall include any deputies and representatives.

(g) Civil Engineer: A professional engineer in the branch of civil engineering holding a valid certificate of registration issued by the State of Utah.

(h) Clearing and Grubbing: Moving, removing, displacing, and/or stockpiling, by manual or mechanical means, trees, and other vegetation and/or the top organic layer as described in the geotechnical report. In the absence of a geotechnical report the organic layer shall not be greater than eight (8”) inches.

(i) Community Development Director: That person charged with the responsibility of directing all phases of the Community Development Department and the enforcement of all State statutes and City laws pertaining to this office, or his duly authorized representative.

(j) Compaction: The act of compacting or consolidating soil and rock material to a specified density, and the resulting compacted state of the material.

(k) Detention: The holding back or delaying of the flow of water, through manmade or natural means.

(l) Dredging: The practice of deepening a waterway by mechanical means by the removal of sediments.

(m) Enforcement Authority: The City Engineer, the Engineering Inspector, and other designated representatives of the City Engineer, or any duly appointed Code Enforcement Officer or police official charged with the responsibility for enforcement of the provisions of this Title

(n) Engineering Geologist: A professional engineering geologist licensed or registered under the laws of Utah and capable of applying the geological sciences to engineering practices for the purpose of assuring that the geological features affecting the location, design, construction, operation, and maintenance of engineering works are recognized and adequately provided for.

(o) Erosion: The process of detachment of soil particles or other surface material by the action of wind, water, snow, or ice.

(p) Erosion Control Measures: The structural and nonstructural Best Management Practices (BMPs) for erosion control that prevents displacement of soil particles by wind or water. BMP Erosion control measures may include seeding, mulching, vegetative buffer strips, sod, plastic coverings, rip rap, gabions, other channel armoring methods, burlap coverings, watering, and other BMP measures that control the movement of the ground surface or soil.

(q) Farming and Agricultural Operations: Any activity or process normally performed as part of the farming use of the land which would prepare the soil for planting or harvesting of agriculturally usable products.

(r) Fill: Deposits of soil, rock, or other materials placed by man.

(s) Finished Grade: The final grade or elevation of the building site, slope or terrace (0.1 plus or minus feet).

(t) Grade: The elevation of the ground surface as measured from a known vertical control. Existing grade means grade currently on the site. Natural grade means the grade unaltered evidenced by the presence of indigenous plants and grasses.

(u) Grading: The act or result of digging, excavating, transporting, spreading, depositing, filling, compacting, settling, or shaping of land surfaces and slopes, and other operations or activities involving the physical movement of rock or soil.

(v) LDDCS: Land Disturbance Design and Construction Standards.

(w) Land Disturbance: Any disturbance of native soils, plants, or environment, including, but not limited to, clearing, grubbing, grading, excavation, filling, dredging, construction of earth-filled dams, and any other types of earthwork.

(x) Land Disturbance Design and Construction Standards: City of West Jordan Land Disturbance Design and Construction Standards as adopted by the City.

(y) Land Disturbance Permit: The land disturbance permit required by the City in accordance with provisions of this Title.

(z) Landmark Trees: Trees that measure over three inch (3") caliper.

(aa) Landscape Architect: A professional landscape architect licensed or registered under the laws of Utah.

(bb) Lot Level: Design, construction and infrastructure related to construction on a specific lot within an approved subdivision or site plan development.

(cc) Planting Date: The date native seed can be applied without temporary irrigation, generally from October 15 through March 1, or as otherwise determined by the City's Engineering Department.

(dd) Project: A defined site that has obtained final subdivision plat or site plan approval from the City.

(ee) Sediment: The transport of soil or earth material by wind, water, snow or ice.

(ff) Sediment Control Measures: The structural and nonstructural BMP that contains the deposited, displaced soil particles caused by erosion. This may include (but not limited to) dikes, sediment detention traps, sediment detention basins, filters, fences, barriers, swales, berms, drains, check dams, and other measures that control the deposition of soil or earth material.

(gg) Site: A parcel or parcels of real property owned by one or more persons on which activity regulated by this Title is occurring or is proposed to occur.

(hh) Slope: A portion of ground forming a natural or artificial incline, including retaining wall.

(ii) Soil: All earth material, of whatever origin, which overlies bedrock.

(jj) Soils Engineer: A professional civil engineer licensed under the laws of Utah who is experienced in soil mechanics and slope stability analysis.

(kk) Structure: Anything constructed or erected which requires location on the ground or is attached to something having location on the ground.

(ll) Subdivision Level: Design, construction and infrastructure related to subdivision development and systems such as drainage, culinary water, wastewater systems, etc.

(mm) Swales: Shallow grassed or otherwise protected trenches that are wider than they are deep that provide a specific pathway for drainage water.

(nn) Wet Weather Plan: A detailed erosion and sediment control plan and construction sequence that clearly shows how construction will be processed during the period of October 31 of each year until March 31 of each year.

81-1-050 Administration.

The Engineering Department is designated as the responsible department, with the City Engineer as the official responsible for the administration of this Title. The City Engineer may delegate any or all administrative duties provided herein as deemed necessary.

81-1-060 Conflict.

In the event of a conflict between the terms of this Title or any other law, ordinance or rule, the more restrictive provision shall apply.

Chapter 81-2 LAND DISTURBANCE PERMIT

81-2-010	Land Disturbance Permit Required.
81-2-020	Exemptions.
81-2-030	Application.
81-2-040	Plans and Specifications.
81-2-050	Grading Plan.
81-2-100	Slope Length.
81-2-120	Application Waiver.
81-2-130	Fees.
81-2-140	Review and Approval.
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81-2-160	Conditions of Approval.
81-2-170	Denial of Land Disturbance Permits.
81-2-180	Approved Plans.
81-2-190	Modification of Plans.
81-2-200	Correction of Errors.
81-2-210	Term of Land Disturbance Permits.
81-2-220	Extension of Term.
81-2-230	Suspended or Abandoned Work.
81-2-240	Renewal of Expired Land Disturbance Permit.
81-2-250	Suspension or Revocation of Permit.
81-2-260	No Transfer or Assignment of Permit.
81-2-270	Validity of Permit.
81-2-280	Additional Permits.
81-2-290	Emergencies.

81-2-010 Land Disturbance Permit Required.

Except as otherwise provided herein, no person, developer, builder, contractor, etc shall cause to be commenced or performed any land disturbance, grading, relocation of earth, or any other land disturbance activity, and no person shall import or export any earth materials to or from any site, without first obtaining a land disturbance permit. No land disturbance permit shall be issued for any site or project requiring site plan approval until and unless a final site plan has been approved by the Planning Commission, for the site or project, and no land disturbance permit shall be issued for any site or project requiring subdivision approval until and unless the final subdivision plat has been approved by the Planning Commission and recorded for the site or project.

81-2-020 Exemptions.

The following activities do not require a land disturbance permit. Activities exempted from the land disturbance permit requirements set forth herein are subject to and shall be performed in accordance with the Land Disturbance Design and Construction Standards, the Hillside Overlay Ordinance and all other applicable ordinances, rules, regulations, standards and specifications of the City.

(a) An excavation which does not exceed fifty (50) cubic yards; or affects an area that is less than three-thousand (3,000) square feet; or does not create a cut slope greater than five feet (5') in height or steeper than two horizontal to one vertical (2:1); provided, however, any

excavation which is made in an area of adverse geological conditions or which alters a drainage course must obtain a permit.

(b) A fill which is less than one foot (1') in depth and placed on natural terrain with a slope flatter than five horizontal to one vertical (5:1); affects an area that is less than three-thousand (3,000) square feet; is less than three feet (3') in depth and is not intended to support structures; provided, any fill over fifty (50) cubic yards or which affects a drainage course must obtain a permit.

(c) Excavations below the finished grade for basements and footings of buildings, retaining walls, swimming pools, or other structures authorized by a valid building permit. This shall not exempt any fill made of materials from such excavations or exempt any excavation having an unsupported height greater than five feet (5') after the completion of such structures.

(d) Mining and quarrying operations conducted under a valid special use permit issued by the City pursuant to applicable zoning regulations.

(e) The depositing of rubbish or other materials at any dump or sanitary fill conducted under a valid permit and/or applicable zoning ordinances. Such exemption shall not extend to surrounding berms, permanent access roads, building sites, or protective drainage works.

(f) Farming and agricultural operations conducted under a valid use permit or applicable zoning ordinances.

(g) Soil and water conservation work under the direct control of the United States Natural Resources Conservation Service; provided, the construction of water impounding structures of earth shall require a permit where the maximum depth to which water is or may be impounded is five feet (5') or greater.

(h) Grading operations conducted by the City for approved capital improvement projects.

81-2-030 Application.

Application for a land disturbance permit shall be filed with the City Engineer on forms furnished by the City for such purpose. Applications shall include all the plans, specifications, reports, documentation and information required herein. Three (3) sets of all required plans, specifications and reports shall be submitted with each application. All such plans, specifications and reports shall be prepared and signed by a civil engineer, soils engineer, engineering geologist and/or landscape architect, as required by this Title and the LDDCS. Additional experts in applicable field should be utilized for preparation of such documents and reports as appropriate. No application shall be processed until all required plans, specifications, reports, documentation and information have been received by the City in accordance with the provisions and requirements of this Title.

81-2-040 Plans and Specifications.

Each application for a land disturbance permit shall include the following plans, specifications, reports, documentation and information:

- (a) A vicinity sketch or other data adequately indicating the site location;
- (b) The property lines and dimensions and bearings of the property on which the work is to be performed;
- (c) The location of any existing buildings or structures on the property where the work is to be performed and the location of any building or structure on the land of adjacent property owners, which building or structure is within fifty feet (50') of the property boundary;
- (d) The location of landmark trees as indicated by the designation of the location of the center of the trunk;
- (e) Accurate topography showing suitable contours of the existing and proposed ground elevations. The contours shall be extended past the boundary lines of any project for a minimum of one hundred feet (100'). The City Engineer may require the contours to be extended to include watershed areas and all other areas influencing the proposed project or site
- (f) The elevations, dimensions, locations, extent, and slopes of all proposed land disturbance activities shown by contours or other means;
- (g) A certification, by a soils engineer, of the quantity and type of material of any proposed excavation and fill;
- (h) The estimated starting and completion dates for the proposed land disturbance activities and proposed land disturbance activities schedule and permit term;
- (i) Detailed plans of all drainage devices, walls, cribbing, dams, or other protective devices to be constructed in connection with, or as a part of, the proposed work, together with a map showing the drainage area and estimated runoff of the area served by the drains. All hydrologic and hydraulic calculations shall be signed by a civil engineer;
- (j) Temporary construction entrance and exit plan as indicated in the LDDCS;
- (k) An indication as to the type of structure(s) to be constructed or the proposed use of the site, such as single-family residence, multiple-family development, commercial, or industrial; and
- (l) Any additional plans, drawings, or calculations required herein or by the City Engineer.

81-2-050 Required Plans and Reports.

Unless an application waiver is obtained in accordance with the provisions of this Title, each application for a land disturbance permit shall include the following plans and reports for the proposed land disturbance activity and site. The grading plan shall be prepared in accordance with the requirements and standards for such plans as set forth in the Land Disturbance Design and Construction Standards.

- a) Grading plan prepared and signed a civil engineer
- b) Drainage Plan - Each application for a land disturbance permit shall include a drainage plan for the proposed land disturbance activity and site. The drainage plan shall be

- prepared by a civil engineer and shall be prepared in accordance with the requirements and standards for such plans as set forth in the LDDCS.
- c) Rear and Side Lot Drainage Swales – Swales located in rear and side yards shall part of the grading and drainage plan and be designed as set forth in the LDDCS.
 - d) Erosion and Sediment Control Plan - Each application for a land disturbance permit shall include an erosion and sediment control plan for the proposed land disturbance activity and site. The erosion and sediment control plan shall be prepared by a civil engineer and shall be prepared in accordance with the requirements and standards for such plans as set forth in the LDDCS.
 - e) Revegetation Plan - Each application for a land disturbance permit shall include a revegetation plan for the proposed land disturbance activity and site. The revegetation plan shall be prepared by an erosion control specialist or professional of comparable expertise and shall be prepared in accordance with the requirements and standards for such plans as set forth in the LDDCS, Section 4.
 - f) Soils Report - Each application for a land disturbance permit shall include a soils report for the site. The soils report be prepared and signed by a soils engineer and shall be prepared in accordance with the requirements and standards for geological reports as set forth in the LDDCS, Section 2
 - g) Geological Report - When deemed necessary by the City Engineer due to the circumstances and conditions of the site, an application for a land disturbance permit shall include a geological report for the site. The geological report, when required, shall be prepared and signed by a engineering geologist and shall be prepared in accordance with the requirements and standards for geological reports as set forth in the LDDCS, Section 2.
 - h) Exploratory Work - Surface and subsurface exploratory work and reports may be required when deemed necessary by the City Engineer due to site conditions and/or hazards on the site. When required, such exploratory work and reports shall be performed and prepared by a soils engineer and/or engineering geologist.

81-2-100 Slope Length.

All applications for land disturbance activities involving or proposing cut and/or fill slopes shall include a report prepared and signed by an erosion control specialist or professional of comparable expertise addressing the design, safety, stability of the proposed slope lengths. Such report shall indicate how the applicant will address the issue of length of slope using the Revised Uniform Soils Loss Equation (RUSLE). The report shall indicate the method and/or materials to be used.

81-2-120 Application Waiver.

The City Engineer may waive any application requirement, plan, specification or report when deemed unnecessary for the proposed application and for good cause showing. A request for an application waiver shall be submitted by the applicant in writing setting forth the grounds and reasons for the waiver. An application shall not be deemed complete for purposes of the filing of a completed application until the City Engineer has approved the application waiver request. Failure of the City Engineer to approve the request within 60 days shall be deemed a denial.

81-2-130 Fees.

All applicable fees shall be paid by applicant with the filing of an application for a land disturbance permit. An application will not be deemed complete until the required fees have been received by the City. The fee amount shall be as adopted by City Council.

81-2-140 Review and Approval.

The City Engineer shall review the application, plans, and specifications, reports, documentation and information filed by an applicant for a land disturbance permit. If the City Engineer determines that the application is incomplete, or that additional information is needed from the applicant regarding the proposed land disturbance activities, the City Engineer shall notify the applicant in writing of such deficiencies or the need for additional information. The City Engineer may also request review of the application, plans and specifications by other departments of the City for compliance with the laws and ordinances under their jurisdiction.

Once satisfied that the work described in an application for land disturbance permit and the plans and specifications filed with the application conform to the requirements of this Title and other pertinent laws and ordinances, all applicable fees have been paid, and all required bonds have been provided in accordance with the provisions of Chapter 4 of this Title, the City Engineer may issue a land disturbance permit to the applicant.

81-2-150 Issuance.

The City Engineer shall provide the applicant with a written decision, within 30 days, regarding the approval or denial of the application for land disturbance permit and related plans and shall provide the applicant with a copy of such decision. If the application is approved, a copy of the land disturbance permit will be provided to the applicant.

81-2-160 Conditions of Approval.

In granting any land disturbance permit pursuant to the provisions of this Title, the City Engineer or his or her authorized representative may attach such conditions as may be reasonably necessary to protect public health and safety. Such conditions may include, but will not be limited to:

- a) The improvement of any existing site condition to conform with the standards of this Title; and
- b) Requirements for fencing excavations or fills which would otherwise be hazardous, and
- c) Requirements for access and haul routes. The City Engineer may impose conditions to the land disturbance permit with respect to access or haul routes to and from land disturbance activity sites, the hours of work, methods of controlling dust, and safety precautions involving pedestrian or vehicular traffic as determined required in the interest of the public health, safety and welfare.

81-2-170 Denial of Land Disturbance Permits.

(a) A land disturbance permit shall not be issued in any case where it is determined by the City Engineer that the work proposed by the applicant is hazardous, or is likely to

endanger any private property, result in the deposit of debris on any public way, or interfere with any existing drainage course.

(b) A land disturbance permit shall not be issued if the land area for which grading is proposed is subject to geological or flood hazard to the extent that no reasonable amount of corrective work can eliminate or sufficiently reduce the hazard to human life or property as determined by the City Engineer.

(c) A land disturbance permit shall not be issued if the proposed land disturbance activity would not comply with the requirements of an approved site plan, subdivision plat, or any provisions of law, including the provisions of this Title.

81-2-180 Approved Plans

Prior to issuance of the land disturbance permit, the applicant shall provide the City with four (4) sets of the final plans, specifications and computations (full-size) and two (2) sets of 11x17-inch plans. Upon issuance of the land disturbance permit, the City Engineer shall endorse in writing, or stamp "Approved for Construction" on all required sets of plans and specifications. The City Engineer shall retain two (2) sets of the plans and specifications during the period of construction and as thereafter required by the Government Records Access and Management Act (GRAMA). Upon Approval, the City Engineer shall return one set of the final plans and specifications, stamped "Approved", to the applicant. The applicant shall retain the approved set of plans and specifications at the site covered by the land disturbance permit at all times during which the work authorized thereby is in progress.

81-2-190 Modification of Plans.

No approved plans or specifications shall be changed, modified, altered or amended, without approval of the City Engineer in accordance with the procedures and requirements set forth herein for original approval of such plans and specifications. Modification of plans will require additional City review and will be subject to additional fees.

81-2-200 Correction of Errors.

The issuance of a land disturbance permit based upon submitted plans, specifications and documents shall not prevent or preclude the right of the City from thereafter requiring the correction of errors which may be later discovered in such plans, specifications and documents.

81-2-210 Term of Land Disturbance Permits.

Each land disturbance permit shall contain a specified term as determined by the City. The date the land disturbance permit expires shall be noted on the land disturbance permit. No person shall perform land disturbance, grading, relocation of earth, or any other land disturbance activity beyond the expiration date, unless an extension of term is granted or a new land disturbance permit is obtained in accordance with this Title.

81-2-220 Extension of Term.

Prior to expiration of the land disturbance permit, the land disturbance permit holder may apply for an extension of time in which to complete the work in a reasonable and expeditious manner. The City Engineer may grant an extension of time, upon a showing of good cause, for a period or periods not exceeding a total of one (1) year. Denial of an extension of time does not preclude the right of the land disturbance permit holder to apply for a new land disturbance

permit for the remaining balance of the work. Adequate security or written consent from the surety must be provided for any extension of time before approval of the extension is granted or becomes effective. If the extension is denied, the City will make a demand on the bond and complete the work.

81-2-230 Suspended or Abandoned Work.

Every land disturbance permit issued by the City Engineer under the provisions of this Title expires by limitation and becomes null and void if the land disturbance permit holder suspends or abandons the construction or work authorized by such land disturbance permit, at any time after the work is commenced, for a period of thirty days (30) or longer. After construction or work under a land disturbance permit has been suspended or abandoned for a period of thirty (30) days or longer, a new or renewed permit must be obtained prior to recommencing work.

81-2-240 Renewal of Expired Land Disturbance Permit.

If a land disturbance permit has expired, a new land disturbance permit shall be obtained before any work can be recommenced. If no changes have been made or will be made to the original plans and specifications for such work, and any suspension or abandonment has not exceeded one (1) year, the fee for the new land disturbance permit will be one-half the amount ordinarily required for a new land disturbance permit. If changes have been made or will be made in the original plans or specifications for the land disturbance activity, or the suspension or abandonment has exceeded one (1) year, the fee for a new permit shall be required for a new permit for the proposed land disturbance activity.

81-2-250 Suspension or Revocation of Permit.

The City may, in writing, suspend or revoke a permit when the permit is issued in error, or on the basis of incorrect information supplied, or when work conducted thereunder is in violation of the terms of the permit or the provisions of this Title or other applicable City Ordinances, rules, regulations, standards and specifications, or pertinent laws.

81-2-260 No Transfer or Assignment of Permit.

Land disturbance permits shall not be transferable or assignable and work shall not be performed under a land disturbance permit in any place other than that specified in the permit. Nothing herein shall prevent a permit holder from subcontracting the work to be performed under a land disturbance permit; provided, however, the permit holder shall be and remain responsible and liable for the performance of the work and land disturbance activities under the permit and for all bonding and other requirements of this Title and the applicable permit.

81-2-270 Validity of Permit.

The issuance of a land disturbance permit shall not be construed to be a permit for violation of any of the provisions of this Title or any other City Ordinances, rules, regulations, standards or specifications or other pertinent laws. Permits presuming to give such authority shall be deemed invalid.

81-2-280 Additional Permits.

The issuance of a land disturbance permit shall not relieve the owner, applicant, permit holder, or developer from obtaining any and all other permits or approvals required by the City or any other applicable agency having jurisdiction over the work or property affected by the proposed land disturbance activity.

81-2-290 Emergencies.

The provisions of this Title shall not apply to any land disturbance activity which is conducted during a period of emergency or disaster, as declared and defined by the City, and which is directly connected with or related to the relief of conditions caused by such emergency or disaster.

Chapter 81-3 LAND DISTURBANCE REGULATIONS

81-3-010	Compliance With Permit.
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81-3-180	Erosion Control and Revegetation.
81-3-190	Wet Weather Plan.
81-3-200	Land Disturbance Design and Construction Standards.
81-3-210	Lot Impervious Surface Area Drainage.

81-3-010 Compliance With Permit.

The land disturbance permit holder and contractor and their agents shall carry out the proposed land disturbance activities in accordance with the approved plans and specifications, the conditions of the land disturbance permit, and the requirements of this Title and all other applicable ordinances, rules, regulations and standards of the City.

81-3-020 Protective Devices.

The land disturbance permit holder and contractor and their agents shall maintain all required protective devices and temporary drainage during the progress of the land disturbance activities and shall be responsible for the observance of the hours of work, mud tracking, dust control, methods of hauling, and other applicable regulations.

81-3-030 Maintenance of Site.

The land disturbance permit holder and contractor and their agents shall be responsible for the maintenance of the site and the removal of all debris during the term of the permit.

81-3-040 Access and Haul Routes.

Temporary construction entrance and exit routes shall be provided by the permit holder in accordance with the approved plans and permit access at key points to the site or project to eliminate the problem of tracking mud and debris from the construction site onto private or public streets.

81-3-050 Consent of Adjacent Property Owners.

Whenever any land disturbance activity requires entry onto adjacent property for any reason, the land disturbance permit applicant shall obtain the written consent of the adjacent property owner or their authorized representative and shall file a copy of such consent with the City Engineer before a land disturbance permit may be issued.

81-3-060 Cuts and Fills.

(a) Height. Except as otherwise provided herein, no finished fill slope shall exceed a vertical height of twenty-five feet (25'). The City Engineer may approve a fill slope in excess of twenty-five feet (25') as deemed appropriate in his or her sole discretion based upon the circumstances and conditions of the proposed site and fill. Any fill slope proposed in excess of twenty-five feet (25') shall be supported by documentation and a report prepared and signed by a professional engineering geologist and soils engineer attesting to the appropriateness, safety and stability of the proposed fill slope. Such documentation and report shall be prepared at the applicant's expense and shall address the need for and design of necessary measures to provide for the safety and stability of the proposed slope in accordance with the LDDCS.

(b) Slope. Except as otherwise provided herein, no cut or fill shall exceed a slope of two horizontal to one vertical (2:1). The City Engineer may approve a cut or fill slope in excess of two horizontal to one vertical (2:1) as deemed appropriate in his or her sole discretion based upon the circumstances and conditions of the proposed site and the cut or fill in accordance with the LDDCS. Any cut or fill slope proposed in excess of two horizontal to one vertical (2:1) shall be supported by documentation and a report prepared and signed by a professional engineering geologist and soils engineer attesting to the appropriateness, safety and stability of the proposed cut or fill slope. Such documentation and report shall be prepared at the applicant's expense and shall address the need for and design of necessary measures to provide for the safety and stability of the proposed cut or fill slope.

(c) Unstable Material. The City Engineer may require any cut or fill to be constructed with an exposed surface flatter than two horizontal to one vertical (2:1) when, in the City Engineer's opinion, under the particular conditions, such flatter surface is deemed necessary for stability or safety.

(d) Fill Slope Limits. Toes of fill slopes shall not be made nearer to a property boundary line than one-half (1/2) of the height of the fill, or twenty feet (20'), whichever is less. Fill slopes shall not be divided horizontally by property lines. Fill slopes occurring on a side or rear lot line shall be made a part of the downhill lot.

(e) Intervening Terraces. When intervening terraces are used, terraces shall be paved using materials as approved by the City and shall have a minimum width of six feet (6'). Terraces shall be extensively landscaped in accordance with an approved landscaping plan. Terraces shall be spaced at vertical intervals of twenty-five feet (25'); provided, however, for slopes less than forty feet (40') in vertical height, terraces shall be approximately at mid-height. For slopes flatter than two horizontal to one vertical (2:1), or where soil conditions require, additional intervening terraces may be required.

(f) Compaction. All fills shall be placed, compacted, inspected, and tested in accordance with the provisions of this Title and the Land Disturbance Design and Construction Standards. If the strict enforcement of the compaction provisions of this Section is determined by

the City Engineer to be unnecessary because of the proposed or probable use of the land, the City Engineer may waive the requirements. The requirements of this Section shall not be waived when structures are to be supported by the fill, the fills are being placed in areas to be designated as hillside, or where the fills are necessary as a safety measure to aid in preventing the saturation, settling, slipping, or erosion of the fill.

(g) Fills Toeing Out on Natural Slopes. Except as otherwise provided herein, no fills toeing out on natural slopes, which are steeper than two horizontal to one vertical (2:1) shall be permitted. The City Engineer may approve such fills toeing out on natural slopes which are steeper than two horizontal to one vertical (2:1) as deemed appropriate in his or her sole discretion based upon the circumstances and conditions of the proposed site and fill. Any fill slope proposed to toe out on natural slopes which are steeper than two horizontal to one vertical (2:1) shall be supported by documentation and a report prepared and signed by a professional engineering geologist and soils engineer attesting to the appropriateness, safety and stability of the proposed fill. Such documentation and report shall be prepared at the applicant's expense and shall address the need for and design of necessary measures to provide for the safety and stability of the proposed fill.

(h) Combined Cut and Fill Slopes. Combined cut and fill slopes shall meet the requirements of this section insofar as steepness, height, and terracing are concerned except that, where the slope exceeds twenty-five feet (25') in height, the required drainage bench shall be placed at the top of the cut slope.

(i) Setback. Fill placed on or above the top of an existing or proposed cut or natural slope steeper than three horizontal to one vertical (3:1) shall be set back from the top of the slope a minimum distance as required by the International Building Code, as adopted by the City, or such greater distance as approved by the City Engineer based upon submitted reports and documentation for the project.

(j) Existing Fills. All existing man-made fills on any and all sites shall be properly evaluated by a soils engineer. If deficiencies exist, recommendations and design criteria for corrective measures shall be included within the soils engineering report.

(k) Measure of Settlement. The City Engineer or the Building Official may require the determination of the settlement characteristics of any fills to establish that any movements have substantially ceased. In such cases, a system of bench marks shall be installed by a civil engineer or land surveyor at critical points on the fill, and accurate measurements of both horizontal and vertical movements shall be taken and evaluated by the soils engineer for a period of time sufficient to define the settlement behavior. The evaluation period shall be monitored in accordance with the approved geotechnical report for the project.

(l) Buttress Fills. All buttress fills shall be designed in accordance with the Land Disturbance Design and Construction Standards and the recommendations and design criteria, including the subdrain system, submitted by the soils engineer or engineering geologist with the approval of the City Engineer.

81-3-070 Erosion Control and Drainage Devices.

BMP's, such as, but not limited to, intervening terraces, diverter terraces, vee channels, runoff computations, drainage dispersal walls, subdrains and site drainage, are to be provided and designed as indicated in the LDDCS.

81-3-080 Areas Subject to Slides and Unstable Soil.

A detailed evaluation shall be completed for all areas subject to slides or unstable soils by a soils engineer and/or engineering geologist including design criteria for corrective measures. Exploratory work and/or reports may be required by the City Engineer for such conditions in accordance with permit requirements set forth in Chapter 2 of this Title.

81-3-090 Planting and Irrigation of Cut and Fill Slopes.

All manufactured cut and fill slopes shall be planted and maintained until established. Temporary irrigation may be required in accordance with the provisions of this Title and the LDDCS. The permit holder is responsible for operating and maintaining the irrigation system.

81-3-100 Identification of Building Envelope Within Hillside Ordinance District.

The permit holder shall indicate on the site plan or subdivision plat required for the site or project, the maximum building envelope, or area of ultimate land/vegetation disturbance, including designation of the building envelope's distance from the lot or site boundary lines, which will be caused by the proposed structure and its appurtenances. Prior to the beginning of any type of land disturbance or construction on a given lot, the contractor performing the work is responsible for identifying the building envelope in the field by marking of the building envelope perimeter. The Building Official may require markers to be surveyed when deemed necessary or appropriate. No land disturbance activity shall commence on the lot prior to inspection by the City's Building and Safety Division of the building envelope marking.

81-3-110 Property Line and Corner Markers.

The permit holder shall ensure that property lines and corner survey markers are installed for the site or project. These markers are to include rebar placed at the back corners of each lot and markers placed on the curb for locating the side property lines. If curb and gutter do not exist, the front markers are to be placed in the road pavement.

81-3-120 Slope Protection Easements.

The permit holder shall provide slope protection easements for all slopes constructed as part of the project. Slope protection easements shall be provided either through indicating them on the final plat or by separate recordable easement acceptable to the City.

81-3-130 Lots Graded Toward Street for Drainage.

Except as otherwise provided herein, storm water runoff from individual lots shall be directed toward the streets. Exceptions may be granted by the City Engineer, when deemed appropriate and necessary, in accordance with the provisions of this Section. Aesthetics reasons such as the creation of view lots shall not constitute sufficient reason for granting an exception. If the permit holder finds that draining storm water toward the street is unobtainable, for a portion or all of the lot, the permit holder shall demonstrate to the City Engineer that there are no other avenues for drainage of the storm water. In such cases, the permit holder shall prepare a drainage plan which indicates how the storm water will be disposed of from the lot, to either a City owned storm drain, a natural stream or channel, a manmade channel, other City-approved facility or retained on-site. The permit holder is responsible for obtaining the necessary approvals and

permits for the discharge or retention of storm water flows. The City Engineer will determine if such alternate drainage is both necessary and appropriate.

81-3-140 Lots Which Cannot Be Graded Toward the Street.

(a) Approval Required. Lots that cannot be drained toward the street may be allowed to drain a portion of their storm water runoff toward the rear of the yard, after review and approval by the City Engineer. Prior to obtaining this approval, the permit holder shall prepare a drainage plan, which indicates how the storm water will be disposed of from the lot, to either a City owned storm drain, a natural stream or channel, or manmade channel, or other City approved facility or retained on-site. Such disposal is to be protected by a drainage easement dedicated for this purpose, and the facilities shall be subject to the bonding provisions set forth in Chapter 81-4.

(b) Swales. Swales located in rear and side yards shall be of materials as approved by the City that will prevent erosion, and shall be a permanent feature of the lot and shall be shown in a drainage easement on the site plan or final plat for the project. An actual design drawing of the swale system shall be prepared and be included as part of the grading and drainage plan for the project. If slopes exist between lots sufficient space shall be allowed to include a swale at the top of the slope and one at the bottom, all within dedicated storm drainage easements. Where storm water is transferred from a lot of higher elevation, to a lower lot in elevation, sufficient energy dissipation shall be constructed to reduce the water velocity to an acceptable level. Engineering calculations are to be submitted to the Engineering Department certifying the proposed design of the energy dissipation facilities as set forth in the LDDCS.

(c) Notice. Swales shall be constructed and in place before building permits are issued on subdivision lots. The developer shall notify the homebuilders and homeowners shall be notified of these drainage swale easements and the need to maintain them both during and after construction. Homeowners are to be notified by the developer of the installation of these side and rear yard swales through an acceptable instrument to the City. A notice of these drainage swale easements shall also be recorded on the subdivision plat for the project. After completion of the swales, the homeowners shall be responsible for maintenance of swales.

(d) Bonding. In the event these types of swales are used for the project, the Developer shall provide sufficient bonding of these swales as part of the City's regular public improvement bonding, to ensure these facilities will be constructed.

(e) Underground Facilities. The Developer may select the option of designing and constructing underground drainage facilities to replace aboveground drainage swales if these facilities meet certain City requirements. These requirements include the design being approved by the Engineering Department, inclusion of these facilities within City approved drainage easements, maintenance of the system by a Homeowner's Association, and other requirements as may be deemed necessary by the City.

81-3-150 Materials for Side and Rear Yard Drainage.

Side and rear yard swales and drainage facilities shall be designed into projects as an integral component of the storm water system of the project which needs to transfer storm water runoff from the rear and side yards to the street, or to other rear yard storm water facilities. These swales or drain facilities shall be designed and constructed in such a way that they become a permanent feature of the side and/or rear yard and shall be constructed of a material as approved by the City which prevents erosion. Inspections of these swales or drain facilities shall be

conducted during the subdivision construction phase of the project and during lot level development. Developers are to provide recorded drainage easements wide enough to provide for the possible slight field relocation of rear and side yard drainage swales, or other drainage facilities. At a minimum, the drainage easement shall be for the width of the swale plus two feet (2').

81-3-160 Flow of Water from One Lot to Another – Limited Use.

In the case where storm water flow is allowed to flow from a higher lot to a lower lot, in elevation, sufficient energy dissipation shall be designed and constructed to reduce the water velocity to an acceptable level to prevent erosion. The design and construction of these energy dissipation structures shall be approved by the Engineering Department in conjunction with the review and approval of the drainage plan for the project.

81-3-170 Landscaping of Certain Lots for Erosion Control.

The City reserves the right to require that the lots be revegetated or stabilized prior to issuance of building permits or that lots be fully landscaped prior to the issuance of a Certificate of Occupancy, as part of the requirements of the project. The purpose of this requirement is to ensure that, for certain areas in the City, which have soils susceptible to severe erosion, that erosion is controlled. The criteria to be used by the City are the size of the lot and sizes of adjacent lots, elevation differences between lots, and the type of soils in the project, along with other factors. A landscaping plan shall be submitted to the Engineering Department for approval prior to commencement of landscaping improvements required hereunder.

81-3-180 Erosion Control and Revegetation.

The developer is to indicate erosion control and revegetation BMPs to be used for the project on the project drawings and as part of the project descriptions included with the application in accordance with the City's LDDCS. Erosion and sedimentation control measures will be inspected upon completion, during construction of the subdivision, and once the subdivision construction is complete. The Engineering Department will be responsible for these inspections. Once the subdivision level construction is complete and improvement work begins on individual lots, erosion and sedimentation control BMP will be inspected prior to any disturbance, during construction and once lot level construction is complete. The Building Division will be responsible for these inspections.

81-3-190 Wet Weather Plan.

The City Engineer may require that land disturbance activities and erosion control or revegetation plans be modified, if unforeseen delays occur due to weather generated problems not considered at the time the land disturbance permit was issued, including submission and approval of a wet weather plan.

81-3-200 Land Disturbance Design and Construction Standards.

All land disturbance activities shall be conducted in accordance with the Land Disturbance Design and Construction Standards, the Hillside Overlay District Ordinance, the 'Development Processing Manual,' 'Road and Bridge Design and Construction Standards,' 'Storm Drainage and Flood Control Design and Construction Standards,' 'Culinary Water Design

and Construction Standards' and all other applicable ordinances, rules, regulations, standards and specifications of the City.

81-3-210 Lot Impervious Surface Area Drainage.

All impervious surface areas on lots, including roofs and their drains, driveway pads and other such areas, are to be drained toward the street unless otherwise approved by the City Engineer.

Chapter 81-4 BONDS

- 81-4-010 Land Disturbance Activities and Improvements Bond.**
- 81-4-020 Revegetation Bond.**
- 81-4-030 Restoration Bond.**

81-4-010 Land Disturbance Activities and Improvements Bond.

Prior to issuance of a land disturbance permit, the applicant shall be required to enter into a bond agreement in a form acceptable to the City providing security to insure completion of the land disturbance activities and improvements required to be installed and/or provided pursuant to the provisions of this Title and the land disturbance permit. The applicant shall be required to complete all land disturbance activities and improvements in accordance with the terms and conditions of the land disturbance permit, the bond agreement, and all applicable ordinances, resolutions, standards, specifications, and plans. The bond shall be equal to 100% of the engineers estimated cost, and approved by the City Engineer, of the land disturbance activities and improvements to be installed and/or provided. Except as otherwise provided in this Section, the bond shall be administered and processed in accordance with the bond provisions set forth in the City's Subdivision Ordinance regarding bonds and security for subdivision public improvements.

81-4-020 Revegetation Bond.

Prior to issuance of a land disturbance permit, the applicant shall be required to enter into a revegetation bond agreement in a form acceptable to the City providing security to insure installation and completion of revegetation improvements required to be installed and/or provided pursuant to the provisions of this Title and the land disturbance permit. The applicant shall be required to install and complete all revegetation improvements in accordance with the terms and conditions of the land disturbance permit, the bond agreement, and all applicable ordinances, resolutions, standards, specifications and plans. The bond shall be equal to 100% of the engineers estimated cost, and approved by the City Engineer, of the revegetation improvements required to be installed and/or provided. Except as otherwise provided in this Section, the revegetation bond shall be administered and processed in accordance with the bond provisions set forth in the City's Subdivision Ordinance regarding bonds and security for subdivision public improvements.

81-4-030 Restoration Bond.

Prior to issuance of a land disturbance permit, the applicant shall be required to enter into a restoration bond agreement in a form acceptable to the City providing security to insure installation and completion of restoration improvements required to be installed and/or provided pursuant to the provisions of this Title and the land disturbance permit. The applicant shall be required to install and complete all restoration improvements in accordance with the terms and conditions of the land disturbance permit, the bond agreement, and all applicable ordinances, resolutions, standards, specifications and plans. The bond shall be equal to 100% of the engineers estimated cost, and approved by the City Engineer, of the restoration improvements required to be installed and/or provided. Except as otherwise provided in this Section, the restoration bond shall be administered and processed in accordance with the bond provisions set forth in the City's Subdivision Ordinance regarding bonds and security for subdivision public improvements.

Chapter 81-5 INSPECTION

81-5-010	Permit Holder Supervision and Inspection.
81-5-020	City Inspections.
81-5-030	Additional Inspections or Testing.
81-5-040	Inspection Requests.
81-5-050	Duty to Keep Work Accessible and Exposed.
81-5-060	Entry Onto Premises.
81-5-070	Certification or Approval.
81-5-080	Transfer of Responsibility for Certification.
81-5-090	Final Inspection.
81-5-100	Building Permits.
81-5-110	Validity of Inspection.

81-5-010 Permit Holder Supervision and Inspection.

The land disturbance permit holder shall provide, at the permit holder's sole cost and expense, all required supervision, inspection and safety precautions before, during and after all land disturbance activities in accordance with the LDDCS and other applicable City Ordinances, rules, regulations, standards and specifications regarding such activities. The land disturbance permit holder shall be required, at the permit holder's sole cost and expense, to design, inspect and certify all land disturbance activities at such intervals and in accordance with such design, inspection and certification standards and requirements provided in the Land Disturbance Design and Construction Standards and other applicable City Ordinances, rules, regulations, standards and specifications. Certain land disturbance activities may require continuous or constant inspection and supervision by a civil engineer or other authorized inspector, as a condition of the land disturbance permit or when deemed necessary by the City Engineer, in accordance with the terms and conditions of this Title and the LDDCS.

81-5-020 City Inspections.

In addition to permit holder inspections and certifications, all land disturbance activities shall be subject to City inspection as specified and required in the LDDCS, the Hillside Overlay Ordinance, and other applicable City Ordinances, rules, regulations, standards and specifications. The City may also make or require other inspections of land disturbance activities to ascertain compliance of such work with the land disturbance permit and applicable City Ordinances, rules, regulations, standards and specifications, when deemed necessary by the City Engineer, in accordance with the terms and conditions of this Title and the LDDCS.

81-5-030 Additional Inspections or Testing.

The City Engineer may require additional inspections and/or testing of land disturbance activities by an approved testing agency when deemed necessary by the City Engineer in accordance with the terms and conditions of this Title and the LDDCS. Any such additional inspections and/or testing shall be at the permit holder's expense.

81-5-040 Inspection Requests.

When inspections are required to be conducted by the City, the permit holder, or authorized agent of the permit holder, shall notify the City Engineer in writing or by telephone that such work is ready for inspection at least one (1) business day before the inspection desired.

81-5-050 Duty to Keep Work Accessible and Exposed.

The permit holder shall cause the land disturbance activities and work to be accessible and exposed for inspection by the applicable required inspector until such inspection has been conducted and approved or certified, as applicable. The City, its officers, agents and employees, shall not be liable for any expense incurred by the permit holder in removing or replacing any materials or improvements required to allow inspection.

81-5-060 Entry Onto Premises.

The City, and its authorized representatives, shall have access to the premises described in the land disturbance permit for the purpose of inspecting the progress of the work.

81-5-070 Certification or Approval.

Inspections and certifications required to be made by the permit holder's engineer shall be conducted and certification of the same submitted to the City prior to further construction or land disturbance activities. Inspections required to be made by the City shall be conducted and approved by the City prior to further construction or land disturbance activities.

81-5-080 Transfer of Responsibility for Certification.

If the land disturbance permit holder changes the civil engineer, the soils engineer, the engineering geologist, the contractor, or the testing agency of record during the course of permitted work, the land disturbance permit holder shall file an assignment and assumption agreement of the new engineer, contractor or testing agency responsible for certification of the site or project. Such assignment and assumption agreement shall be filed with and approved by the City Engineer.

81-5-090 Final Inspection.

Final inspection of the permitted land disturbance activities shall be conducted by the City. No final inspection of permitted land disturbance activities shall be scheduled or conducted until and unless all work has been completed in accordance with the land disturbance permit, the final approved plans and specifications, and all applicable City Ordinances, rules, regulations, standards and specifications, including, but not limited to, installation of all drainage facilities and protection devices, all required revegetation, and all required erosion and sediment control measures. No final inspection shall be scheduled or conducted until the permit holder has submitted, and the City has approved, a post-construction maintenance schedule for the revegetation, erosion control and other required improvements.

81-5-100 Building Permits.

No building permit or other development approval shall be given for any property, parcel, site or project for which a land disturbance permit has been issued until final inspection and approval has been given under the land disturbance permit.

81-5-110 Validity of Inspection.

Any inspection approval or certification shall not be construed to be an approval of a violation of any of the provisions of this Title or any other applicable law, ordinance, rule, regulation, standard or specification. Inspections presuming to give such authority shall be deemed invalid.

Chapter 81-6 ENFORCEMENT

81-6-010	Enforcement.
51-6-015	Violations.
81-6-020	Remedies and Enforcement Powers.
81-6-030	Notice of Violation.
81-6-040	Suspension or Revocation of Land Disturbance Permit.
81-6-050	Notice of Suspension or Revocation.
81-6-060	Cessation of Work.
81-6-070	Decision of Suspension or Revocation.
81-6-080	Right of Entry.
81-6-090	Appeals.
81-6-100	Liability.
81-6-110	Right to Stop Work.

81-6-010 Enforcement.

This Title is to be enforced pursuant to the provisions set forth herein as applicable. The City Engineer and other Enforcement Authorities are responsible for the enforcement of the provisions of this Title.

81-6-015 Violations.

(a) Violations Enumerated. No person shall fail, refuse, or neglect to comply with the following:

(1) Provisions of this Title and land disturbance permits issued in accordance with this Title

(2) Orders issued by the City Engineer or the Building Official pursuant to the provisions of this Title;

(2) Conditions imposed on land disturbance permits pursuant to the provisions of this Title; and

(3) Rules and regulations of the office of the City Engineer with respect to grading, which were in effect at the time the land disturbance permit was issued.

(b) Continuing Violation. Each and every day, or portion thereof, during which any violation of any of the provisions of this Title is committed, continued, or land disturbance permitted, shall be considered a separate offense.

81-6-020 Remedies and Enforcement Powers.

(a) Nothing herein is intended to limit or prohibit the enforcement of the City of West Jordan Municipal Code or other applicable laws through civil or criminal process where the City has determined that enforcement of the procedures outlined in these sections will not result in effective redress, where there have been repeated violations of the provisions of this Title, or where the severity of the violation warrants redress through civil or criminal action.

(b) The following sanctions shall be available to redress violations of the provisions of this Title:

(1) Issuance of a Notice of Violation;

(2) Revocation or suspension of land disturbance permits, conditional use land disturbance permits or plan or other approvals issued by City of West Jordan;

(3) The placement of requirements for corrective action on land disturbance permits, licenses, or other entitlements issued by City of West Jordan as a condition of the land disturbance permit, license, or entitlement;

(4) Requiring the responsible permit holder to post a bond, irrevocable letter of credit, or other adequate security to ensure compliance with the provisions of this Title or other applicable laws;

(5) Withholding of permits, certificates or other forms of authorization pertaining to any land where there exists an uncorrected violation of this Title;

(6) Issuance of a stop work order;

(c) Penalties. Violation of any of the provisions of this Title shall upon conviction be punishable as a class C misdemeanor.

(d) Other remedies; remedies cumulative. The City shall have such other remedies as are and as may be from time to time provided by State law or City ordinance for the violation of any provision of this Title. Remedies shall be cumulative.

(e) At the time of issuance of a notice of violation, the Enforcement Authority will determine the appropriate level of sanction and will provide written notice to the responsible person of the proposed level of sanction and the reasons therefore as outlined herein.

(f) Where multiple violations have occurred or are occurring, each violation of the provisions of this Title or other applicable laws is subject to a separate sanction. The City may take into account the number and severity of violations in determining the type of action to take against the offending party.

81-6-030 Notice of Violation.

(a) When a violation is discovered, and the responsible permit holder has not been issued a previous Notice of Violation for the same violation within the past twelve (12) months, the Enforcement Authority shall issue a Notice of Violation in order to notify the responsible person of the violation and to order that the violation be corrected within fourteen (14) calendar days. The notice may include a stop work order that orders the responsible person to immediately cease all work on the project until the violation is corrected. The issuance of a Notice of Violation shall not be a prerequisite for the issuance of a stop work order by the City.

(b) The Notice of Violation shall be in writing and set forth the facts constituting the violation, the specific provisions of the law which have been violated, the proposed sanctions for the violation, and shall require that the City Engineer be contacted within five calendar days if the responsible person disputes the Notice of Violation.

(c) Failure to correct the violation within the amount of time specified in the Notice of Violation may result in issuance of a citation, a stop work order, a notice of intent to suspend or revoke, or other enforcement action as deemed appropriate by the City.

(d) In the case of a violation involving: continuing construction or development, an emergency situation (as reasonably determined by the City), or a violation for which a previous Notice of violation was issued within the past twelve (12) months, the City may use the enforcement powers and remedies available to it under this chapter without prior notice. In such case, notice shall be sent simultaneously with the beginning of enforcement action.

81-6-040 Suspension or Revocation of Land Disturbance Permit.

The City Engineer may suspend or revoke a land disturbance permit and/or suspend any land disturbance activity if:

- (a) Conditions at the site vary from those shown on the approved plans;
- (b) Construction does not conform to the approved plans, time schedules, or conditions of the land disturbance permit;
- (c) The work does not comply with applicable ordinances, rules, regulations and standards;
- (d) The site is left in a condition hazardous to the public or to the adjacent properties, and the land disturbance permit holder does not comply with reasonable requirements to correct said conditions;
- (e) The land disturbance permit holder does not comply with reasonable requirements to safeguard the workers, the public, or other persons acting in a lawful manner;
- (f) The land disturbance permit holder, in connection with the operations for which the land disturbance permit was issued, fails to operate equipment properly on public roads; allows material to encroach into, obstruct, or be deposited within a public road right-of-way or within a drainage channel in a manner not authorized by said land disturbance permit; or causes unauthorized obstruction or diversion of drainage channels;
- (g) The land disturbance permit holder fails to have a qualified, City-approved inspector working under the supervision of a civil engineer on the site during operations, when so required by the land disturbance permit, or fails to have the work under proper supervision;
- (h) Emergency conditions exist on the site, which constitute a threat to health, safety or public welfare, whether or not caused by the actions of the land disturbance permit holder; or
- (i) The land disturbance permit holder has been issued a Notice of Violation and has failed to correct the violation within the time specified.

81-6-050 Notice of Suspension or Revocation.

Prior to the suspension or revocation of a land disturbance permit, the City Engineer shall give the land disturbance permit holder written notice of intention to suspend or revoke the land disturbance permit, the notice shall specify the grounds for such intended action and the time and place for the holding of a conference between the City Engineer and the land disturbance permit holder, or its authorized representatives, to review the grounds for the proposed action. Notice of the proposed action shall be given to the land disturbance permit holder at least forty-eight (48)

hours, before the time set for the conference, if given by personal service, and at least ninety-six (96) hours, before the time set for the conference, if given by first-class mail. Weekends and holidays are not counted in determining the time for the giving of notice and the holding of the conference. With the consent of the land disturbance permit holder, the time periods provided for herein may be shortened or extended.

In the case of an emergency, and only where an unacceptable level of risk to public health, safety and welfare would incur from any delay, the notification deadlines may be disregarded and the City Engineer may act decisively to reduce or eliminate the hazard. In such a situation, the City Engineer will then make every reasonable effort to confer with the land disturbance permit holder in a timely manner to resolve the concerns, which resulted in the suspension. Costs, including additional City staff time and equipment, shall be borne by the land disturbance permit holder.

81-6-060 Cessation of Work.

Upon receipt of the notice of intended suspension or revocation, the land disturbance permit holder is to cease all work in connection with the land disturbance permit, with the exception of work necessary to correct any condition cited in the notice of proposed action as a ground for suspension or revocation, and work of an emergency nature. The time necessary for completion of these emergency corrections will be determined by the City Engineer.

81-6-070 Decision of Suspension or Revocation.

(a) Within twenty-four (24) hours following the conclusion of the conference, the City Engineer is to render a written decision, either revoking the land disturbance permit, suspending the land disturbance permit, or authorizing the land disturbance permit holder to proceed with the work. Such action may be with or without conditions. The decision is to be served upon the land disturbance permit holder by personal service or by first-class mail, postage prepaid, within twenty-four (24) hours after the rendition of the decision.

(b) If the land disturbance permit holder fails to correct the objectionable or emergency conditions causing the revocation or suspension, the City may cause the work necessary to correct said conditions to be done, and the City may take action against the land disturbance permit holder's security to cover the cost of performing the work.

(c) The City Engineer may either reinstate or revoke any land disturbance permit that has been suspended.

81-6-080 Right of Entry.

In the administration and enforcement of this Title, any duly authorized official or employee of the City shall have authority to enter upon the premises of the permitted site for the purposes of investigation and inspection; provided however, that such right of entry shall be exercised at reasonable times. No land disturbance permit holder shall refuse to allow such inspection. In the case where the responsible person is not a land disturbance permit holder, the Enforcement Authority is to provide twenty-four (24) hours written notice of the intent to inspect, except in emergency situations or when consent has been obtained of the owner and/or occupant of the site to be inspected. The notice shall state that the property owner has the right to refuse entry and that, in the event such entry is refused, inspection may be made only upon issuance of a search warrant as allowed by law.

81-6-090 Appeals.

Any person aggrieved of a final determination of the City Engineer in the issuance, denial, suspension or revocation of a land disturbance permit may appeal such decision of the City Engineer to the City Council by filing a written appeal with the City Recorder within thirty (30) days from the date of the City Engineer's decision. The City Council will give written notice to the City Engineer, the appellant, and all other persons requesting the same, specifying the place, date, and time of hearing the appeal.

81-6-100 Liability.

Neither issuance of grading approval under the provisions of this Title, nor compliance with the provisions this Title, or with any conditions imposed in a land disturbance permit issued under the provisions of this Title, is to relieve any person from responsibility for damage to any person or property or impose any liability upon the City for damage to any person or property.

81-6-110 Right to Stop Work.

Nothing herein is to be construed as indicating that the City cannot immediately stop the work being performed if, in the opinion of the City Engineer, the damage being done is of such a nature that it requires immediate cessation of the work. This could result in the bypassing of the normal processes of notices and increasing levels of enforcement, which will typically be followed.

Appendix D

Land Disturbance Ordinance

See latest copy of 89-4 Part 5 Hillside Development Overlay Zone on the City website.

Appendix E

Land Disturbance Ordinance

See latest copy of Title 90, Chapter 4, Storm Water Discharges and Storm Water Quality Management Ordinance (Future)

Appendix F

Land Disturbance Ordinance

THE CITY OF WEST JORDAN, UTAH

A Municipal Corporation

RESOLUTION NO. _____

A RESOLUTION OF THE CITY COUNCIL OF CITY OF WEST JORDAN ESTABLISHING REQUIREMENTS PERTAINING TO REVEGEGATION BONDS WHICH ARE REQUIRED IN CONNECTION WITH DEVELOPMENTS WITHIN THE CITY

Whereas, the City Council of the City of West Jordan has reviewed Title 81 - Land Disturbance Ordinance and the Land Disturbance Design and Construction Standards and now wishes to adopt a Revegetation Agreement and Bond to assist with the implementation of the ordinance and standards; and

Whereas, the City Council desires to establish requirements for the posting of revegetation bonds in connection with developments within the City; and

Whereas, the City Council has determined that in order to protect the public health, safety and welfare that revegetation bonds will be required in certain cases before land disturbance permits are issued within the City.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF WEST JORDAN, UTAH, THAT:

Section 1. Revegetation Bond Requirements. In cases where the City determines that revegetation, whether interim or permanent, is necessary, no land disturbance permit shall be issued by the City until a satisfactory revegetation bond estimate is prepared by the Developer for the intended improvements, is approved by the City Engineer, and is posted by the Developer with the City. The amount of the bond shall be posted to ensure that revegetation of disturbed areas will occur within twenty-one (21) calendar days after completion of final grading.

Following the completion of the initial revegetation, the City Engineer or designee shall inspect the work to be certain that installation is as per supplier and/or manufacturer recommendations i.e. seed rate based on Pure Live Seed (P.L.S.) and the seed protection is appropriate for slope length, soil type, vegetation used and weather conditions. Upon approval of the City Engineer, the bond amount may be reduced by 50% (the "Initial Reduction"). If the work is not approved, the Developer shall replant and/or reseed and/or stabilize any non stabilized areas which are designated by the City Engineer.

Twenty-four months following the Initial Reduction, the City shall inspect the disturbed areas to verify that growth has occurred and that any slopes and/or areas that have been disturbed are stabilized (i.e. lack of rill or gully erosion). Upon approval of the City, the remaining bond shall be reduced to equal ten-percent (10%) of the entire original bond amount (the "Second Reduction") which shall remain in force during the Warranty Period described below. If the work is not approved, the Developer shall replant and/or reseed and/or stabilize all areas within the initial area of disturbance and take all other actions reasonably necessary as directed by the City Engineer to provide erosion control and slope and/or area stabilization within the initial area of disturbance. In such case the Second Reduction shall be postponed until the City determines that the remedial work has stabilized the initial area of disturbance.

A twelve (12) month warranty period (the "Warranty Period") shall commence from the date of the Second Reduction. At the end of the Warranty Period, the City Engineer will make an inspection to determine whether or not the revegetation growth has taken hold and the disturbed

areas are established and stabilized i.e. lack of rill or gully erosion. The technical standards method of evaluating erosion will be utilized to make this determination. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations. Upon determining that the revegetation growth has taken hold and the disturbed areas are established and reasonably free from erosion, the City Engineer shall authorize the release of the remaining bond.

Section 2. Severability. If any section, part or provision of this Resolution is held invalid or unenforceable, such invalidity or unenforceability shall not affect any other portion of this Resolution, and all sections, parts and provisions of this Resolution shall be severable.

Section 3. Effective Date. This Resolution shall become effective immediately upon its passage.

Adopted by the City Council of West Jordan, Utah, this ____ day of _____, 2004.

CITY OF WEST JORDAN

ATTEST:

By: _____
Mayor Bryan D. Holladay

MELANIE BRIGGS
City Recorder

Voting by the City Council:

"AYE" "NAY"

Rob Bennett	_____	_____
Kathy Hilton	_____	_____
Mike Kellermeyer	_____	_____
Stuart Richardson	_____	_____
Kim V. Rolfe	_____	_____
Lyle C. Summers	_____	_____
Mayor Bryan D. Holladay	_____	_____

CITY RECORDER'S CERTIFICATE OF PUBLICATION

I, Melanie Briggs, certify that I am the City Recorder of the City of West Jordan, Utah, and that the foregoing Resolution was posted at the following locations on the ____ day of _____, 2004: West Jordan City Hall, 8000 South Redwood Road, West Jordan, Utah; West Jordan Library, 1970 West 7800 South, West Jordan, Utah and the Community Oriented Policing Substation, 7061 South 1700 West, West Jordan, Utah.

MELANIE BRIGGS
City Recorder

[SEAL]

REVEGETATION AGREEMENT
REDUCTION REQUEST

I. Developer Information Required

A. Project Name: _____
Project's Address: _____

B. Owner's Name: _____
Owner's Address: _____
Telephone Number: _____

C. Depository Institution: _____
Institutions Address: _____
Telephone Number: _____

D. The Revegetation Reduction Requested:

- ☐ Initial Reduction
- ☐ The Second Reduction
- ☐ Other (Attach description)
- ☐ Warranty Period begins (date): _____
- ☐ Warranty Period final Reduction

E. Total dollar amount of reduction \$ _____

F. Developers Certification:

The work described has been completed in accordance with the City of West Jordan Resolution No. 04-00, a resolution establishing requirements pertaining to revegetation bonds which are required in connection with developments within the City. It is understood and agreed that a final 10% of the entire original bond amount will not be released until an 24-month warranty has passed and the revegetation has been approved and accepted by the City.

Date: _____

Developer's Signature

Revegetation Bond Inspection

II Observation of Revegetation

A. Description of Revegetation requested

- Initial Reduction
- The Second Reduction
- Other Reduction
- Warranty Period

B. Approval or Reduction of the Reduction (attach description of rejection)

- 9 Initial Reduction
- 9 The Second Reduction
- 9 Other Reductions
- 9 Warranty Period

C. Dollar amount of reduction recommended \$ _____

D. Revegetation Reduction Certification

All work associated with the indicated reduction appears to / does not meet the criteria set forth in Resolution No. 04-00, a resolution establishing requirements pertaining to revegetation bonds which are required in connection with developments within the City. The reasons why this request does not meet the criteria is attached.

Date: _____

City Engineer

Revegetation Bond Inspection

Project: _____

Type of Reduction Requested and Date: _____

III. Accounting Review

1. Remaining Revegetation Bond amount:

Original bond amount: _____

Previous Reductions:

Initial Reduction: _____

The Second Reduction: _____

Other Reductions: _____

Warranty Period Reduction: _____

Recommended Reduction: _____

Balances Remaining after Release _____

REVEGETATION AGREEMENT

(Escrow Deposit Form)

THIS AGREEMENT is made and entered into by and between City of West Jordan, a Utah municipal corporation, hereinafter referred to as the "City" and _____, a Utah _____ company, hereinafter referred to as "Developer" and _____, a Utah or federally chartered bank or savings and loan association authorized to do business in the State of Utah, whose address is _____, (hereafter "Bank").

WHEREAS, Developer owns property located within the City, which property is more particularly described in Exhibit "A", and referred to herein as the "Property"; and

WHEREAS, Developer desires to obtain a land disturbance permit from the City in order to regrade the Property which grading will result in removal and/or disturbance of existing vegetation and drainage patterns; and

WHEREAS, in order to obtain a land disturbance permit, Developer is required to revegetate and stabilize all disturbed areas, to implement appropriate erosion control measures and to post a satisfactory bond ensuring the installation and warranty of such revegetation, stabilization and erosion control measures; and

WHEREAS, the City will not grant the land disturbance permit until Developer promises to provide and warrant the required revegetation and stabilization of the disturbed areas and the erosion control measures in accordance with the terms and conditions of this Agreement and to provide a satisfactory guarantee securing the same.

NOW, THEREFORE, in consideration of the mutual promises contained herein, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereby agree as follows:

1. **Revegetation and Stabilization.** Developer hereby agrees to revegetate or cause to be revegetated the disturbed slopes and/or areas located within _____ of the Project in conjunction with the construction of _____ utilizing native materials and to provide erosion control and slope and/or area stabilization for all such disturbed areas (the "Disturbed Areas"). Developer agrees to maintain, repair, reseed, and replant all revegetation, stabilization and erosion control measures for the Disturbed Areas as required and approved by the City Engineer.
2. **Escrow Account** – As an independent guarantee to City, for the purpose of insuring Developer's performance of its obligations as set forth herein, Developer hereby assigns and sets over to CITY all rights, title, and interest in the principle of that certain Escrow Account held by Bank in the amount of \$ _____ (herein the "Proceeds") entitled, (insert amount) _____, (hereinafter "Account"). (insert name and account number of Escrow Account)
3. **Initial Inspection and Reduction.** After Developer has completed the initial revegetation and the City has inspected and approved such initial revegetation the City may reduce the guarantee by

50-percent ("Initial Reduction"). Such reduction shall be approved by the City Manager in writing. The City Manager shall not approve the reduction unless the installation is in compliance with supplier and/or manufacturer recommendations i.e. the seed rate based on Pure Live Seed (P.L.S.) and the seed protection being appropriate for slope length, soil type, vegetation used and weather conditions.

4. Second Inspection. Twenty-four (24) months following the Initial Reduction, the City shall inspect the Disturbed Areas to verify that growth has occurred and that any slopes and/or areas that have been disturbed are stabilized; i.e. lack of rill or gully erosion (the "Second Inspection"). The Developer shall replant, reseed and stabilize all non-stabilized areas within the Disturbed Areas during the aforesaid twenty-four month period and take all other actions necessary to provide erosion control and slope and/or area stabilization within the Disturbed Areas. The technical standards method of evaluating erosion will be utilized for inspection. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations.
5. Second Reduction. If the City approves the revegetation, stabilization and erosion control measures installed and maintained by the Developer based upon the Second Inspection, the guarantee may be reduced to an amount equal to ten percent (10%) of the amount (the "Second Reduction"). Such reduction shall be approved by the City Manager in writing. The ten percent (10%) retained amount shall remain in force during the Warranty Period described herein. If the City does not approve the revegetation, stabilization and erosion control measures installed and maintained by the Developer, Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas as required. If any areas need to be replanted, reseeded or stabilized, the City may retain a portion of the guarantee to insure such work is done or may make written demand for remittance of the Proceeds to the City as provided herein.
6. Warranty Period. After approval of the revegetation, stabilization and erosion control measures and the Second Reduction, a twelve (12) month warranty period ("Warranty Period") shall commence from the date of the Second Reduction. The Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas during the Warranty Period and take all other actions necessary to provide erosion control and slope and/or area stabilization within the Disturbed Areas.
7. Warranty Inspection. At the end of the Warranty Period, the City shall inspect the Disturbed Areas to verify that revegetation growth has taken hold and that the Disturbed Areas are established and stabilized; i.e. lack of rill or gully erosion. The technical standards method of evaluating erosion will be utilized for inspection. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations.
8. Final Reduction. If the City determines that the revegetation growth has taken hold and the Disturbed Areas are established and reasonably free from erosion at the end of the Warranty Period, the remaining portion of the Proceeds may be released to Developer. Final release shall be evidenced by a Resolution of the City council. If the City does not approve the revegetation,

stabilization and erosion control measures installed and maintained by the Developer at the end of the Warranty Period, Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas as required. If any areas need to be replanted, reseeded or stabilized the City may retain a portion of the guarantee to insure such work is done or may make written demand for remittance of the Proceeds to the city as provided herein.

9. Demand for and Use of Proceeds. In the event the City determines Developer is in default under the terms of this Agreement, Bank shall withdraw upon the City's written demand, remit Proceeds to the City. The City may expend the proceeds to complete or repair revegetation, stabilization, erosion control measures or warranty repairs and corrections to be installed, completed, replanted, reseeded or stabilized using the funds received from the Escrow Deposit. Prior to mailing demand on the guarantee, the City shall notify Developer of the default and demand performance hereunder. If Developer has not cured its default within the Notice Period, or in the case of a default that cannot reasonably be cured within the Notice Period, if Developer has not diligently commenced to cure such default within the Notice Period and thereafter diligently pursued the cure of said default, the City shall have the right to make demand on the guarantee and may cause the required revegetation, stabilization and/or erosion control measures to be installed, completed or repaired using such funds and/or to make warranty repairs and corrections. The Notice Period shall be ten (10) days or if the City reasonably determines that human safety will be threatened or irreparable property damage will occur than such shorter period of time as the City may reasonably specify in its notice of default.
10. Non-Release of Developer's Obligations. It is understood and agreed between the parties that the establishment and availability to the City of the guarantee as herein provided and any withdrawals from the Escrow Deposit by the City shall not constitute a waiver by or estoppel against the City and shall not release or relieve the Developer from Developer's obligation to install and fully pay for the revegetation, stabilization and erosion control measures as required herein, and the right of the City to make demand for and to use Proceeds shall not affect any rights and remedies of the City against the Developer for breach of any covenant herein, including the covenants of paragraph 1 of this Agreement. Further, the Developer agrees that if the City uses Proceeds to perform or cause to be performed all or any portion of the work and installation of revegetation, stabilization and erosion control measures required of the Developer hereunder, then any and all costs incurred by the City in so doing which exceed the Proceeds collected by the City shall be paid by the Developer to the City, including administrative, engineering, legal, labor and materials, and other procurement fees and costs.
11. Notices. Any notice required or desired to be given hereunder shall be deemed sufficient if delivered personally or sent by certified mail, postage prepaid, return receipt requested, addressed to the respective parties at their last known addresses.
12. Severability. Should any portion of this Agreement for any reason be declared invalid or unenforceable, the invalidity or unenforceability of such portion shall not affect the validity of any of the remaining portions and the same shall be deemed in full force and effect as if this Agreement had been executed with the invalid portions eliminated.
13. Governing Law. This Agreement and the performance hereunder shall be governed by the laws of the State of Utah.

14. Binding Effect. This Agreement shall inure to the benefit of, and be binding upon, the parties hereto, their respective officers, agents, representatives, successors and assigns.

15. Default. The parties herein each agree that should they default in any of the covenants or agreements contained herein, the defaulting party shall pay all costs and expenses, including a reasonable attorneys fee which may arise or accrue from enforcing this Agreement, or in pursuing any remedy provided hereunder or by the statutes or other laws of the State of Utah, whether such remedy is pursued by filing suit or otherwise, and whether such costs and expenses are incurred with or without suit or before or after judgment.

16. Amendment. Any amendment or modification of this Agreement shall be made in writing signed by the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement by and through their respective duly authorized representatives as of the ____ day of _____, 20__.

DEVELOPER

DEPOSITORY

By: _____

By: _____

Its: _____

Its: _____

CITY OF WEST JORDAN

ATTEST:

Mayor Bryan Holladay

Melanie S. Briggs, City Recorder

APPLICANT NOTARY

(Complete only if APPLICANT is an INDIVIDUAL.)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, the signer(s) of the foregoing instrument who duly acknowledged
to that he/she/they executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(complete only if APPLICANT is a PARTNERSHIP)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, who being by me duly sworn did say that he/she are the
_____, of _____, a partnership,
and that the foregoing instrument was duly signed by the partnership at a lawful meeting held or by
authority of its bylaws and signed in behalf of said partnership.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(Complete only if APPLICANT is a CORPORATION)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____, who being by me duly sworn did say that he/she is the _____, of _____ Corporation, and that the foregoing instrument was signed in behalf of said corporation by authority of its Board of Directors, and he/she acknowledged to me that said corporation executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(Complete only if APPLICANT is a LIMITED LIABILITY COMPANY.)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____, who being by me duly sworn did say that he/she/they is/are the _____ of _____, by authority of its members or its articles of organization, and he/she/they acknowledged to that said limited liability company executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

DEPOSITORY NOTARY

STATE OF _____)

:SS

COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me,
_____, who being by me duly sworn did say that he/she is
the _____ of _____, a
_____ corporation, and that the foregoing instrument was
signed in behalf of said corporation by authority of its Board of Directors, and he/she acknowledged to
me that said corporation executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

Exhibit “A”

Property Description

REVEGETATION AGREEMENT

(Letter of Credit Form)

THIS AGREEMENT is made and entered into by and between City of West Jordan, a Utah municipal corporation, hereinafter referred to as the "City" and _____, a Utah _____, hereinafter referred to as "Developer".

WHEREAS, Developer owns property located within the City, which property is more particularly described in Exhibit "A", and referred to herein as the "Property"; and

WHEREAS, Developer desires to obtain a land disturbance permit from the City in order to regrade the Property which grading will result in removal and/or disturbance of existing vegetation and drainage patterns; and

WHEREAS, in order to obtain a land disturbance permit, Developer is required to revegetate and stabilize all disturbed areas, to implement appropriate erosion control measures and to post a satisfactory bond ensuring the installation and warranty of such revegetation, stabilization and erosion control measures; and

WHEREAS, the City will not grant the land disturbance permit until Developer promises to provide and warrant the required revegetation and stabilization of the disturbed areas and the erosion control measures in accordance with the terms and conditions of this Agreement and to provide a satisfactory Letter of Credit securing the same.

NOW, THEREFORE, in consideration of the mutual promises contained herein, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereby agree as follows:

1. Revegetation and Stabilization. Developer hereby agrees to revegetate or cause to be revegetated the disturbed slopes and/or areas located within _____ of the Project in conjunction with the construction of _____ utilizing native materials and to provide erosion control and slope and/or area stabilization for all such disturbed areas (the "Disturbed Areas"). Developer agrees to maintain, repair, reseed, and replant all revegetation, stabilization and erosion control measures for the Disturbed Areas as required and approved by the City Engineer.
2. Letter of Credit. Developer hereby files, as an independent guarantee with City for the purpose of insuring Developer's performance of its obligations as set forth here, an Irrevocable Letter of Credit, (herein the "Letter of Credit"), numbered _____, issued by _____, a(n) _____ Corporation,
(Issuer) (State)
located at _____; _____;
(Issuer Address) (Issuer telephone)
_____, in the amount of, \$ _____, (herein
(Issuer facsimile)
the Proceeds").

The Letter of Credit is issued in favor of CITY to the account of _____, Developer herein, and is made a part of this Agreement and attached hereto as Exhibit "B". Developer shall ensure that the Letter of Credit shall contain the following provisions:

It is a condition of this Letter of Credit that is shall be deemed automatically extended without amendment for one (1) year from the present or any future expiration date unless at least thirty (30) days prior to such expiration date CITY is notified by registered letter, return receipt requested, or overnight courier service that Issuer elects not to consider the Letter of Credit renewed for any such period.

3. Initial Inspection and Reduction. After Developer has completed the initial revegetation and the City has inspected and approved such initial revegetation, the City may reduce the guarantee by 50-percent ("Initial Reduction") such reduction shall be approved in writing by the City Manager. The city Manager shall not approve the reduction unless instillations is in compliance with supplier and/or manufacturer recommendations; i.e. the seed rate based on Pure Live Seed (P.L.S.) and the seed protection being appropriate for slope length, soil type, vegetation used and weather conditions.
4. Second Inspection. Twenty-four (24) months following the date of the Initial Reduction, the City shall inspect the Disturbed Areas to verify that growth has occurred and that any slopes and/or areas that have been disturbed are stabilized; i.e. lack of rill or gully erosion (the "Second Inspection"). The Developer shall replant, reseed and stabilize all non-stabilized areas within the Disturbed Areas during the aforesaid twenty-four month period and take all other actions necessary to provide erosion control and slope and/or area stabilization within the Disturbed Areas. The technical standards method of evaluating erosion will be utilized for inspection. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations.
5. Second Reduction. If the City approves the revegetation, stabilization and erosion control measures installed and maintained by the Developer based upon the Second Inspection, the guarantee may be reduced to an amount equal to ten percent (10%) of the original amount (the "Second Reduction"), such reduction shall be approved in writing by the City Manager. The 10 percent (10%) retained amount shall remain in force during the Warranty Period described herein. If the City does not approve the revegetation, stabilization and erosion control measures installed and maintained by the Developer, Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas as required. If any areas need to be replanted, reseeded or stabilized, the City may retain a portion of the guarantee to insure such work is done or may written demand for remittance of the Proceeds to the City as provided herein.
6. Warranty Period. After approval of the revegetation, stabilization and erosion control measures and Second Reduction, a twelve (12) month warranty period ("Warranty Period") shall commence from the date of the Second Reduction. The Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas during the Warranty Period and take all other actions necessary to provide erosion control and slope and/or area stabilization within the Disturbed Areas.

7. Warranty Inspection. At the end of the Warranty Period, the City shall inspect the Disturbed Areas to verify that revegetation growth has taken hold and that the Disturbed Areas are established and stabilized; i.e. lack of rill or gully erosion. The technical standards method of evaluating erosion will be utilized for inspection. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations.
8. Final Release. If the City determines that the revegetation growth has taken hold and the Disturbed Areas are established and reasonably free from erosion at the end of the Warranty Period, the remaining portion of the Proceeds may be released to Developer. Final release shall be evidenced by a Resolution of the City Council. If the City does not approve the revegetation, stabilization and erosion control measures installed and maintained by the Developer at the end of the Warranty Period, Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas as required. If any areas need to be replanted, reseeded or stabilized the City may retain a portion of the guarantee to insure such work is done or may make written demand for remittance of the Proceeds to the City.
9. Demand for the Use of Proceeds. In the event the City determines Developer is in default under the terms of this Agreement, the City may demand the Proceeds of the Letter of Credit. The City may expend the Proceeds to complete or repair revegetation, stabilization, erosion control measures or warranty repairs and corrections to be installed, completed, replanted, reseeded or stabilized using the funds received from the Letter of Credit. Prior to making demand on the guarantee, the City shall notify Developer of the default and demand performance hereunder. If Developer has not cured its default within the Notice Period, or in the case of a default that cannot reasonably be cured within the Notice Period of said notice, if Developer has not diligently commenced to cure such default within the Notice Period and thereafter diligently pursued the cure of said default, the City shall have the right to make demand on the guarantee and may cause the required revegetation, stabilization and/or erosion control measures to be installed, completed or repaired using such funds and/or to make warranty repairs and corrections. The Notice Period shall be ten (10) days or, if the city reasonably determines that human safety will be threatened or irreparable property damage will occur, then such shorter period of time as the City may reasonably specify in its notice of default.
10. Non-Release of Developer's Obligations. It is understood and agreed between the parties that the establishment and availability to the City of the guarantee as herein provided and any release or demand on the guarantee by the City shall not constitute a waiver by or estoppel against the City and shall not release or relieve the Developer from Developer's obligation to install and fully pay for the revegetation, stabilization and erosion control measures as required herein, and the right of the City to demand and use Proceeds shall not affect any rights and remedies of the City against the Developer for breach of any covenant herein, including the covenants of paragraph 1 of this Agreement. Further, the Developer agrees that if the City uses Proceeds to perform or cause to be performed all or any portion of the work and installation of revegetation, stabilization and erosion control measures required of the Developer hereunder, then any and all costs incurred by the City in so doing which exceed the Proceeds collected by the City shall be paid by the Developer to the City, including administrative, engineering, legal, labor and materials, and other procurement fees and costs.

11. Notices. Any notice required or desired to be given hereunder shall be deemed sufficient if delivered personally or sent by certified mail, postage prepaid, return receipt requested, addressed to the respective parties at their last known addresses.
12. Severability. Should any portion of this Agreement for any reason be declared invalid or unenforceable, the invalidity or unenforceability of such portion shall not affect the validity of any of the remaining portions and the same shall be deemed in full force and effect as if this Agreement had been executed with the invalid portions eliminated.
13. Governing Law. This Agreement and the performance hereunder shall be governed by the laws of the State of Utah.
14. Binding Effect. This Agreement shall inure to the benefit of, and be binding upon, the parties hereto, their respective officers, agents, representatives, successors and assigns.
15. Default. The parties herein each agree that should they default in any of the covenants or agreements contained herein, the defaulting party shall pay all costs and expenses, including a reasonable attorneys fee which may arise or accrue from enforcing this Agreement, or in pursuing any remedy provided hereunder or by the statutes or other laws of the State of Utah, whether such remedy is pursued by filing suit or otherwise, and whether such costs and expenses are incurred with or without suit or before or after judgment.
16. Amendment. Any amendment or modification of this Agreement shall be made in writing signed by the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement by and through their respective duly authorized representatives as of the ____ day of _____, 20__.

DEVELOPER

DEPOSITORY

By: _____

By: _____

Its: _____

Its: _____

CITY OF WEST JORDAN

ATTEST:

Mayor Bryan Holladay

Melanie S. Briggs, City Recorder

APPLICANT NOTARY

(Complete only if APPLICANT is an INDIVIDUAL.)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, the signer(s) of the foregoing instrument who duly acknowledged
to that he/she/they executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(complete only if APPLICANT is a PARTNERSHIP)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, who being by me duly sworn did say that he/she are the
_____, of _____, a partnership,
and that the foregoing instrument was duly signed by the partnership at a lawful meeting held or by
aughority of its bylaws and signed in behalf of said partnership.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(Complete only if APPLICANT is a CORPORATION)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, who being by me duly sworn did say that he/she is the
_____, of _____ Corporation, and that the
foregoing instrument was signed in behalf of said corporation by authority of its Board of Directors, and
he/she acknowledged to me that said corporation executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(Complete only if APPLICANT is a LIMITED LIABILITY COMPANY.)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, who being by me duly sworn did say that he/she/they is/are the
_____ of _____, by
authority of its members or its articles of organization, and he/she/they acknowledged to that said limited
liability company executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

Exhibit “A”

Property Description

REVEGETATION AGREEMENT

(Surety Form)

THIS AGREEMENT is made and entered into by and between City of West Jordan, a Utah municipal corporation, hereinafter referred to as the "City" and _____, a Utah _____ company, hereinafter referred to as "Developer" and _____, a corporation authorized to do business in the State of Utah, whose address is _____, (hereafter "Surety").

WHEREAS, Developer owns property located within the City, which property is more particularly described in Exhibit "A", and referred to herein as the "Property"; and

WHEREAS, Developer desires to obtain a land disturbance permit from the City in order to regrade the Property, which will result in removal and/or disturbance of existing vegetation and drainage patterns; and

WHEREAS, in order to obtain a land disturbance permit, Developer is required to revegetate and stabilize all disturbed areas, to implement appropriate erosion control measures and to post a satisfactory bond ensuring the installation and warranty of such revegetation, stabilization and erosion control measures; and

WHEREAS, the City will not grant the land disturbance permit until Developer promises to provide and warrant the required revegetation and stabilization of the disturbed areas and the erosion control measures in accordance with the terms and conditions of this Agreement and to provide a satisfactory guarantee securing the same.

NOW, THEREFORE, in consideration of the mutual promises contained herein, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereby agree as follows:

1. Revegetation and Stabilization. Developer hereby agrees to revegetate or cause to be revegetated the disturbed slopes and/or areas located within _____ of the Property in conjunction with the construction of _____ utilizing native materials and to provide erosion control and slope and/or area stabilization for all such disturbed areas (the "Disturbed Areas"). Developer agrees to maintain, repair, reseed, and replant all revegetation, stabilization and erosion control measures for the Disturbed Areas as required and approved by the City Engineer.
2. Surety Bond.
 - a. Amount. Developer shall execute and deliver to the City a Surety Bond in the amount of _____ dollars and no/100ths (\$ _____) to secure Developer's obligations as set forth herein.
 - b. Extent of Surety Liability: Independent Obligation. Surety hereby acknowledges that it is aware of, understands, and agrees to each provision of this Agreement. Except as otherwise provided by law or by this Agreement, the extent of Surety's obligation to guarantee

Developer's performance under this Agreement shall be limited to the Proceeds of this surety bond. This paragraph shall not limit the right of City to pursue any and all remedies it may have in equity or at law as a result of Surety's failure to perform under this Agreement. Surety expressly acknowledges that its obligation under this Agreement is independent of any obligation of City either expressed or implied. Surety agrees that its performance is not and shall not be conditioned upon the commencement of actual construction work in the subdivision or development, or upon the sale of any lots or any part of the subdivision or development. Surety further acknowledges:

- (1) That its obligation to perform under this Agreement is independent of any other remedy available to City to secure proper completion of the Improvements.
- (2) That Surety may not assert as a defense that City has remedies against other persons or entities or has other remedies in equity or at law that would otherwise relieve Surety of its duty to perform as outlined in this Agreement, or preclude City from requiring Surety's performance under this Agreement; and
- (3) That Surety may not assert as a defense that City has remedies against other entities or has other remedies in equity or at law that would otherwise relieve Developer of its duty to perform as outlined in this Agreement, or preclude City from requiring Applicant's performance under this Agreement.

In recognition whereof, Surety agrees to its obligations and commitment in this bond agreement by having a duly authorized representative execute this agreement, with such authorization being evidenced by a power of attorney attached hereto as Exhibit "B", and incorporated by this reference.

3. Initial Inspection and Reduction. After Developer has completed the initial revegetation and the City has inspected and approved such initial revegetation, the City may reduce the guarantee by 50-percent ("Initial Reduction"). Such reduction shall be approved by the City Manager in writing. The City Manager shall not approve the reduction unless the installation is in compliance with supplier and/or manufacturer recommendations; i.e. the seed rate based on Pure Live Seed (P.L.S.) and the seed protection being appropriate for slope length, soil type, vegetation used, and weather conditions.
4. Second Inspection. Twenty-four (24) months following the Initial Reduction, the City shall inspect the Disturbed Areas to verify that growth has occurred and that any slopes and/or areas that have been disturbed are stabilized; i.e. lack of rill or gully erosion (the "Second Inspection"). The Developer shall replant, reseed and stabilize all non-stabilized areas within the Disturbed Areas during the aforesaid twenty-four month period and take all other actions necessary to provide erosion control and slope and/or area stabilization within the Disturbed Areas. The technical standards method of evaluating erosion will be utilized for inspection. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations.
5. Second Reduction. If the City approves the revegetation, stabilization and erosion control measures installed and maintained by the Developer based upon the Second Inspection, the

guarantee may be reduced to an amount equal to ten percent (10%) of the amount (The “Second Reduction”). Such reduction shall be approved by the City Manager in writing. The ten percent (10%) retained amount shall remain in force during the Warranty Period described herein. If the City does not approve the revegetation, stabilization and erosion control measures installed and maintained by the Developer, Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas as required. If any areas need to be replanted, reseeded or stabilized, the City may retain a portion of the guarantee to insure such work is done or may make written demand for remittance of the Proceeds to the City as provided herein.

6. Warranty Period. After approval of the revegetation, stabilization and erosion control measures and the Second Reduction, a twelve (12) month warranty period (“Warranty Period”) shall commence from the date of the Second Reduction. The Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas during the Warranty Period and take all other actions necessary to provide erosion control and slope and/or area stabilization within the Disturbed Areas.
7. Warranty Inspection. At the end of the Warranty Period, the City shall inspect the Disturbed Areas to verify that revegetation growth has taken hold and that the Disturbed Areas are established and stabilized; i.e. lack of rill or gully erosion. The technical standards method of evaluating erosion will be utilized for inspection. This method of evaluating erosion consists of comparing plant production, soil cover, and erosion on the revegetated areas with an adjacent undisturbed site. Either the quadrant frame method or step transect method may be employed to measure the comparison. Either method shall be performed at several randomly selected locations.
8. Final Release. If the City determines that the revegetation growth has taken hold and the Disturbed Areas are established and reasonably free from erosion at the end of the Warranty Period, the remaining portion of the Proceeds may be released to Developer. Final release shall be evidenced by a Resolution of the City Council. If the City does not approve the revegetation, stabilization and erosion control measures installed and maintained by the Developer at the end of the Warranty Period, Developer shall replant, reseed and stabilize all non-stabilized areas of the Disturbed Areas as required. If any areas need to be replanted, reseeded or stabilized the City may retain a portion of the guarantee to insure such work is done or may make written demand for remittance of the Proceeds to the City as provided herein.
9. Demand for and Use of Proceeds. In the event the City determines Developer is in default under the terms of this Agreement, City may make demand upon the Surety Bond. The City may expend the Proceeds to complete or repair revegetation, stabilization, erosion control measures or warranty repairs and corrections to be installed, completed, replanted, reseeded or stabilized. Prior to mailing demand on the guarantee, the City shall notify Developer of the default and demand performance hereunder. If Developer has not cured its default within the Notice Period, or in the case of a default that cannot reasonably be cured within the Notice Period, if Developer has not diligently commenced to cure such default within the Notice Period and thereafter diligently pursued the cure of said default, the City shall have the right to make demand on the guarantee and may cause the required revegetation, stabilization and/or erosion control measures to be installed, completed or repaired using such funds and/or to make warranty repairs and corrections. The Notice Period shall be ten (10) days or if the City reasonably determines that human safety will be threatened or irreparable property damage will occur, then such shorter period of time as the City may reasonably specify in its notice of default.

10. Non-Release of Developer's Obligations. It is understood and agreed between the parties that the establishment and availability to the City of the guarantee as herein provided and any withdrawals from the Escrow Deposit by the City shall not constitute a waiver by or estoppel against the City and shall not release or relieve the Developer from Developer's obligation to install and fully pay for the revegetation, stabilization and erosion control measures as required herein, and the right of the City to make demand for and to use Proceeds shall not affect any rights and remedies of the City against the Developer for breach of any covenant herein, including the covenants of paragraph 1 of this Agreement. Further, the Developer agrees that if the City uses Proceeds to perform or cause to be performed all or any portion of the work and installation of revegetation, stabilization and erosion control measures required of the Developer hereunder, then any and all costs incurred by the City in so doing which exceed the Proceeds collected by the City shall be paid by the Developer to the City, including administrative, engineering, legal, labor and materials, and other procurement fees and costs.
11. Notices. Any notice required or desired to be given hereunder shall be deemed sufficient if delivered personally or sent by certified mail, postage prepaid, return receipt requested, addressed to the respective parties at their last known addresses.
12. Severability. Should any portion of this Agreement for any reason be declared invalid or unenforceable, the invalidity or unenforceability of such portion shall not affect the validity of any of the remaining portions and the same shall be deemed in full force and effect as if this Agreement had been executed with the invalid portions eliminated.
13. Governing Law. This Agreement and the performance hereunder shall be governed by the laws of the State of Utah.
14. Binding Effect. This Agreement shall inure to the benefit of, and be binding upon, the parties hereto, their respective officers, agents, representatives, successors and assigns.
15. Default. The parties herein each agree that should they default in any of the covenants or agreements contained herein, the defaulting party shall pay all costs and expenses, including a reasonable attorneys fee which may arise or accrue from enforcing this Agreement, or in pursuing any remedy provided hereunder or by the statutes or other laws of the State of Utah, whether such remedy is pursued by filing suit or otherwise, and whether such costs and expenses are incurred with or without suit or before or after judgment.
16. Amendment. Any amendment or modification of this Agreement shall be made in writing signed by the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement by and through their respective duly authorized representatives as of the ____ day of _____, 20 ____.

DEVELOPER

DEPOSITORY

By: _____

By: _____

Its: _____

Its: _____

CITY OF WEST JORDAN

ATTEST:

Mayor Bryan Holladay

Melanie S. Briggs, City Recorder

APPLICANT NOTARY

(Complete only if APPLICANT is an INDIVIDUAL.)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, the signer(s) of the foregoing instrument who duly acknowledged
to that he/she/they executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(complete only if APPLICANT is a PARTNERSHIP)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____
_____, who being by me duly sworn did say that he/she are the
_____, of _____, a partnership,
and that the foregoing instrument was duly signed by the partnership at a lawful meeting held or by
authority of its bylaws and signed in behalf of said partnership.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(Complete only if APPLICANT is a CORPORATION)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____, who being by me duly sworn did say that he/she is the _____, of _____ Corporation, and that the foregoing instrument was signed in behalf of said corporation by authority of its Board of Directors, and he/she acknowledged to me that said corporation executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

(Complete only if APPLICANT is a LIMITED LIABILITY COMPANY.)

STATE OF _____)

:SS

COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me, _____, who being by me duly sworn did say that he/she/they is/are the _____ of _____, by authority of its members or its articles of organization, and he/she/they acknowledged to that said limited liability company executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

DEPOSITORY NOTARY

STATE OF _____)

:SS

COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me,
_____, who being by me duly sworn did say that he/she is
the _____ of _____, a
_____ corporation, and that the foregoing instrument was
signed in behalf of said corporation by authority of its Board of Directors, and he/she acknowledged to
me that said corporation executed the same.

NOTARY PUBLIC

My Commission Expires:

Residing in _____ County, _____

Exhibit “A”

Property Description

Appendix G

Land Disturbance Ordinance

See latest copy of Storm Water Management Plan submitted to the State of Utah Department of Environmental Quality, Division of Water Quality

COPY

CITY OF WEST JORDAN
STORM WATER MANAGEMENT PLAN

Submitted to:

State of Utah
Department of Environmental Quality
Division of Water Quality

Submitted by:

City of West Jordan Engineering Division
8000 South Redwood Road
West Jordan, Utah 84088

August 14, 1993

CITY OF WEST JORDAN STORM WATER MANAGEMENT PLAN

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GLOSSARY

BMP	Best Management Practices
City	City of West Jordan
ECP	Erosion Control Plan
NPDES	National Pollutant Discharge Elimination System
RFP	Request for Proposal
SLVHD	Salt Lake Valley Health Department
SLAHM	Solid, Liquid, and Airborne Hazardous Materials
COUNTY	Salt Lake County
SWMO	Storm Water Management Ordinance
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
UAC	Utah Administrative Code
UDOT	Utah Department of Transportation
UPDES	Utah Pollutant Discharge Elimination System

CITY OF WEST JORDAN STORM WATER MANAGEMENT PLAN

INTRODUCTION

PURPOSE

This City of West Jordan Storm Water Management Plan (SWMP) will be implemented to limit, to the maximum extent practicable, the discharge of pollutants from the City's storm water drainage systems into "Waters of the State", including natural streams, creeks, rivers, lakes, ponds, and wetlands, also including man-made irrigation canals. The development and implementation of the SWMP is to fulfill requirements, as Co-permittee with Salt Lake County under its State of Utah UPDES Permit No. UTS000001, "Authorization To Discharge Municipal Storm Water", Section II, in accordance with Section 402(p)(3)(B) of the Federal Clean Water Act, and the Utah Administrative Code (UAC) R317-8-3.9).

SWMP COORDINATION

Agency: City of West Jordan, Engineering Division

Contact: Mr. James "Woody" Woodruff, P.E., City Engineer,
Phone: (801)569-5072
Mr. Gerald B. Robinson, Jr., P.E., P.G., City Senior Staff Engineer,
Phone: (801)569-5073

The Salt Lake County (the "County"), as Co-Permittee with the City of West Jordan (the "City"), has submitted a separate SWMP to describe the SLCo's portion of the SWMP within the City. In addition, the Utah Department of Transportation (UDOT), also a Co-permittee in the County's permit, will submit a separate SWMP for its contribution of storm water into the City's system.

SWMP REVIEW AND MODIFICATION

This Storm Water Management Plan (SWMP) by the City, dated January 2004, is the first submittal by the City to acquire a General Permit to discharge storm water. It has been prepared to include the most recent Best Management Practices (BMPs), emphasizing on those pertaining to the "Construction Site Storm Water Runoff Control", "Post-Construction Site, In-perpetuity, Storm Water Runoff Control", and "Industrial and High Risk Runoff". The SWMP will be reviewed by the City on an annual basis, and all accumulated data, conclusions, recommendations for change or modification of the Plan found in that review will be described and submitted to the County for inclusion in its Annual Report to the Utah State Division of Water Quality on July 1 of each new Fiscal Year.

STAFFING AND RESOURCE ALLOCATIONS

Implementation of the Storm Water Management Plan including management and operations staffing and programs will be funded by City primarily general taxes, permit and user fees.

EXISTING CITY PROGRAMS

The City already has historically enforced certain BMPs through Engineering construction project design review. These "Policies" have helped to reduce pollutants from entering the storm water runoff systems.

Existing programs, aimed at reducing contaminants and pollutants from entering the City's storm water, began in January 2002. The City had already implemented the Policy that all properties being constructed for new Commercial or Industrial purposes within the City must provide detainment of storm water on-site of the project, in volume sufficient for the 100-year frequency, 24-hour duration storm. In addition, a requirement had been implemented to restrict the rate of discharge of storm water from the site to 0.2 cubic feet per second (cfs), per acre of property. Implementation of these two requirements has been effective in retainment of sediment loads from the storm water discharge onsite. These policies have also provided temporary storage for the storm water volume directly, thus allowing reduction or "throttling down" of the rate of storm water discharge from the property. This reduction from all properties having such facilities, in turn, has guarded against water discharge overloading of the City's storm drain system at any single location and at any single point in time.

And, as an additional policy adopted January, 2002, Commercial or Industrial facilities discharging storm water from all new construction sites must be equipped with a pre-approved water/oil and grease separators, before the storm water can be discharged into the City storm drain systems or receivable waters.

Also, in early 2002, the City adopted the Policy that the storm water BMPs being required on Commercial and Industrial properties be implemented as well on Residential Subdivisions, Multiple-Family Subdivisions, and Condominium Subdivisions, at or greater than one acre.

Recognizing that storm water provisions required today for new development projects cannot be effectively applied to existing built properties, new construction regulations will apply to replacement/redevelopment projects.

CITY OF WEST JORDAN STORM WATER MANAGEMENT ORDINANCE

In order to fully comply with the NPDES storm water requirements, the City is in the process of adopting a Storm Water Management Ordinance".

Year	Implementation	Assessment
2003	Draft new City Storm Water Management Ordinance. <u>City pledge:</u> have representative from Engineering Division and from City's Attorney office complete first draft by March 31.	Completed first draft of Ordinance
2003	Circulate new City Storm Water Management Ordinance for review and comment to City staff and management. <u>City Pledge:</u> circulate by March 31, receiving comments back by April 21.	Comments from review received and recorded. Rewrite in-hand.
2003	Circulate revised Ordinance for final comment. <u>City pledge:</u> circulate by May 5, receiving final comments by May 16.	Comments from final review received and recorded. Final rewrite in-hand.
2003	Submit final Ordinance for City Council review and adoption. <u>City pledge:</u> consideration on June 3.	Document process (City Council presentation, minutes, etc.) Adopted Ordinance.
2003-2008	Implement City of West Jordan Storm Water Management Ordinance and enforce. <u>City pledge:</u> to implement and begin enforcement by June 30, 2003.	Document investigation efforts and enforcement actions taken

CHAPTER ONE

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER ONE

PUBLIC EDUCATION AND COMMUNITY OUTREACH PROGRAM

The Public Education and Community Outreach Program of the City's SWMP addresses the increasing public and professional awareness of storm water quality concerns and the BMPs available to protect the storm water. The BMPs described in this section of the SWMP include: 1) education and training of staff; 2) education and training of the public. Other programs available in the community include household hazardous waste, leaf bag collection and participation in the County Storm Water Coalition programs. These education and training efforts will introduce the UPDES program, focus on known contaminant sources, and provide information and training on pollution control.

SCHOOL PROGRAM

Description: Provide students with educational materials, demonstrations, and outreach activities regarding the impact of daily activities on storm water quality through the "High School Mentor" and the "Urban Stew" programs, and through distribution of Education materials.

In the City of West Jordan, there are 2 High Schools, 4 Middle Schools, and 12 Elementary Schools.

High School Mentor Program: This program teaches high school students (grades 10 through 12) basic water quality concepts and issues. Classes will be conducted by the County.

High School students (grades 10 through 12), after training, will present the information to younger students in the Middle Schools (grades 7 through 9) and, possibly in the Elementary Schools (grades 4 through 6).

Urban Stew Program: This program uses a 25-minute storm water quality lesson taught both by High School students or SLCo personnel. The purpose of the presentation is to describe pollutants that occur in storm water, the sources of the pollutants, and the impacts they can cause. All materials are supplied to the High School students by the County.

Educational Materials: The County will distribute educational materials designed to inform communities of the impacts of storm water discharges on local water bodies. These materials include such items as tabloids, activity books, stenciled pencils, note pads, etc.

Permit Requirement: II.F.1.a – Public Education and Outreach.

Objective: To reduce pollutants being introduced into receiving waters by increasing Public awareness of problems associated with contaminants and pollutants, and by identifying solutions to prevent contamination and polluting.

Implementation and Assessment: The following Table represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	High School Mentor Program-- <u>City Pledge:</u> support County in its teaching program.	Document the number and names of student attendees per year, per school, and per grade class
2003-2008	Urban Stew Presentations Program-- <u>City Pledge:</u> support County in its teaching program.	Document the number and names of student attendees per year, per school, and per grade class

2003-2008	Development and Distribution of Educational Material Hand-outs Program— <u>City Pledge:</u> support County in its distribution program.	Document materials distributed and the names and number of students per grade class receiving those materials.

COMMUNITY/RESIDENTIAL PROGRAM

Description: Inform the public concerning the impacts of storm water discharges on receiving water bodies, and of the steps that can be taken to reduce those impacts, including number and amount of pollutants that enter the storm water systems. Programs include Outreach activities, and distribution of educational materials. Inform the general public about the hazards associated with illegal discharges and improper disposal of wastes. In addition, promote, publicize, and facilitate the proper management and disposal of such wastes as used oil and household hazardous wastes. Develop educational materials concerning the proper storage, use, and disposal of such items as pesticides, herbicides, and fertilizers (PHF).

Public Reporting Program: Establish "hot-line" contacts to encourage and promote public reporting of observed illegal dumping and illicit discharges into the City's storm water runoff systems.

Procedures for filing of formal complaints with both SLCo and the City of West Jordan are already in place, and can accommodate calls for illegal dumping and illicit discharging.

Information Booths Program: Information booths, manned by informed persons, will be provided at appropriate community and educational events. Displays include a graphic panel illustrating the Hydrologic Cycle in an urban setting and are accompanied by a series of pamphlets and other educational materials.

Mass-Media Education Materials Program: The production and presentation of informative materials designed to educate the Public about storm water quality issues includes television and radio commercials, videos, stickers, etc. This program is produced and presented by the County.

Educational and Informative Newsletter: This program, conducted by the City, will distribute an informative Storm Water Newsletter to each residence and business within the City. It will be included with the monthly billing statement for City Services at least once during each calendar year. The newsletter will discuss progress of the City Storm Water Management Plan, as well as to offer helpful hints and suggestions as to how individual citizens or entrepreneurs can help guard against pollution of storm water runoff.

Household Hazardous Waste Program: This program provides for distribution of educational materials to the Public regarding proper disposal of used oil and household hazardous wastes.

Leaf Bag Collection Program: Through this County program, leaf bags are distributed to City residents for the purpose of composting of fallen leaves during the Fall season.

Salt Lake County Storm Water Coalition Program: This organization consists of a Coalition of various State and County Regulatory Agencies, State Construction Agencies, and City municipalities whose purposes primarily are that of : 1) reducing the load of pollutants entering the storm drains and receiving water bodies within the Salt Lake Valley; 2) enforcing the appropriate regulations appertaining; and 3) education of and distribution of information to the residents and businesses within the Salt Lake Valley meeting on a monthly basis.

Permit Requirement: II. F.1.b. and d. – Public Education and Outreach
II. F.3. f. and g. – Illicit Discharges and Improper Disposals

Objective: Reduce pollutants being discharged into receiving waters by increased public awareness of problems and solutions. Discourage discharge of pollutants to the storm water system and receiving waters through a program encouraging public reporting of violations observed and by enforcement actions taken against violators. Reduce the impact to water quality through timely clean-up actions. Educate residents and landowners on the potential impact to receiving waters from the improper storage, over-application and mis-application, and disposal of pesticides, herbicides, and fertilizers (PHF).

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the current term of the Permit.

Year	Implementation	Assessment
2003-2008	Public Reporting of Illicit Storm Drain Dumping – follow-up on reports and take enforcement action Program-- <u>City pledge:</u> ongoing review of call-up reports to both SLCo and WJC, and immediate referral to WJC Police Dept. for enforcement of City Ordinance.	Document number of reports received, by both mail and phone. Document enforcement actions taken
2003-2008	Attend Community Events with information booths and information distribution Program-- <u>City pledge:</u> to assist SLCo in its efforts to conduct information booths.	Document representation at local events, assess the response (# visitors, etc.)

2003-2008	Develop mass educational materials via TV and radio commercials, stickers, etc. Program-- <u>City pledge:</u> to assist SLCo in its Mass Media efforts, as called upon. To contribute \$500.00 per year to SLCo for development of mass-media programs and materials.	Document advertisements and other means of informing the public. Document list of contributions
2003-2008	Develop educational and informative Storm Water Newsletter-- <u>City pledge:</u> to compose yearly Storm Water Newsletter for May of each year distribution to all residential, commercial, and industrial properties. These will be mailed with a monthly utilities billing.	Document number of yearly Newsletters distributed
2003-2008	Promote, publicize, and facilitate proper management and disposal of used oil, household hazardous wastes, and pesticides, herbicides, and fertilizers-- <u>City pledge:</u> to assist SLCo in its distribution of educational materials program, as needed.	Document information booths, numbers of informational pamphlets distributed, etc.
2003-2008	Leaf Bag Collection Program-- <u>City pledge:</u> to assist SLCo in its leaf bag program, as needed.	Document number of leaf bags distributed
2003-2008	Participate in the Salt Lake County Storm Water Coalition Program-- <u>City pledge:</u> to participate in monthly meetings and coalition activities.	Document meetings, educational materials developed through the Coalition

COMMUNITY / COMMERCIAL / INDUSTRIAL PROGRAMS

Description: Develop a program to inform public employees, commercial businesses and industries of the water quality concerns in urban development and storm water runoff. Develop educational material on the proper use of pesticides, herbicides, and fertilizers.

Pesticide, Herbicide, and Fertilizer Education Program: Educational material to be distributed by County to businesses and industries regarding the potential impact to receiving waters from the over-application and mis-application of pesticides, herbicides, and fertilizers.

Other Solid, Liquid, and Airborne Hazardous Materials: Educational material to be distributed by County to businesses and industries regarding the potential impact to receiving waters due to improper storage, use, or disposal of solid, liquid, or gaseous hazardous materials other than pesticides, herbicides, and fertilizers.

Salt Lake County Storm Water Coalition: This organization consists of a Coalition of various State and County Regulatory Agencies, State Construction Agencies, and City municipalities whose purpose is reducing the load of pollutants entering the storm drains and receiving water bodies, and enforcing the appropriate regulations. This Coalition meets on a monthly basis.

Permit Requirement: II.F.1.c. and e. – Public Education and Outreach

Objective: To educate public employees, commercial businesses, and industries about the hazards associated with illegal discharges and improper disposal of waste. Also, to provide information regarding the potential impact to receiving waters from the improper storage, over-application and mis-application, and disposal of pesticide, herbicides, and fertilizers. Additionally, to inform concerning the hazards associated with illegal discharges and illicit disposal of wastes.

Implementation and Assessment: The table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	SLCo to review its current Pesticide, Herbicide, and Fertilizer education program – <u>City pledge:</u> to assist SLCo in its current program, as needed.	County to assess the current program and determine changes required.
2003-2008	SLCo to Implement changes identified in prior task – <u>City pledge:</u> to assist SLCo in the implementation program, as needed.	Document changes made to PHF program

CHAPTER ONE
PUBLIC EDUCATION AND OUTREACH PROGRAM

2003-2008	Participate in the Salt Lake County Storm Water Coalition Program-- <u>City pledge:</u> to participate in the monthly Coalition meetings.	Document meetings and educational materials developed through Coalition

CHAPTER TWO

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER TWO

PUBLIC INVOLVEMENT / PARTICIPATION PROGRAM

The Public Involvement /Participation Program section of the SWMP addresses the importance of public involvement in the development and implementation of the SWMP . The goals of the Community participation program are: 1. public ownership; 2. broader public acceptance and support; 3. shorter time requirement for implementation of program phases; 4. broader base of program expertise; 5. development of important relationships with other community and governmental programs.

The BMPs described in this section of the SWMP provide opportunities for the public to play an active role in the development and implementation of the SWMP.

This program will be integrated with the "Public Education and Outreach Program" in order to supplement education with hands-on programs.

PUBLIC NOTICE REQUIREMENTS PROGRAM

Description: Compliance with all State, City, and local Public Notice requirements.

Permit Requirements: II.F.2.b.– Public Involvement/Participation

Objective: Provide opportunities for Public Involvement in the development and implementation of the SWMP.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the Permit term. The Purpose of measurable goals is to gauge Permit compliance and program effectiveness following the schedule identified.

Year	Implementation	Assessment
2003	Identify Public Notice requirements as required by Federal, State, City, and local authority – <u>City pledge:</u> establish requirements list by April 1, 2003.	Document Public Notices issued
2003-2008	Incorporate the use of the required PublicNotice requirements as required – <u>City pledge:</u> meet public notice requirements.	Document Public Notices advertised and the number and content of responses to the notices

STORM DRAIN STENCILING PROGRAM

Description: Locate and identify all inlet devices into the City's Storm Water Runoff systems. Use public volunteer groups to mark/label City's storm water runoff system inlets to minimize the likelihood of illegal dumping.

Storm Drain Stenciling Program:

Encourage volunteer groups to sponsor the painting of stencils or placing glued markers on the inlets with appropriate warning messages.

See also, Storm-Water Systems Map Program, Chapter 3, Page 2.

Permit Requirement: II.F.2.c. – Public Involvement/Participation.

Objective: To reduce pollutants from entering receiving waters to the MEP by identifying storm water system inlets and by increasing public awareness of problems and solutions. To include Public volunteer services to place or stencil these markers.

Implementation and Assessment: The following Table represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004	Locate and identify all inlet sources into the storm drain systems throughout the City– <u>City pledge:</u> to locate all inlets by latitude and longitude (GPS) and to singularly identify and enter into data base. Will be accomplished by City forces by September 15, 2004. (See "Storm Drain System Map Program", Chapter Three)	Completed project and data base entry
2004-2008	Installing stencil-painted or stickered message on all inlets into the City's storm water system, identifying the system with "clever message" to not discharge liquids or solids there – <u>City pledge:</u> utilize volunteer citizen groups and organizations as available to install message identified above on all storm water system inlets within the City. Evaluate effectiveness and maintain as needed.	Document meetings, number of storm drains stenciled, etc.

ADOPT-A-ROADWAY PROGRAM

Description: Community program designed to "Keep highways free of debris and litter".

Adopt-A-Roadway Program: Provide opportunities for groups and organizations to have their group recognized publicly for helping to keep roadside areas free from litter. Volunteer groups will pick up litter as needed on a City-assigned roadway stretch.

Permit Requirement: II.F.2.c. – Public Involvement/Participation

Objective: Keeping City major roadways free of debris by periodic litter removal. In turn, this removal from the roadways will protect the City's Storm Water Runoff System inlets from receiving litter and other pollutants.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Adopt-A-Roadway Program – <u>City pledge:</u> to organize, advertise, receive applications, and staff several programs of Adopt-A-Highway for selected roadways by April 1, 2004. Dates of collection will be as needed and at locations as assigned by the City. The City operations will supervise this program.	Maintain records of all roadways receiving Adopt-A-Roadway programs, showing: 1) area adopted, 2) group name; 3) date(s) cleaned

CHAPTER THREE

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER THREE

ILLICIT DISCHARGE AND IMPROPER DISPOSAL DETECTION AND ELIMINATION PROGRAM

This Section of the SWMP addresses non-storm water flows that are discharged to receiving waters via storm water conveyance systems. The Program will implement BMPs to assist in the identification of illicit discharges and removal of these discharges from the system. This program will also address enforcement through the City's Storm Water Management Ordinance.

This program will also be integrated with the Public Education and Outreach Program to promote awareness of the importance of protecting the storm water system from illicit discharge and impacts to receiving waters.

STORM WATER SYSTEMS MAP PROGRAM

Description: Update existing City of West Jordan storm-water systems map and data base as required.

City Mapping Program: The City is in the process of completing a Storm Water Masterplan. As part of this project, all storm water facilities will be identified, located, given a specific number, listed in a data base, and shown on maps. These facilities include storm drain catch basins, junction boxes, clean-out basins, storm water ditches, canals, streams, etc. Data collected will include size, flowline elevations, diameter and type of pipe entering and leaving, etc. In addition all storm water outfalls into Waters of the State will be identified and listed.

See also "Storm Drain Stenciling Program", Chapter Two, Page 3.

Permit Requirement: II.F.3.a.--- Illicit Discharges and Improper Disposal

Objective: Identify intake and discharge areas of the storm water systems in order to determine the source and extent of dry weather flows, and the particular water bodies these flows are affecting. The Storm Drain System Map(s) will be used for tracing dry weather flows and for computing the annual stormwater loads.

Implementation and Assessment: The Table below represents measureable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004	City storm water system mapping program – <u>City pledge:</u> complete map(s) by September 15, 2004	Up-to-date maps as described
2004-2008	City updating of storm system maps – <u>City pledge:</u> maintain and update existing map annually from as-built plans for construction projects completed during year.	Record dates of update, changes made, and production of new maps
2004 – 2008	City updating land-use plans – <u>City Pledge:</u> update as land uses are changed.	Revise land use changes from the most recent City Land Use Map

ADDRESS CITY'S STORM WATER MANAGEMENT ORDINANCE

Description: Prohibit illicit discharges into the City's storm water systems, including appropriate enforcement procedures and actions, in the "City of West Jordan Storm Water Management Ordinance." Examples of illicit discharges include sanitary wastewater, sewage, improper disposals of waste oil, paint, household toxic liquids or substances, and spills from roadway accidents.

Exceptions:

- water line flushing
- diverted stream flows
- rising ground waters
- uncontaminated ground water infiltration [as defined in 40CFR 35.2005(20)] to separate storm drains
- discharges from potable water sources
- uncontaminated footing/foundation drains
- uncontaminated water from crawl space pumps
- air conditioning condensate
- irrigation water
- springs
- lawn watering
- individual residential car washing
- flows from riparian habitats and wetlands
- street wash waters
- discharges or flows from emergency fire fighting activities

Permit Requirement: II.F.3.b.– Illicit Discharges and Improper Disposal

Objective: Prevent pollution from entering receiving "Waters of the State" from City Storm Water Systems by enforcements and penalties provided in the City's Storm Water Management Ordinance.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Include in the New City Storm Water Management Ordinance adequate provisions for Illicit Discharge and Improper Disposal Detection and Elimination – <u>City pledge:</u> to include as an element of the SWMO.	Ordinance adequate in regard to Illicit and Improper Discharge into City storm water systems

CHAPTER THREE

ILLCIT DISCHARGE AND IMPROPER DISPOSAL DETECTION AND ELIMINATION PROGRAM

2003	Adopt City of West Jordan Storm Water Management Ordinance with controls governing Illicit and Improper Discharge into City's Storm Water Systems. <u>City Pledge:</u> adoption of Ordinance by Mayor and City Council action by June 3, 2003.	Document process (City Council presentation, minutes, etc.)
2003-2008	Implement City of West Jordan Storm Water Management Ordinance with provisions relative to Illicit and Improper Discharge into City's Storm Water Systems <u>City pledge:</u> to implement and begin enforcement by July 1, 2003.	Document investigation efforts and enforcement actions taken.

DRY WEATHER SCREENING PROGRAM

Description: Continue the County's Dry Weather Screening Program designed to detect and address illicit discharges. The Dry Weather Screening Program is detailed in the "Sampling Plan for Dry Weather Screening", dated March 1996, revised September 2000.

Provide for this Program, with enforcements and penalties, in the "City of West Jordan Storm Water Management Ordinance".

The program is designed to detect, address, and stop illicit discharging or "dumping" of harmful and deleterious substances or materials into storm drain systems. Primarily, it consists of a water sampling program taken periodically from selected outfalls along a storm water drainage system at times when the water being conveyed is not from a natural storm. This water may occur from such natural sources as intercepted high groundwater tables, springs, diverted streams, etc., or may be from man-caused, but legal, sources such as irrigation and lawn-watering practices, air conditioning condensates, flushing of water lines, etc. Sources, however illicit, may include sanitary sewage and effluents, various discharges from manufacturing processes, oil and grease from automotive garages and businesses, etc.

The intent of the program is to discover and stop those persons and businesses causing illicit discharges, and impose penalties to discourage continued violations.

Dry Weather Screening Program: this program is detailed in the County's "Sampling Plan for Dry Weather Screening", dated March 1996, revised September 2000. County will conduct this program within the City limits.

Investigations and Enforcements: Any dry weather flows that can be identified will be traced to their source. If the source is found to be an illegal man-caused source, the SLVHD will be informed of the illicit connection or illegal discharge for prosecution and enforcement action.

Permit Requirement: II.F.3.C. – Illicit Discharges and Improper Disposal.

Objective: Identify, address, and eliminate illicit discharges into the storm drain systems. The goal will be to conduct dry weather screening on all identified outfalls once each year during the permit term.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

CHAPTER THREE

ILLICIT DISCHARGE AND IMPROPER DISPOSAL DETECTION AND ELIMINATION PROGRAM

Year	Implementation	Assessment
2003	Include in the New City Storm Water Management Ordinances adequate provisions for "Dry Weather Screening program" – <u>City pledge:</u> include in SWMO.	Document provision in the Ordinance
2003-2008	SLCo to continue "Dry Weather Screening Program" – <u>City pledge:</u> assist SLCo in its "Dry Weather Screening Program" as called upon.	Document findings of yearly screening program, number of outfalls visited and number of outfalls with suspected conditions
2003-2008	SLCo to investigate and apply enforcements on any suspect outfalls that exhibit evidence of illicit discharge. <u>City pledge:</u> assist SLCo in its investigation and enforcements, as called upon.	Document any investigation efforts and findings
2003-2008	SLCo and / or West Jordan City to report findings indicating illicit discharge to SLCo and to Salt Lake Valley Health Department (SLVHD) to take actions toward eliminating them. <u>City pledge:</u> assist SLCo in its reporting of findings.	Document enforcement actions taken

INTERAGENCY PROGRAM / SALT LAKE COUNTY STORM WATER COALITION

Description: For both SLCo and CWJ, Continue coordination and participation in the Salt Lake Storm Water Coalition for the purpose of enforcing and reducing the load of contaminants to the MEP which enter storm drains and receiving water bodies from illicit discharges. Provide support to federal, state, and other local entities in the efficient control of contaminants as required under appropriate regulations, such as the "Storm Water Permit Program", "Underground Storage Tank Program", "Class V Well Inventory and Management Program", and "Municipal Wastewater Pretreatment Program".

Salt Lake County Storm Water Coalition: The Coalition meets monthly to coordinate new educational materials/programs, storm water program development, and to inform all members of new regulations or storm water workshops.

Permit Requirement: II.F.3.C. -- Illicit Discharges and Improper Disposal
II.f.1.-- Public Education and Outreach

Objective: Through Interagency cooperation, reduce contaminants and pollutants originating from illicit discharges or improper disposal from entering stormwater runoff system, including storm drains.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Continue participating in Salt Lake County Storm Water Coalition. <u>City pledge:</u> continued participation.	Document Coalition Meetings
2003-2008	Interact with Public Education and Outreach Programs-- <u>City pledge:</u> support County programs	Document programs affecting City
2003-2008	Coordinate illicit investigations with the Coalition, especially the SLVHD. <u>City pledge:</u> to assist SLCo in its coordination with SLVHD as called upon.	Document number of illicit discharges/connections investigated and penalties assessed

CHAPTER FOUR

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER FOUR

CONSTRUCTION SITE STORM WATER MANAGEMENT PROGRAM

This Section of the SWMP addresses water quality concerns relative to pollution of storm water runoff waters by activities involved in the construction process. All provisions herein apply only to construction activities on construction sites greater than or equal to one acre. The BMPs described in this Section include the development of a Construction Site Program designed to reduce pollutants entering storm water runoff systems due to construction activities.

The accumulation of soil material may harm the system by reducing its flow capacity, but may also contribute physical, chemical, and biological pollutants to the eventual receiving waters.

PROVISION IN CITY'S STORM WATER MANAGEMENT ORDINANCE

Description: Develop in the "City of West Jordan Storm Water Management Ordinance" provisions on all construction sites equal to or exceeding one acre in size to require owners/ construction contractors/ operators to use on-site erosion and sediment controls and to maintain appropriate structural and non-structural BMPs to reduce pollutant discharge during times of soil disturbances or excavation operations. Also, develop penalties to enforce and ensure compliance with the erosion and sediment controls.

The Ordinance will require Developers to submit erosion control plans for the construction sites to the City's Engineering Division. The plan will consist of: 1) a completed "Storm Water Pollution Prevention Plan" (SWPP); 2) construction site plan sheet(s) showing erosion controls.

The ordinance will require contractors or operators to control waste such as discarded building materials, concrete truck wash-outs, chemicals, fuels and oils storage, litter and sanitary wastes at the construction site, etc.

Permit For Storm Water Discharge ~ Provide requirements in the Ordinance for developers/contractors/ operators to obtain a Storm Water Discharge Permit from the City prior to construction activity.

Permit Requirement: II.F.4.a.& b.- Construction Site Storm Water Runoff Control

Objective: Prevent the discharge of sediment from construction-site erosion and the discharge of other pollutants, such as oil, grease, toxic and sanitary wastes, etc. from construction sites into the City-owned storm water systems.

Develop effective requirements and adequate enforcement procedures within the City's Storm Water Management Ordinance to require an erosion control plan and proper waste handling plan for all development sites, to control the reduction of erosion, sediment transportation and other pollution from construction sites.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Include in the New City Storm Water Management Ordinance provisions for "Construction Site Storm Water Runoff Control" – <u>City pledge:</u> to have representatives from Engineering Division and from City's Attorney office review Ordinance in regard to Illicit and Improper Disposal and ensure is adequate by February 24.	Provisions made in Ordinance
2003	Adopt City of West Jordan Storm Water Management Ordinance with controls governing "Construction Site Storm Water Runoff Controls". <u>City Pledge:</u> adoption of Ordinance by Mayor and City Council action by June 1.	Document process (City Council presentation, minutes, etc.)
2003-2008	Implement City of West Jordan Storm Water Management Ordinance with new changes relative to "Construction Site Storm Water Runoff Control". <u>City pledge:</u> to implement and begin enforcement by July 1, 2003.	Document investigation efforts and enforcement actions taken.

Specifications For Erosion Control Plan In Storm Water Prevention Plan (SWPP)

Under the Storm Water Management Ordinance, the City of West Jordan requires that all construction sites of size one acre or more within the City must be continuously operating under a construction-site erosion control plan acceptable and approved by the City's Engineering Division. This erosion control plan requirement includes: 1) submittal by the Owner/ Developer of a completed application form; 2) submittal by the Owner/Developer of a Storm Water Pollution Prevention Plan (SWPP) with the application.

Storm Water Permit application forms and SWPP forms will be available on West Jordan's Web site or from the City's Engineering office. Both forms must be completed by a Registered Professional Engineer, and the SWPP form must include the following information:

A. General Information:

1. Site Description – A description of the site as it will exist during the construction period , including a map with spot elevations and contour lines of the site. This description must include the nature and location of the construction activity, including a description of the intended sequence of major activities which will disturb soils on the site. Must include estimates of the total area of the site and of the total area that is expected to be disturbed during construction, including excavation , grading, or other activities. The City Engineering Division reserves the right to limit the area of the proposed disturbance at any single time, in order to prevent excessive erosion at the site;

2. Control Description – A description of the proposed erosion control measures that will be implemented. Refer to the SLCo's "Guidance Document for Stormwater Management" and to the Stormwater Management Manual. The SWPP must clearly describe both the times and the exact locations during the construction process that the measures will be implemented for each major activity. The SWPP shall also state the name and phone number of the person or entity responsible for implementation of each control measure.

B. Goals and Criteria:

1. Prevent or minimize uncontrolled discharge – The proposed measures and controls shall be designed to prevent the discharge of sediment, debris, and all other construction-related pollutants from the construction site.
2. Prevent or Minimize Construction Debris – The proposed measures and controls shall be designed to prevent or minimize the deposition, discharge, tracking by construction vehicles, or dropping of mud, sediment, debris, or other potential pollutants onto public streets and rights-of-way.
3. Best Management Practices (BMPs) – The proposed measures and controls shall consist of BMPs available at the time that the SWPP is submitted. Best Management Practices included in the current SWPP (2003) include, but are not limited to, temporary silt or sediment fences, sediment traps and detention ponds, gravel construction entrances and wash down pads to reduce or eliminate off-site tracking, establishment of temporary grasses and permanent vegetative cover, use of straw mulch as a temporary ground cover, erosion control blankets, temporary interceptor dikes and swales, storm drain inlet protections, check dams, subsurface drains, pipe slope drains, level spreaders, rock outlet protection, reinforced soil retaining systems, and gabions.
4. Stabilization – The proposed measures and controls shall be designed to preserve existing vegetation, where possible. Disturbed portions of the site shall be stabilized, and the amount of disturbance at any single point in time shall be limited. Stabilization practices include temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures.
5. Minimize Risk of Discharge of Other Materials – The proposed measures and controls shall minimize the risk of discharge of construction-related pollutants from the construction site, including paint thinners, solvents, other chemicals, gasoline, oil, grease, washing waters from concrete trucks, etc. Such measures may include implementation of storage practices to minimize exposure of the material to storm water as well as spill prevention and response.

CONSTRUCTION-SITE PLAN REVIEW PROGRAM

Description: Develop procedures to implement effective construction site plan review to control water quality impacts to the City's storm water systems and to the end receiving waters.

Also, include in the site plan review requirements for Contractors/Operators to control wastes other than storm water runoff that can result from the project during construction, thus adversely impacting the City's storm water systems and/or the end receiving waters

Ordinance : The City Storm Water Management Ordinance will supply the framework for this Program, as well as the regulatory jurisdiction for enforcement.

City Personnel Training: Train personnel to review site plans to evaluate the plans for the following short-term storm water erosion controls:

1. All building sites, for whatever intent of usage, and of 1-acre or greater in size are required to have the short-term construction erosion controls;
2. Excavation and shaping of the construction site at all times shall have complete drainage into a City-owned storm water facility or from a City Engineering Division-approved facility for conveyance away from the site ;
3. Drainage into a City-owned storm water facility must have protections above its entrance which removes the sediments, oils, fuels, chemicals, floatables, debris, etc. This protection is to be provided by such devices as conveyance ditches, sediment basins, silt traps around all inlets into channels or pipes, berms, etc. (see SWPP for suggestions and requirements). In instances where the calculated flows are so large as to require limiting of the flow from the site, then permanent basins are to be constructed to detain the water for limited discharge for the permanent, after construction rate;
4. No storm water runoff in any amount is to be discharged from the property onto adjoining streets, properties, ditches or canals.
5. Both structural and non-structural facilities and controls must be in place before any construction involving soil disturbance can begin on the site, operating 24-hours per day throughout the project.

Permit Requirement: II.F.4.b. & c. – Construction Site Storm Water Runoff Control

Objective: Enhance the existing construction site approval process to include construction Erosion Control Practices, and Stabilization & Structural practices to protect the quality of the storm water runoff waters during construction.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Develop water quality impact review procedures in accordance with City's "Storm Water Rules Regulations, Standards, and Specifications", and with City's Storm Water Management Ordinance, particularly in reference to Construction Site Storm Water and Other Pollutions Program – <u>City pledge:</u> develop by June 1.	Completed water quality procedure – Amend as necessary
2003-2008	Provide personnel training to City's Engineering Division Staff in regard to the new procedures – <u>City pledge:</u> Training Program will be designed by the City and initial training completed by July 1.	Document training program content, date held, and names of City Review Engineers trained.
2003	Implement Engineering Division design review procedures and begin enforcement – identify water quality concerns arising from new projects – <u>City pledge:</u> implementation and enforcement will begin by July 1.	Document the number of and content of water quality concerns arising
2003-2008	Review success of BMP implementation – <u>City pledge:</u> complete review by December 31 each year, beginning 2003.	Document review process and recommendations for change

CONSTRUCTION SITE INSPECTIONS OF EROSION CONTROLS PROGRAM

Description: Develop procedures for site inspection by City Inspector(s) and enforcement of erosion control and pollution source control measures at construction sites.

Include the procedures accepted for the inspection of erosion and other pollution-causing conditions at construction sites in the City Storm Water Management Ordinance.

Train the City Engineering Inspectors concerning the erosion control requirements in the SWPP and in the BMPs available for use on construction sites.

Permit Requirement: II.F.4.e. – Construction Site Stormwater Runoff Control

Objective: Ensure that BMPs are properly installed, are in place daily, and are reducing pollutants in storm water runoff from construction activities.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Provide for inspection requirements at construction sites in the City's Storm Water Management Ordinance. <u>City pledge:</u> prepare by June 3.	Provision included on or before time pledged
2003	Develop procedures for construction site inspections pertaining to erosion control-- <u>City pledge:</u> develop by June 1.	Developed procedures
2003	Train the City Inspectors in the BMPs available for use on construction sites, and in the necessary enforcements at construction sites-- <u>City pledge:</u> to train by July 1.	Training provided--record and certify
2003-2008	Begin site inspections -- <u>City Pledge:</u> conduct inspections in each of the five years pledged under the Permit, beginning July 1.	Document inspections and findings--compile monthly

2003-2008	Initiate enforcement and penalty actions as necessary – <u>City Pledge:</u> begin enforcements and inflict penalties as necessary in each of the five years pledged under the Permit, beginning July 1.	Document enforcement actions taken

PUBLIC-REPORTING PLAN PROGRAM

Description: The public can help identify violations of the City's Construction Site Storm Water And Other Pollution Programs. Encourage owners/contractors/operators, private citizens, etc. to report violations on construction sites and mud-tracking on roadways.

Maintain procedures for the receipt and consideration of public inquiries, concerns, and information submitted regarding storm water runoff from construction activities.

Public Reporting Program: The City of West Jordan, Engineering Division maintains 24-hour phone lines for public concerns. Salt Lake Valley Health Department (SLVHD) maintains a phone line for public reporting during business hours.

Permit Requirement: II.F.4.d.-- Construction Site Storm Water Runoff Control

Objective: Encourage public participation in reporting storm water quality concerns arising during construction activities. Initiate follow-up procedures.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2006	Encourage public reporting of violation of erosion control practices, mud tracking, or in-transit spillage during construction of project. <u>City pledge:</u> conduct advertising encouraging public reporting of violations. Advertise in the local public newspaper and in the City's annual Storm Water Newsletter Also, request SLCo to advertise in the City's Storm Water School Education Program and in the City's information booths at City events by December 31, 2003.	Document number of newsletters, number of school classes and number of students taught, number of information booths and handouts distributed. Summarize at end of each year.
2003-2008	Coordinate with SLVHD on all storm water-related calls received –	Document the number and type of calls received
2003-2008	Follow-up on all reports and take enforcement actions where necessary –	Document number of reports received and any enforcement actions taken

CONTRACTOR/ OPERATOR EDUCATION PROGRAM

Description: Develop and distribute appropriate education and training materials for construction-site contractors and operators.

Guidance Document for Stormwater Management: SLCo has developed a guidance document of BMPs, which includes a chapter specifically for construction site BMPs. The document is available from SLCo's web site and in hard copy from the SLCo's Engineering Division.

Permit Requirement: II. F.4.f – Construction Site Storm Water Runoff Control

Objective: Provide readily available reference for designers, construction site operators and owners to utilize in planning and implementation of structural and non-structural BMP's to reduce pollutants discharged to the City's storm drain systems during construction.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Evaluate, adapt, and revise County Guidance document for use by City – <u>City pledge:</u> complete by June 1.	Document having read for content and ideas, listing such for use
2003	Begin distribution of Guidance Document to designers, contractors or operators – <u>City pledge:</u> to begin distribution in pre-Development meetings by July 1.	Document number of documents distributed and names of those receiving

CHAPTER FIVE

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER FIVE

PERMANENT, POST-CONSTRUCTION SITE STORM WATER MANAGEMENT PROGRAM

This Control Measure addresses the importance of the in perpetuity storm water runoff management following construction on new project sites or following reconstruction on existing sites where existing construction has been added to, modified, or rearranged. And, as discussed elsewhere, the Control Measure is only applicable to projects greater than or equal to one acre in size, also including land disturbance in projects less than one acre that are part of a larger common plan of development or sale exceeding that size.

Substantial impacts of post-construction runoff are caused both by an increase in the amount and in the type of sediment being discharged from the site, and in the type and quantity of pollutants from other sources within the area subject to storm water runoff. In addition, as the City continues to develop, the increased costs for additional or redesigned City infrastructure, the increased maintenance costs of the existing systems, and other numerous costs inherent to the growth in population all have wrought an overwhelming monetary impact on the City. Therefore, it has become necessary for the City to make drastic changes in its day to day policies relative to storm water management.

This program will be integrated with the Construction Site Storm Water Runoff Control Program of the SWMP to provide information and up-to-date BMPs to the end user. The following BMPs describe implementation tasks and assessment tasks to be completed by the City of West Jordan for the Post-Construction Storm Water Management in New Development and Redevelopment projects.

STORM WATER UTILITY USERS FEE

Description: Evaluate storm water management costs and develop a provision in the City's Storm Water Management Ordinance to impose a storm water utility usage fee on all property owners within the City.

Permit Requirement: The City of West Jordan Storm Water Management Plan provides for the following – Storm Water Utility Users Fee Ordinance.

Objective: To provide funding both for the City's present and future construction needs for storm water utilities development and for the maintenance of that development system.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Complete studies necessary to determine a supportable Storm Water Utility User's Fee – <u>City pledge:</u> Complete by September 1.	Written report documenting findings and recommendations
2003	Ensure that City's Storm Water Management Ordinance has adequate provisions through which a Storm Water Utility Users Fee can be assessed – <u>City pledge:</u> Develop appropriate language and include for Ordinance adoption by June 1.	Record findings as to adequate inclusion

PERMANENT, POST-CONSTRUCTION SITE STORM WATER MANAGEMENT PROGRAM

Description: 1) Develop a provision in the City's Storm Water Ordinance (SWMO) for Post-Construction Storm Water Detention, Conveyance, and Discharge from property sites equal to or exceeding one acre in size. Include in the new provision the requirement that the Owner/Developer of a construction project must acquire a Permit from the City Engineering Division to discharge storm water from the newly constructed project site into a City-, a County-, or a UDOT-storm water system or directly into "Waters of the State" (WOTS). This Permit must be in the possession of Owner/Developer before discharge from the property and into the City's storm water systems legally can occur.

Storm Water Discharge Permit:

The City's SWMO requires that the Owner/Developer of the property on which construction is to occur obtain a Storm Water Discharge Permit from the City's Engineering Division prior to connecting to the City's storm water systems. This requirement is both for properties connecting on for the first time as well as for properties already connected to the system but having additional construction on the property, as described elsewhere in this management plan. The Permit is administered under Ordinance 14627 to the City's Storm Water Management Ordinance. The required information to obtain this permit is listed at the end of the Tables on the pages following.

2) Develop a provision in the City's SWMO for New and modified Commercial, Industrial, or Multi-Family Residential properties requiring both structural and non-structural storm water facilities and practices to control the in-perpetuity storm water discharge from the property site. Provide for penalties for non-compliance to these requirements.

3) Develop incentives to owners of other existing properties where no change is being requested to construct the same above storm water amenities on their property voluntarily.

4) Develop a provision that all Commercial, Industrial, or Multi-Family Residential property owners become totally responsible for the in perpetuity maintenance of private storm water facilities on their property.

Application requirements for a Post-Construction storm water discharge Permit are listed at the end of this program.

5) Develop a program within the City to consider water quality impacts of new development and redevelopment projects in the comprehensive land use master planning process.

Permit Requirement: II.F.3.b.– Post Construction Storm Water Management

Objective: Reduce the long term effects of pollutants in storm water runoff from construction of both new development and redevelopment projects.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Year	Implementation	Assessment
2003	Include in the New City Storm Water Management Ordinance provisions for Post-Construction, storm water conveyance, detention, and discharge permits -- <u>City pledge:</u> develop provisions by March 31.	Assess, ensure, and record
2003	Adopt City of West Jordan Water Management Ordinance -- <u>City Pledge:</u> adoption of Ordinance by Mayor and City Council action by June 3.	Document process (City Council presentation, minutes, etc.)
2003	Implement Post Construction Storm Water Permit Controls including: 1) Final inspection of construction site by Engineering Division as part of project construction completion. 2) Periodic inspection of storm water management facilities to determine functionality and adequate maintenance. <u>City pledge:</u> to implement and begin enforcement by July 1.	Document investigation efforts and enforcement actions taken.
2003	Distribute design guidelines. Have available at City Engineering Division, City Hall -- <u>City pledge:</u> to have these materials available by June 1.	Document advertisements and distribution

Requirements for Application for Storm Water Quality Permit

A Post-Construction Storm Water Discharge Permit is required for all Property Owners/ Developers for each newly constructed property discharging storm water into a City-owned drainage facility. Applications must be submitted to the City's Engineering Division with preliminary plans. The application shall include:

A. Application

A completed application form. Application forms will be available at the City's Engineering Division Office, City Building, 8000 South Redwood Road, West Jordan, Utah.84088, and will be available on the City website.

B. Best Management Practices (BMP) Plan

Propose approved structural and non-structural practices appropriate to the specific site using the City's Guidance Document for Storm water Management. The BMPs shall be designed to ensure that the quality and quantity of storm water released to the storm drain system meets the requirements of federal, state and local laws and regulations and the City's Utah's Pollutant Discharge elimination system (UPDES) permit, and further, will not exceed the design capacity of the storm drain system or jeopardize the integrity of the storm drain system.

C. Maintenance Plan

A plan outlining how the applicant will maintain any private stormwater improvements in perpetuity.

COMPREHENSIVE LAND USE MASTER PLAN PROGRAM

Description: Consider water quality impacts of new development and re-development in the Comprehensive Land Use Master Planning Process.

Permit Requirement: II.F.5.c. – Post-Construction Storm Water Management in New Development and Redevelopment

Objective: Limit the discharge of pollutants to pre-development levels.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term. The purpose of measurable goals is to gauge permit compliance and program effectiveness following the schedule identified.

Year	Implementation	Assessment
2003	Identify areas where urban development is likely to occur and areas that are sensitive to the effect of urbanization – <u>City pledge:</u> Complete initial survey by October 1.	Review and update as necessary
2003-2008	Develop design criteria for storm water controls for new- and re-development – <u>City pledge:</u> Implement by January 1, 2004; update annually.	Review and update as necessary

CAPITAL IMPROVEMENT DEVELOPMENT PROGRAM

Description: Include City construction projects under Post-Construction storm water management permit requirements.

Permit Requirement: II.F.5.d.-- Post Construction Storm Water Management City projects.

Objective: Municipal developments shall be designed and maintained such that the impact to storm water is reduced, and BMPs developed to the same or greater level as private and other public projects.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Include City projects in P.C. permit program.	Review proposed ordinance.
2003-2008	Provide training for City project managers and consultants on long-term storm water controls.	Document training sessions and names of those persons being trained

CHAPTER SIX

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER SIX

POLLUTION PREVENTION / FACILITY MAINTENANCE FOR MUNICIPAL OPERATIONS PROGRAM

The Pollution Prevention/Facility Maintenance Program addresses routine operation and maintenance activities in the drainage systems, roadways, parks and open spaces, etc. to reduce pollutants entering the storm drain systems. The program will include snow removal, deicing, salt-pile management, and road crew training; storm drainage system maintenance, structural floatable debris controls, oil and grease controls, maintenance yard practices, flood control projects, litter ordinance development, pesticide, herbicide, and fertilizer program, and spill prevention and response.

STORM DRAIN SYSTEM MAINTENANCE PROGRAM

Description: Maintain and improve existing City of West Jordan storm drainage system operation, maintenance, and cleaning procedures.

Identify areas of chronic problems, and develop and implement corrective actions.

Provide an up-to-date map showing the existing City-owned systems, including all storm drain, ditches, canals, and detention basins, etc. Provide map to show all inlets, clean-out boxes, catch basins, etc. and all end-point discharges into "Waters of the State".

Permit Requirement: II.F.6.a(1) – Pollution Prevention/Facility Maintenance

Objective: Maintain and operate the storm water drainage system to reduce the discharge of pollutants.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2004	Completion of map(s) showing all storm water systems, catch basins, outlets into receiving waters, pipes, etc., along with database of elevations, pipe diameters, basin capacities, etc. – <u>City pledge:</u> completion of Storm Water System Map September 15, 2004.	Acquirement and assessment of Plan and Maps described
2003-2008	Review existing operation and maintenance procedures and practices annually, making changes or alterations as required – <u>City pledge:</u> review, alter, and update annually during December.	Update as necessary
2003-2008	Track system cleaning activities – <u>City pledge:</u> compile annually in December.	Document system maintenance and cleaning results
2003-2008	Prioritize system areas of concern (high use/frequent cleaning) – <u>City pledge:</u> review annually.	Document priority maintenance and cleaning activities

FLOATABLE DEBRIS CONTROL PROGRAM

Description: Develop a program designed to utilize structural controls where necessary to reduce the discharge of floatables.

Permit Requirement: II.F.6.a.(2) – Pollution Prevention / Facilities Maintenance

Objective: Reduce storm water quality impacts from floatables by providing structural controls to remove from storm water runoff. Apply controls on both public and private structures, and require adequate maintenance by owner/operator.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Develop program to assess the needs for structural controls to remove floatable debris from storm water, and determine responsibility and schedule for maintenance of each facility-- <u>City pledge:</u> Complete by October 1, 2003	Completed Program. Evaluate program and recommendations
2003-2008	Implement program -- <u>City pledge:</u> By December 1, 2004	Assess program annually.
2003-2008	Install new structural controls per recommendations -- <u>City pledge:</u> By June 1, 2004	Document installation and effectiveness of new controls

SNOW REMOVAL AND DEICING OF ROADWAYS PROGRAM

Description: Review and assess the current snow removal disposal and de-icing procedures by the City of West Jordan for prevention and reduction of storm water pollution.

Permit Requirement: II.F.6.b.(1) – Pollution Prevention/Good Housekeeping

Objective: Operate snow removal and de-icing procedures in a manner to reasonably reduce the discharge of pollutants.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2004	Review snow removal/disposal practices and de-icing procedures to minimize pollutants entering the storm water runoff – <u>City pledge:</u> Complete review by August 1, 2003; implement changes by October 1, 2003.	Document current activities, evaluate effectiveness of program and implement any changes determined necessary
2003-2008	Annually, provide training on snow removal and de-icing procedures– <u>City pledge:</u> provide training annually.	Document training sessions, names and number of attendees

SALT PILE MANAGEMENT PROGRAM

Description: Develop proper procedures and facilities for salt pile storage to prevent migration of concentrated salt-water brines into ground water and into storm drain systems. Develop proper procedures and facilities pertaining to truck loading/unloading and materials handling to reduce potential storm water contamination.

Permit Requirement: II.F.6.b.(5) -- Pollution Prevention/Facilities Maintenance

Objective: Reduce salt contamination in storm water runoff from salt-pile storage yards and in percolation into the underlying groundwater system.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Maintain list and site map of all SLCo, UDOT, and City of West Jordan salt pile storage and transfer locations within the City -- <u>City pledge:</u> compile map by October 1, 2003, and add to or revise map annually.	Update list and map as necessary
2000	Inspect City salt storage areas to observe the present pluses and minuses of the site relative to contamination controls, making note of cracks and faults at the site -- recognize that BMPs are to require the storage area to be in a lined-shallow pit -- to identify problems and possible solutions. <u>City pledge:</u> inspect the sites by October 1 of each year.	Document problems and possible solutions
2004	Conduct site inspection of salt storage areas during snow event -- <u>City pledge:</u> Inspect sites during winter, 2004.	Assess performance of existing controls and operations
2004	Observe and document handling and loading/unloading procedures at each of the sites prior to and during storm events -- <u>City pledge:</u> observe and document in late Fall and early Winter each year.	Assess handling and loading/unloading operations

STORM DRAIN SYSTEM WASTE DISPOSAL PROGRAM

Description: Review current disposal procedures for waste removed from the storm drain system, including catch basins, cleanout boxes, ditches and canals, detention basins, oil and grease separators, including dredge spoil, accumulated sediments, grit and salt from the Winter de-icing procedures, oil and grease and rubber residue from daily traffic movements, floatables, and other debris.

Permit Requirement: II.F.6.b.(2) – Pollution Prevention/Facilities Maintenance

Objective: Effective accumulation, collection, removal and disposal of waste from the storm drain system cleaning operations to reduce the discharge of pollutants into the City's storm water runoff facilities.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004-2008	Review current storm drain waste removal/disposal practices and procedures – develop effective improvements – <u>City pledge:</u> Review operation, adding or revising, annually by March of each year, beginning 2004.	Assess where water quality impacts occur during operation, determine pollutants of concern, revise as necessary
2004-2008	Provide training to City personnel – <u>City pledge:</u> Include in annual training program.	Document training sessions, names, and number of attendees

STREET-SWEEPING WASTE DISPOSAL PROGRAM

Description: Review current disposal procedures for "sweepings debris" accumulated during street sweeping operations.

Permit Requirement: II.F.6.b.(2) – Pollution Prevention/Facilities Maintenance

Objective: Effective accumulation, collection, removal and disposal of waste from the street sweeping operations to reduce the discharge of pollutants into the City's storm water runoff facilities.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004-2008	Review current disposal of City street sweeping waste removal/disposal practices and procedures – develop effective improvements – <u>City pledge:</u> Review operation, adding or revising, annually by March of each year, beginning 2004.	Document improvements
2004-2008	Provide training to City personnel – <u>City pledge:</u> Include in annual training program	Document training sessions, names, and number of attendees

ROAD CREW TRAINING PROGRAM

Description: Provide training regarding pollutants that can be discharged to the storm drain system during the routine maintenance work including road construction, road maintenance, and storm drain maintenance activities.

Permit Requirement: II.F.6.b.(3) – Pollution Prevention/Facilities Maintenance

Objective: Minimize pollutants entering storm drain system due to inadequate procedures and practices in the City's road construction and maintenance programs.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004-2008	Review and assess current materials-loading, handling, and application procedures used in the City's road building and road maintenance program that may contribute pollutants to the City's storm drain system. Determine ways to make improvements that can eliminate, or reduce pollution – <u>City pledge:</u> Review and assess, making changes where necessary, in March of each year, beginning 2004.	Document current procedures, identified problem areas, and recommended revisions. Record changes and implement, as necessary
2003-2008	Provide training to City personnel involved in road construction and road maintenance – <u>City pledge:</u> Include in annual training program.	Document training sessions and names and number of attendees

POLLUTION PREVENTION PRACTICES FOR MAINTENANCE YARDS PROGRAM

Description: Assess existing conditions in City equipment yards and maintenance facilities. Identify improvements to pollutant discharge.

Train City personnel in methods and procedures to prevent pollutants and contaminations discharge.

Permit Requirement: II.F.6.b.(6) – Pollution Prevention/Facilities Maintenance

Objective: Minimize pollutants entering storm drain system from equipment and maintenance facilities.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Maintain list and site map of all City, SLCo and UDOT equipment yards and maintenance facilities in West Jordan City – <u>City pledge:</u> To compose map by October 2003, and to add-to or correct as additional ones are created or deleted.	Compose map showing yards and facilities. Update list and map as necessary
2004-2008	Inspect City yards and facilities for materials handling, materials storage, and other routine operation procedures that can contribute to pollution of the City's storm water systems – <u>City pledge:</u> Inspect annually.	Document problems and possible solutions.
2003- 2008	Provide training for personnel working in equipment yards and maintenance facilities – <u>City pledge:</u> Include in annual training program.	Document training sessions and names and number of attendees

FLOOD CONTROL PROJECTS PROGRAM

Description: Assess City flood control projects for water quality concerns. Modify capital improvement projects as necessary.

Permit Requirement: II.F.6.c. -- Pollution Prevention/Facilities Maintenance

Objective: Evaluate water quality impacts of new and existing flood control projects. Include source and/or structural controls, and practices to reduce pollutants.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004-2008	Design future flood control projects and storm water runoff facilities to control/reduce pollution. Assess past flood control project sites and facilities for possible renovations to further reduce pollution – <u>City pledge:</u> Design future and assess past City Capital Improvement Projects to address pollution control.	Document assessment results, the changes required, and the results of the changes, project by project
2003-2008	Provide training for Engineers and consultants to improve design standards – <u>City pledge:</u> Include in annual training program.	Document training sessions and names and numbers of attendees

CITY LITTER ORDINANCE / PUBLIC EDUCATION PROGRAM

Description: Revise/Develop a Litter Ordinance to reduce the discharge of litter (including floatables) to the storm drain system. Coordinate with Public Education and Outreach and the Public Involvement/Participation Programs for the same purpose (see "Adopt-A-Highway Program" Chapter Two, Page 5; Also, see "Floatable Control Program", Chapter Six, Page 4).

Permit Requirement: II.F.6.d. – Pollution Prevention/Facilities Maintenance
II.F.6.a.(2) – Pollution Prevention/Good Housekeeping
II.F.1. – Public Education and Outreach
II.F.2. – Public Involvement/Participation

Objective: Minimize litter and floatables entering storm drain system.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003	Revise/Develop the City's Litter Ordinance to include floatable debris pollution to the City's storm water systems – <u>City pledge:</u> Rrevise/develop Ordinance by July 1.	Document procedures. Revise/Developed Ordinance in hand & presented to City Council
2003	Adoption of revised Litter Ordinance by City Council – <u>City pledge:</u> Adopt by September 1.	Document process
2003-2008	Implement and begin enforcement of new Ordinance – <u>City pledge:</u> Implement and enforce by October 1.	Document any investigation efforts and enforcement actions taken
2004-2008	Coordinate with Public Education and Outreach and Public Involvement/Participation Programs. <u>City pledge:</u> Begin coordination by April to June, 2004.	Document coordination activities and revise as necessary

PESTICIDE, HERBICIDE, AND FERTILIZER PROGRAM

Description: Maintain current inventory of Pesticide, Herbicide, and Fertilizer usage and evaluate that usage on City of West Jordan properties by municipal employees. Also, coordinate this program with the Public Education and Outreach Program (See Chapter One, Page 8).

Permit Requirement: II.F.6.(e) – Pollution Prevention/Facilities Maintenance

Objective: Minimize the discharge of pollutants to storm water from PHF procedures and practices.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Review existing program and revise as needed – <u>City pledge:</u> complete by February 1 of each year.	Record existing program. Assess program and update as necessary
2003-2008	Evaluate other potential chemical or organic materials that can be used as alternate PHFs – <u>City pledge:</u> evaluate by July 1 each year, adding to or revising as necessary.	Document alternatives investigated, revise program accordingly
2003-2008	Evaluate application procedures and rates for PHF usage within the City. Make revisions as required – <u>City pledge:</u> evaluate and revise by July 1 each year.	Document alternatives investigated and revise program accordingly

SPILL PREVENTION AND RESPONSE PROGRAM

Description: Assess and inventory the City's current Spill Prevention and Response Program. Rewrite the Program where necessary. Maintain Personnel on call to respond to reports of spills or discharges, to identify and investigate the source of the discharge, and to use the regulatory authority to enforce actions against violators in correcting the illicit discharge activity. Correlate this program with the "Illicit Discharge And Improper Disposal Detection And Elimination Program (Chapter Three).

Permit Requirement: II.F.6.f.– Spill Prevention and Response
II.F.3. – Illicit Discharges and Improper Disposals

Objective: Prevent spills from reaching storm drain systems and impacting receiving waters. Pursue enforcement actions against violators to discourage further violations.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Inventory and assess current program, agency personnel, and equipment available for spill response and clean-up. Rewrite the program, or portions of the program, if required – <u>City pledge:</u> inventory and assess by July 1 each year, beginning 2003.	Document results of assessment and inventory tasks. Document new program or rewritten program, if rewriting found necessary.
2003-2008	Conduct spill response as necessary – <u>City pledge:</u> conduct as need arises.	Document response activities and any enforcement actions taken
2003-2008	Provide training to phone responders, as well as to spill site responders – <u>City pledge:</u> include in annual training program.	Document training sessions and names and number of attendees

CHAPTER SEVEN

CITY OF WEST JORDAN STORM WATER MANAGEMENT PROGRAM CONTROL MEASURE NUMBER SEVEN

INDUSTRIAL AND HIGH RISK RUNOFF PROGRAM

The Industrial and High Risk Runoff Program addresses the need to establish standards and controls for storm water discharges from industrial or high risk facilities, including presently operating or closed municipal landfills, treatment works, municipal incinerators, waste transfer stations, etc., municipal landfills, hazardous waste facilities, and industrial facilities that are subject to Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), and industrial facilities that are suspected of contributing substantial pollutant loading.

The BMPs described in this section of the SWMP include a landfill storm water management program, a plan to identify and inspect the landfill facilities, and a plan to monitor pollutants in the runoff from them.

The Industrial and High Risk Runoff Program will also be integrated with the "Illicit Discharges and Improper Disposal Program", (Chapter Three of this Plan), to reduce the impacts from these discharges on storm water quality. The following BMPs describe implementation tasks and assessment tasks to be completed by the City of West Jordan for the Industrial and High Risk Runoff Program.

LANDFILL PROGRAM

Description: The Trans-Jordan Landfill solid waste management facility owned by seven cities including West Jordan is located in the City of South Jordan, and is regulated in accordance with the Salt Lake County Health Department Regulation #.

Permit Program: II.G. – Industrial and High Risk Runoff

Objective: Support surface water quality monitoring at the Trans-Jordan Landfill facility to determine if the facility has an impact on storm water quality.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	South Jordan to continue monitoring program and review program adequacy – City pledge: to continue support of the consortium of Cities involved in this waste facility.	Document monitoring activities and update as necessary
2003-2008	South Jordan to continue review of the monitoring results – City pledge: to continue support in the review of monitoring results as part of the consortium of Cities involved in this waste facility.	Document investigation activities

IDENTIFICATION OF INDUSTRIAL AND HIGH RISK FACILITIES PROGRAM

Description: Identify industrial facilities in the City subject to Individual UPDES permits and which may contribute substantial pollutant loads to the storm drain system.

Permit Requirement: IIG. – Industrial and High Risk Runoff

Objective: Develop and maintain a database of the industrial facilities in the City which may contribute pollutants to the storm drain system. Develop controls or practices to reduce pollutants discharged to the storm drain system.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2003-2008	Maintain listing of industries by Standard Industrial Classification (SIC) codes – <u>City pledge:</u> complete the listing during October, 2003, and maintain each succeeding years.	Update database as necessary

INSPECTION OF INDUSTRIAL AND HIGH RISK FACILITIES PROGRAM

Description: Develop an inspection program designed to prioritize and limit pollutants discharged in storm water from industrial and high risk facilities located in the City of West Jordan to the MEP. Set required limits for the program.

Permit Requirement: II.G. – Industrial and High Risk Runoff

Objective: Inspect industrial and high-risk facilities for storm water runoff controls, with intent to determine the adequacy of such controls and to minimize impacts to storm water quality discharging from the facility.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2004	Develop Inspection Program – City pledge: develop by March 1, 2004.	Assess proposed program
2004	Define criteria to prioritize facilities, by such measures as pollutant type, pollutant load, etc. – City pledge: define by March 1, 2004	Document database and high risk categorization
2004-2008	Implement and enforce program – City pledge: to implement program by September 1, 2004 and to enforce in all succeeding years.	Document inspections, findings, and enforcement actions taken

MONITORING OF INDUSTRIAL AND HIGH-RISK FACILITIES PROGRAM

Description: Develop a storm water quality monitoring program for industrial and high risk facilities to determine if storm water controls are adequate.

Monitoring Program: Develop a storm water monitoring program for industrial and high risk facilities in accordance with the SLCo's UPDES permit. This program shall include a requirement that facilities disclose any information relating to UAC R317-8-3.4(7)(d)1,2, and (e). Analyses may include, but are not limited to:

- any pollutant listed in an existing UPDES permit
- oil & grease
- COD
- pH
- BOD₅
- TSS
- total phosphorous
- total Kjeldahl nitrogen
- nitrate plus nitrite nitrogen

Permit Requirement: II.G.– Industrial and High Risk Runoff
II.F.3.c.– Illicit Discharges and Improper Disposals

Objective: Reduce contaminants entering the storm drain system from industrial discharges.

Implementation and Assessment: The Table below represents measurable goals for this BMP to be implemented and assessed during the permit term.

Year	Implementation	Assessment
2005	Develop monitoring program for all eligible Industrial and all High-Risk facilities in the City – <u>City pledge:</u> develop by January 1, 2005.	Assess proposed program
2005-2008	Implement monitoring program for all such sites, including water sampling – continuing the program annually – <u>City pledge:</u> implement program by July 1, 2005; continue annually.	Document findings

2005-2008	Initiate compliance actions and issuing of Citations, as necessary— <u>City pledge:</u> enforce compliance actions by January 1, 2006, and continue enforcement actions in all succeeding years.	Document investigation and enforcement activities

Appendix H

Land Disturbance Ordinance



LAND DISTURBANCE ORDINANCE

CONCEPTUAL APPROVAL CHECKLIST

Project Name:		Map ID:	Zoning:
Gross Area (acres):			
Firm Name:		Engineer:	
Address:			
City:		State:	Zip:
Telephone No.:		Fax No.:	
E-mail Address:			
Property Owner:			
Address:			
City:		State:	Zip:
Planning Reviewed By:		Date Received:	
Engineering Reviewed By:		Date Received:	
General Services Reviewed By:		Date Received:	
Fire Reviewed By:		Date Received:	

INITIAL REVIEW - CONCEPTUAL APPROVAL

OVERALL REQUIREMENTS – Whether the Developer's submittal for the concept plan meets all the requirements of the Land Disturbance Ordinance and whether the submittal is complete.

Dev.	Resp.	Munic.
Eng	City	City Code
<u>Check</u>	<u>Check</u>	<u>Dept. Section</u>

Description

☐	☐	Project
☐	☐	Purpose – Project meets the purposes of the Land Disturbance Ordinance
☐	☐	Project meets the requirements for preliminary engineering disturbance
☐	☐	A development map
☐	☐	A development report

Comments: _____

The Developer's submittal (meets) (does not meet) the requirements of the conceptual approval requirements.

Executive Secretary

Date

Date Returned to Developer: _____ Date Sent to Engineer Dept: _____

DETAILED REVIEW - CONCEPTUAL APPROVAL

DETAILED REQUIREMENTS – Whether the Developer's submittal for the concept plan meets all the requirements of the Land Disturbance Ordinance.

PURPOSE – The project meets the purposes of the Land Disturbance Ordinance as follows:

Dev. Resp. Munic.
Eng City City Code
Check Check Dept. Section

Description

☐	☐	Preservation of natural vegetation, geologic features, wildlife habitat and open space.
☐	☐	Minimize the amount of grading
☐	☐	Retention of trees and other native vegetation
☐	☐	Addresses the design and construction of roads in the Land Disturbance Ordinance
☐	☐	Indicates requirements for placement of building sites within the Land Disturbance Ordinance
☐	☐	Provides for grading which will eliminate sharp angles at the top and toe of cut and fill slopes
☐	☐	Identifies street rights-of-way and grades, lot layouts, structure designs that will aid the objective of reducing excavation and natural topographic disturbance.
☐	☐	Provides for cluster type development or similar concepts that will minimize, as far as possible, disturbance of steep or sensitive terrain.
☐	☐	Encourage early temporary or permanent planting wherever appropriate to maintain necessary cut and fill slopes, stabilizing them by plant roots and concealing the raw soil from view.

Comments: _____

SCOPE AND APPLICATION

Dev.		Resp.	Munic.	
Eng	City	City	Code	
<u>Check</u>	<u>Check</u>	<u>Dept.</u>	<u>Section</u>	<u>Description</u>
☐	☐			Project lies within the Land Disturbance Ordinance
☐	☐			Requirements for preliminary engineering disturbance to hillside
☐	☐			Proposals for surveying, testing or other design-related activities are to be submitted to the Zoning Administrator for review and approval. Areas of proposed disturbance are to be staked and the City is to observe staking.
☐	☐			Thereafter the Zoning Administrator and City Engineer can issue a grading permit
☐	☐			All permanent work is to comply with requirements of Land Disturbance Ordinance

Comments: _____

DEVELOPMENT MAP- Provide a Development Map which meets certain requirements (CDD)

Dev.		Resp.	Munic.	
Eng	City	City	Code	
<u>Check</u>	<u>Check</u>	<u>Dept.</u>	<u>Section</u>	<u>Description</u>
☐	☐			A scale of 1" = 1' or
☐	☐			One or two foot contour intervals
☐	☐			Natural slopes of 30-percent or greater color shaded
☐	☐			The proposed development layout including details
☐	☐			Identify any roads that have grades in excess of 8-percent
☐	☐			Native vegetation, type and location shown

Comments: _____

DEVELOPMENT REPORT – Provide a Development Report which meets certain requirements (CDD)

Dev. Eng	City	City	Resp. Code	Munic. Code	Description
<u>Check</u>	<u>Check</u>	<u>Dept.</u>	<u>Section</u>		
☐	☐				Shows the total development area
☐	☐				Indicates the number of lots or units
☐	☐				Indicates the proposed density
☐	☐				Shows the percentage of each use, such as residential, commercial, recreational, transportation, etc.
☐	☐				Provides a statement of justification for the project design
☐	☐				Indicates the Developer has taken the solar orientation of the project into account.

Comments: _____

DEVELOPMENT REQUIREMENTS – Meet the following requirements.

Dev. Eng	City	City	Resp. Code	Munic. Code	Description
<u>Check</u>	<u>Check</u>	<u>Dept.</u>	<u>Section</u>		
☐	☐				Development in General - Slope areas in excess of 30-percent may not be developed. No more than 30-percent of a development's slope areas in excess of 30-percent may be included in the area calculation to determine density. The Planning Commission may modify this requirement based upon specified findings.
☐	☐				Subdivision, Single Family Lots - Minimum lot size and yard requirements of the underlying zone apply except that every lot is to have at least 3,500 sq.ft. of buildable area. Buildable area is where the slope is 30-percent or less, is to be completely contiguous and have a minimum dimension of 50-feet. Dwelling structures are to be located within 250-feet of a public street. All main and accessory buildings are to be built within the buildable area.
☐	☐				PUD's and Dwelling Groups - The density limitations of the underlying zone are to apply except that all buildings are to be built upon the buildable area. Dwelling structures are to be located within 250-feet of a public street, or a private street that has been approved by the Planning Commission. The minimum requirement for common open space is to be 20-percent of the total project area.
☐	☐				Maximum Impervious Material Coverage - The total maximum allowable coverage by impervious material is to not exceed 35-percent of the total project area. Areas of roofs and driveways will be estimated and included in the total impervious surface area.

Comments: _____

The Developer's submittal (meets) (does not meet) the requirements of the detailed conceptual approval requirements.

City Review Engineer

Date _____

Date Returned to Developer: _____

c:\CWJ Development Processing Manual\Manual\Checklist\Checklist-LDO--Concept Plan 10-21-2004



LAND DISTURBANCE ORDINANCE

PRELIMINARY APPROVAL CHECKLIST

Project Name:		Map ID:	Zoning:
Gross Area (acres):			
Firm Name:		Engineer:	
Address:			
City:		State:	Zip:
Telephone No.:		Fax No.:	
E-mail Address:			
Property Owner:			
Address:			
City:		State:	Zip:
Planning Reviewed By:		Date Received:	
Engineering Reviewed By:		Date Received:	
General Services Reviewed By:		Date Received:	
Fire Reviewed By:		Date Received:	

INITIAL REVIEW - PRELIMINARY APPROVAL

OVERALL REQUIREMENTS – Whether the Developer's submittal meets all the requirements of the Land Disturbance Ordinance and whether the submittal is complete.:

Dev.	Resp.	Munic.
Eng	City	City Code
Check	Check	Dept. Section

Description

☐	☐	Meets the requirements of the Conceptual Approval
☐	☐	Meets the requirements of the Subdivision ordinance
☐	☐	A development model
☐	☐	Soils investigation report
☐	☐	Vegetation report
☐	☐	Geotechnical and geological report
☐	☐	Grading and drainage report

Comments: _____

The Developer's submittal (meets) (does not meet) the requirements of the Preliminary Approval requirements.

Executive Secretary

Date

Date Returned to Developer: _____ Date Sent to Engineering Dept: _____

DETAILED REVIEW - PRELIMINARY APPROVAL

DETAILED REQUIREMENTS – In addition to the information required as part of the subdivision or planned unit development process, additional requirements may be required as part of the Land Disturbance Ordinance ordinance. All reports submitted are to be prepared by persons licensed to practice their specialty or expertise in the State of Utah, if such license for practice is required. The City Engineer may obtain the advice of other experts on the adequacy of the reports submitted and the validity of the conclusions and recommendations reached in the reports. In such cases the City Engineer may consult with such experts, with the reasonable costs of these consultations to be borne by the developer. The Developer is to provide the following:

SCOPE AND APPLICATION

Dev.	Resp.	Munic.
Eng	City	City
Check	Check	Dept.
		Section

Description



Meets the requirements of the Subdivision ordinance

Comments: _____

PROCEDURE - Proposals for developments within the Land Disturbance Ordinance are to be reviewed and approved by the Zoning Administrator. Projects to be reviewed by the City Engineer, Public Works Department and Water Department.

Dev. Resp. Munic.

Eng Check	City Check	City Dept.	Code Section	Description
☐	☐			Project reviewed by the City Engineer
☐	☐			Project reviewed by the General Services Department
☐	☐			Project reviewed by Community Development Department

Comments: _____

DEVELOPMENT STANDARDS – The Developer is to indicate that all of the items listed below have been taken into account in the project design.

Dev. Eng Check	City Check	Resp. City Dept.	Munic. Code Section	Description
☐	☐			Cut and Fill Slopes - The Developer is to meet the following requirements in this area: Cut and fill slopes subject to Chapter 70 of the Appendix to the UBC will also comply with the following, unless otherwise recommended in an approved soils and geology report: Cut and fill slopes will not exceed 12-feet Cut and fill slopes will not exceed a slope ration of 2 H: 1V, except for special conditions specified in the ordinance. Fill slopes are to not be constructed on natural slopes steeper than 2 H: 1 V
☐	☐			Roadway cut and fill slopes, which are located outside the dedicated public right of way, are to be located within recorded easements providing for slope protection and preservation. The form of the easements is to be acceptable to the City.
☐	☐			Earthwork - The Developer is to meet the following requirements in this area: Clearing and stripping: All surface areas to receive fill are to be stripped of any surface vegetation, topsoil and organics and cleared of any trash and debris.
☐	☐			Subgrade preparation: After the site has been cleared and stripped, the exposed subgrade soils in those areas to receive fill are to be scarified to a depth of 8-inches, moisture conditioned and compacted to the requirements of subparagraph d. (4) "Compaction".
☐	☐			Fill materials: All fill materials are to be earth materials free from organic material and other deleterious materials such as metal, concrete, asphalt and other construction debris. Imported fill material should be non-expansive, granular soils with a plasticity index of 12 or less. Fill material, imported and existing, should not

			contain rocks or lumps over 6-inches, in the greatest dimension, and not more than 15-percent of the material larger than 2 ½-inches in size.
☐	☐	ED	Trenches: Trenches are to be contained within approved rights-of-way, except when OSHA requirements make it necessary to make the trench width wider.
☐	☐	ED	Compaction - Fill material is to be spread and compacted in uniform lifts not exceeding 8-inches in uncompacted thickness. Before compaction begins, the fill material is to be brought to within 2-percent of the optimum moisture content. Each lift should be thoroughly mixed before compaction to ensure a uniform distribution of moisture.
☐	☐	ED	Subgrade – 95 percent
☐	☐	ED	Structural fill – 98 percent
☐	☐	ED	Trench backfill – 95 percent
☐	☐	ED	Trench backfill, top 12-inches under pavement & concrete – 98 percent
☐	☐	CCD	Basement wall backfill – 90 percent
☐	☐	CCD	Excavation for structures: All structures are to bear on well-compacted fill material, or firm, undisturbed natural soil.
☐	☐	ED	Written report: The developer is to submit to the City Engineer for his approval, a written summary report of the completed compaction. The report is to show location and depth of tests, materials used, moisture-density curves, moisture contents and relative density, if appropriate. A Civil Engineer, Geotechnical Engineer, is to prepare the report or Soils Engineer licensed by the State of Utah.
☐	☐	ED	The City Engineer may require additional tests or information, if, in his opinion, the conditions or materials require such information or tests.
☐	☐	CCD	Setbacks - The Developer is to meet the following requirements in this area: Setbacks and other restrictions indicated in this Chapter are minimum and may be increased by the City is deemed necessary for erosion, drainage, access, etc. Retaining walls may be used to reduce setbacks when approved by the City.
☐	☐	CCD	Setbacks from property lines: comply with the UBC
☐	☐	CCD	Setbacks from structures: setbacks between graded slopes (cut or fill) and structures are to comply with the UBC
☐	☐	CCD	Setbacks from faults: No structure is to be located over a fault. Minimum setback is 10-feet but recommendations are required in the geological report.
☐	☐	ED	Vegetation and Revegetation - The Developer is to meet the following requirements in this area: All sites cleared of natural vegetation in the course of construction of offsite improvements are to be replanted with vegetation, which has good erosion control characteristics.

☐	☐	ED	New plantings are to be protected with mulch material, fertilized and watered in accordance with the planting and watering schedule.									
☐	☐	ED	The planning and installation of revegetation cover for the total development site is to be supervised by persons/firms, having expertise in the practice of revegetation. This includes landscape architects, nurserymen and certified erosion control specialists.									
☐	☐	ED	Vegetation is to be removed only when absolutely necessary, e.g. for the construction of buildings, roads and filled areas, as approved by the City Engineer.									
☐	☐	ED	Storm water inlets are to be protected to prevent sediment-laden water from entering the storm water system.									
☐	☐	ED	Geology - The Developer is to meet the following requirements in this area:									
☐	☐	CCD	No structures are to be built on or within 10-feet of any identified faults.									
☐	☐	CCD	No structures or improvements are to be allowed on any area known to be within an active landslide area									
☐	☐	CCD	Problems related to perched or shallow ground water are to be identified and mitigated.									
☐	☐	CCD	Structures are not allowed within rockfall zones.									
☐	☐	ED	Fire Protection - The Developer is to meet the following requirements in this area:									
☐	☐	ED	Footing and foundation permits will not be issued until work on the water system has commenced. A full building permit will be issued only when the water system is completed and operational to provide fire protection.									
☐	☐	FD	The Fire Department is to review each development site proposal and each building permit application to determine whether it complies with the UBC.									
☐	☐	CCD	Restrictive covenants are to not require the use of wood shakes or wood exterior siding in the Land Disturbance Ordinance.									
☐	☐	ED	Streets and Right of Ways - The Developer is to meet the following requirements in this area:									
☐	☐	ED	The City’s design and construction standards apply except for the items listed below.									
☐	☐	ED	Design requirements:									
			<table><tr><td><u>Normal</u></td><td></td><td><u>Permissible Exception</u></td></tr><tr><td>Road grade</td><td>10% max.</td><td>No exceptions</td></tr><tr><td>Road grade at street intersections</td><td>5% max.</td><td>As determined by the Planning Commission</td></tr></table>	<u>Normal</u>		<u>Permissible Exception</u>	Road grade	10% max.	No exceptions	Road grade at street intersections	5% max.	As determined by the Planning Commission
<u>Normal</u>		<u>Permissible Exception</u>										
Road grade	10% max.	No exceptions										
Road grade at street intersections	5% max.	As determined by the Planning Commission										
☐	☐	ED	Streets, roadways and private access ways are to follow the natural terrain, as nearly as possible.									
☐	☐	ED	The maximum amount of impervious surface area for streets is to be 20-percent of the entire development site.									
☐	☐	ED	Access points are to be provided to all developed and non-developed areas for emergency and fire fighting equipment.									

☐	☐	CCD	Trail access is to be provided from development sites, which are located near well-established canyon trails.
☐	☐	ED	All fill slopes must be contained within the right-of-way, even for roadways whose right-of-way width has been reduced to the minimum 45-foot width.
☐	☐	ED	Appropriate sight triangles are to be observed, except as waived by the Planning Commission.
☐	☐	ED	Variations to the City's design and construction standards may be developed to solve special hillside visual and functional problems but must be approved by the Planning Commission.
☐	☐	ED	The maximum street grades or rights-of-way is to be 12-percent, except as provided hereafter.
☐	☐	ED	The provisions of this Chapter are to not apply to streets or rights-of-way already constructed or which the City has already approved.
☐	☐	ED	Roads are to be designed to meet the City's Road and Bridge Design and Construction Standards.
☐	☐		Trails - The Developer is to meet the following requirements in this area:
☐	☐	CCD	Trails – a system of public recreational pathways located within the City for use by the public.
☐	☐	CCD	The developer is to dedicate and improve trails necessary to provide public access to public lands and other trails shown on the City or Counties' master plans or required by the Planning Commission. Trails are to be located so that the route is feasible for both construction and long-term maintenance. Side slopes are to not exceed 70-percent and rock cliffs and other insurmountable physical obstructions are to be avoided. The specific location of the trail is to be field verified before approval of the subdivision. The amount of land required for trail dedication is to not exceed 5-percent of the land within the subdivision excluding trails located within the standard street right-of-way. The developer is to not be compensated for land required for trail dedication. (<i>CDD – Planner, ED – Engineer</i>)
☐	☐	CCD	Corner Canyon – Is the project in Corner Canyon. If it is the Developer is to meet the following requirements in this area: The City recognizes the Corner Canyon area to be a unique resource that should be acquired and preserved for the community. Special considerations may be required for any development within the canyon area. Once a development application is submitted to the City for property involved in this area, the City has 90-days from the date of the application to determine whether the City wishes to acquire property under this subparagraph.
☐	☐	CCD	Architectural Design – The Developer is to meet the following requirements in this area: The design of buildings in the Land Disturbance Ordinance is encouraged to be visually compatible with the natural beauty of the foothills and canyon areas.

☐	☐	CCD	Materials for buildings and fences are to blend with the natural beauty of the natural setting.
☐	☐	CCD	The Planning Commission may review the design and comment on the specified exterior materials and colors for all structures other than single-family dwellings.
☐	☐	BD	Exposed foundation walls are to not exceed 4-feet above finished grade at any point.
☐	☐	BD	On Site Development - The property owner is to be fully responsible for making all improvements in accordance with the development site approval, e.g. drainage, erosion and vegetation requirements.

Comments: _____

DEVELOPMENT MODEL – Provide a development model

Dev. Eng	City	City	Resp. Munic. Code	Description
<u>Check</u>	<u>Check</u>	<u>Dept.</u>	<u>Section</u>	
☐	☐	CCD		To a scale as determined by City staff
☐	☐	CCD		With two-foot contour intervals
☐	☐	CCD		Shows natural slope of 30-percent or greater, color shaded
☐	☐	CCD		Indicates the proposed development layout showing details

Comments: _____

SOILS INVESTIGATION REPORT - The Developer is to provide a separate report for review by City staff. This report is to contain the following:

Dev. Eng	City	City	Resp. Munic. Code	Description
<u>Check</u>	<u>Check</u>	<u>Dept.</u>	<u>Section</u>	
☐	☐	ED		The stamp and signature of a Soils Engineer, registered in the State of Utah, on the first interior page of the report.

☐	☐	ED	The nature, distribution and classification (Unified Soil Classification) of existing soils to the appropriate depth of influence by the proposed development, but not less than ten feet deeper than the proposed excavations or to bedrock.
☐	☐	ED	The strength of existing soils, bearing capacity of supporting soils, settlement estimates, lateral pressures and trench excavation limitations
☐	☐	ED	An indication of ground water levels that may affect development and the estimated elevation of high ground water levels.
☐	☐	ED	Appropriate laboratory testing for classification, consistency, strength and consolidation conditions.
☐	☐	ED	Indicates the slope stability
☐	☐	ED	Provides information about potential frost action based on material type and groundwater level
☐	☐	ED	Indicates the frost depth
☐	☐	ED	Includes a discussion of geologic and hydraulic hazards, unless described in paragraph (4) and (5) below entitled Geotechnical and Geological Report and Grading and Drainage Report.
☐	☐	ED	Includes a verified written statement by the persons or firm preparing the soils report describing the general suitability of the site for the Owner's intended use. Identify the soil constraints to development and further stating in his professional opinion, the ability of the proposed development plan to mitigate and/or eliminate said constraints in a manner as to prevent hazards. The report is to include: critically expansive soils, high water table, organic soils, liquefiable soils, collapsible soils, or other soil problems. The City may require a soils investigation of each lot in the subdivision.

Comments: _____

VEGETATION REPORT – The Developer is to provide a separate report for review by City staff. This report is to contain the following:

Dev. Eng	City Check	Resp. City	Munic. Code Section	Description
☐	☐	ED		The stamp and signature of a certified erosion control specialist or registered landscape architect on the first interior page of the report. The Landscape Architect is to have a minimum of 5 years

experience in erosion and revegetation related work. The Developer is to obtain City approval of the professional to be used for this effort and reserves the right to approve or reject individuals submitted.

☐	☐	ED	A map showing the location and identification of existing vegetation
☐	☐	ED	A map indicating the vegetation to be removed and a description of the method of disposal
☐	☐	ED	The vegetation to be planted to replace the amount and type being removed.
☐	☐	ED	The slope stabilization measures to be installed
☐	☐	ED	An analysis of the environmental effects of such operations including effects on slope stability, soil erosion, water quality, wildlife and fire hazard.
☐	☐	ED	The topsoil stockpile areas for restoration of topsoil following completion of construction will be designated.

Comments: _____

GEOTECHNICAL AND GEOLOGICAL REPORT - The Developer is to provide a separate report for review by City staff. This report is to be prepared whenever a proposed development:

- (a) Lies within 1,000 feet of an identified fault, or
- (b) Is located above the Bonneville level of ancient Lake Bonneville or elevation 5,200 feet, or
- (c) Is located on slopes greater than 25-percent, or
- (d) Is determined to have potential hazards by the City Engineer, County Geologist or State Geologist.

The Geotechnical and Geological Report is to be prepared by a geotechnical engineer licensed in the State of Utah and licensed professional geologist and is to include:

Dev. Eng	City Check	Resp. City Dept.	Munic. Code Section	Description
☐	☐	ED		The stamp and signature of the registered geotechnical engineer and geologist who prepared the report. These stamps and signatures are to be on attached to the first interior sheet of the report.
☐	☐	ED		A geologic map showing topography, surface and subsurface geologic features and any geologic limitations to the proposed use.
☐	☐	ED		Depth to bedrock
☐	☐	ED		Geologic hazards
☐	☐	ED		Ability for mitigation or elimination of geologic problems
☐	☐	ED		Subsurface investigative logs and reports

Comments: _____

GRADING AND DRAINAGE REPORT – The application for preliminary approval is to include storm water management, erosion, and grading plans describing the methods by which surface water, natural drainages, flooding, erosion and sedimentation loss, and hydrologic hazards will be controlled during and after construction. The plan is to include:

Dev. Resp. Munic.
Eng City City Code
Check Check Dept. Section

Description

☐	☐	ED	Stamps and Signatures of Licensed Professionals – The report prepared is to include the stamps and signatures of the registered professionals who have prepared the report. Their stamps and signatures are to be affixed to the first interior page of the report. The professionals preparing this report is to be licensed professionals in the State of Utah for their respective professions. Those preparing the report are to include: a licensed civil engineer for the grading and drainage portions of the project, a certified erosion control specialist for the erosion and sedimentation loss portions of the work. The City may accept other professionals who have had at least 5 years experience with erosion and sedimentation loss for this portion of the report including landscape architects and civil engineers. The City reserves the right to accept or reject personnel submitted to the City for approval
☐	☐	ED	Grading Plan – The report is to include a grading plan for the project. This plan is to show present topography to include elevations, lines and grades including the location and depth of all proposed fills and cuts of the finished earth surfaces using a contour interval of one or two feet
☐	☐	ED	Graded Area – The report is to include the proposed area to be graded, which is to be clearly delineated on the plan
☐	☐	ED	Drainage and Erosion Calculations and Details; Hydrologic Hazards – The report is to include all assumptions, information, calculations and proposed details used for design and construction of debris basins, impoundments, diversions, dikes, waterways, drains, culverts and other water management or soil erosion control measures are to be shown. Drainage calculations are to determine runoff volume and peak discharge using the “Rational Method”, “SCS Curve Number Method”, or appropriate equivalent. Data provided is to include
☐	☐	ED	Rainfall depth, duration and distribution
☐	☐	ED	Watershed slope and drainage area delineation

☐	☐	ED	Land condition or watershed surface
☐	☐	ED	Topography of drainage area
☐	☐	ED	Description of soil conditions of watershed. Erosion calculations are to employ predictions of soil loss sheet erosion using the Universal Soil Loss Equation or appropriate equivalent. Data to be provided should include factors of:
☐	☐	ED	Rainfall intensity and duration
☐	☐	ED	Soil erodibility
☐	☐	ED	Land slope and length of slope or topography
☐	☐	ED	Condition of the soil surface and land management practices in use
☐	☐	ED	Surface cover, grass, woodland, crops, pavements, etc
☐	☐	ED	Erosion Control During Construction – The grading and drainage report will be prepared by the developer in which he will describe the methods intended to be employed to control the erosion increase while in construction.
☐	☐	ED	Interim Stabilization during Construction - The developer/builder is responsible for interim stabilization of all disturbed areas during the period of construction to prevent erosion offsite effects, and for final stabilization once construction is completed. The report prepared will address these issues
☐	☐	ED	Limit of Watershed/100-Year Flood Plain Maps – The report is to include maps of the development site (1"=200'), which define the boundaries of any 100-year flood plain and the limits of the watershed
☐	☐	ED	Existing Drainage Channels/Permits – The report is to a separate map, which indicates the historic drainage channels associated with the project. Existing drainage channels are to remain as historically located except that roads and utilities may be installed across such channels as approved by the Planning Commission and the City Council. Where these channels must be modified, permits must be obtained from the Utah Division of Water Rights and the US Corps of Engineers, as applicable. The developer is to provide proof of such applications to the City. Structures and or lots are to be arranged so as to insure adequate setbacks from all drainage channels based upon the 100-year storm.
		ED	Storm Water Collection Facilities – The report is to show any existing and proposed storm water collection facilities associated with the project. Storm water collection facilities are to be required to be constructed on development sites in accordance with the following:
☐	☐	ED	Such facilities are to be the first improvements or facilities constructed on the development site
☐	☐	ED	Such facilities are to be designed to detain the flows of a 10-year storm, while allowing offsite discharge not to exceed 0.1 cubic feet per second per acre
☐	☐	ED	Such facilities are to be so designed as to divert surface water away from cut faces or sloping surfaces of a fill

☐	☐	ED	Such facilities are to be so designed as to divert surface water away from cut faces or sloping surfaces of a fill
☐	☐	ED	Where drainage channels are required, wide shallow swales lined with appropriate vegetation, rock, or other approved material is to be used instead of cutting narrow, deep drainage ditches.
☐	☐	ED	Flow retarding devices, such as detention ponds, check dams and recharge berms are to be used where practical to minimize increases in runoff volumes and peak flow rates due to development.
☐	☐	ED	Minimize Disturbance of Vegetation Cover – The Developer is to indicate in the report how he intends to minimize the disturbance of vegetative cover within the project. Construction of the development is to be such that it minimizes the disturbance of vegetation cover.
☐	☐	ED	Erosion Control Measures to Reduce Suspended Solids – The report to be prepared is to indicate the erosion control measures, which will be employed at the site, during construction and for the long-term. Erosion control measures on the development site are to be required to minimize the increased suspended solids loading in runoff from such areas. A drainage system is to be designed to control storm water erosion during and after construction.
☐	☐	ED	The report is to indicate that no grading or stripping is to be permitted except as part of a development plan approved by the Planning Commission.
☐	☐	ED	Hydrologic Hazards - A description of any hydrologic hazards associated with the proposed site and adjacent area is required and is to be discussed in the report. Hydrologic hazards might include high water table, surface water impoundments, gradient of the property, flood plains, etc.

Comments: _____

The Developer's submittal (meets) (does not meet) the requirements of the detailed preliminary approval requirements.

City Review Engineer

Date

Date Returned to Developer: _____



LAND DISTURBANCE ORDINANCE

FINAL APPROVAL CHECKLIST

Project Name:		Map ID:	Zoning:
Gross Area (acres):			
Firm Name:		Engineer:	
Address:			
City:		State:	Zip:
Telephone No.:		Fax No.:	
E-mail Address:			
Property Owner:			
Address:			
City:		State:	Zip:
Planning Reviewed By:		Date Received:	
Engineering Reviewed By:		Date Received:	
General Services Reviewed By:		Date Received:	
Fire Reviewed By:		Date Received:	

INITIAL REVIEW – FINAL APPROVAL

OVERALL REQUIREMENTS – Whether the Developer's submittal for the final plan meets all the requirements of the Land Disturbance Ordinance and whether the submittal is complete.

Dev. Resp. Munic.
Eng City City Code
Check Check Dept. Section

Description

☐	☐	ED	Project complies with all requirements of the Preliminary Approval (Preliminary Plat).
☐	☐	ED	Project complies with all requirements for the final plan approval as outlined in the City's ordinances.
☐	☐	ED	A revegetation bond has been submitted.

Comments: _____

The Developer's submittal (meets) (does not meet) the requirements of the final approval requirements.

Executive Secretary

Date

Date Returned to Developer: _____ Date Sent to Engineering Dept: _____

DETAILED REVIEW – FINAL APPROVAL

DETAILED REQUIREMENTS – Whether the Developer's submittal for the final plan meets all the requirements of the Land Disturbance Ordinance.

Dev. Resp. Munic.
Eng City City Code
Check Check Dept. Section

Description

☐ ☐ ED

Project complies with all requirements of the Preliminary Approval (Preliminary Plat).

☐ ☐ ED

Project complies with all requirements for the final plan approval as outlined in the City's ordinances.

☐ ☐ ED

Revegetation Bond - A Revegetation Bond is required for projects in the Land Disturbance Ordinance in addition to the other bonding requirements set forth in the Draper Subdivision Ordinance. The revegetation bond is used to guarantee the completion of revegetation projects, the stabilization of grading sites, cuts and fills and construction of storm water runoff facilities and the construction of recreation space as required in this Section. This bond is to be in an amount equal to 110-percent of the cost of construction of such work and is to continue for 18 months after the completion date of such projects, improvements or facilities.

Comments: _____

The Developer's submittal (meets) (does not meet) the requirements of the detailed final approval requirements.

City Review Engineer

Date

Date Returned to Developer: _____

c:\CWJ Development Processing Manual\Manual\Checklist\Checklist-LDO-Final Approval 10-21-2004

Appendix I

Land Disturbance Ordinance



Engineering Department
8000 South Redwood Road
West Jordan, Utah 84088
(801) 569-5091
Fax (801) 569-5099

LAND DISTURBANCE PERMIT
APPLICATION AND AGREEMENT
Application Fee - \$50.00

Date: _____

Name of Applicant: _____

Mailing Address: _____

(24 HR) Phone: _____ Fax: _____

Please Check One

- ☐ Subdivision
- ☐ Site Plan
- ☐ Other

Location of Land Disturbance: _____

Purpose of Land Disturbance: _____

Cubic Yards _____ Square Feet _____

Please provide the following:

- ☐ Vicinity map showing the site location
- ☐ Property lines, dimensions and bearing of the property
- ☐ Location of existing buildings or structures on the property and adjacent property with 50 feet of property boundary
- ☐ Accurate topography showing contours of the existing and proposed ground elevations
- ☐ The elevations, dimensions, locations, extent, and slopes of all proposed land disturbance activities shown by contours
- ☐ A certification of the quantity and type of material of proposed excavation or fill
- ☐ The estimated starting and completion dates
- ☐ Detailed plans of all drainage devices, walls, cribbing, dams, or other protective devices to be constructed with or as a part of the proposed work
- ☐ Temporary construction entrance and exit plan
- ☐ Type of structure to be constructed on site
- ☐ Erosion Control Plan
- ☐ Revegetation Plan

Conditions of Approval:

1. Applicant shall apply appropriate tackifier to dirt stockpile if requested by the City of West Jordan
2. Applicant shall be responsive to adjacent property owners and will address all concerns expressed in a timely manner
3. Applicant shall maintain all erosion control measures

*The applicant must notify the City Engineer or the Engineering Inspector twenty four (24) hours in advance before any work is started.

*All public roadway signage shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD)

Applicant is required to consult utility companies operating in this area before excavation. In granting this permit City of 'West Jordan makes no representation as to the location of utility facilities in the area to be excavated or the affect of the permitted excavation on said utilities.

Prior to beginning any land disturbance activities there must be property protected by barriers which indicate which trees can and cannot be removed and must be inspected by an Engineering Department inspector.

In consideration for the granting of a Land Disturbance Permit by City of 'West Jordan, the above-named applicant hereby promises (1) to perform the excavation applied for in a professional manner and in conformity with ordinances of City of 'West Jordan and (2) to save harmless City of 'West Jordan, its officers, agents, employees or servant from any and all costs, damages and liabilities that which may accrue or be claimed to accrue by reason of any work performed under a permit issued pursuant to this application.

_____	_____/_____/_____
Signature of Applicant	Date
_____	_____/_____/_____
City Engineer	Date

Appendix J

Land Disturbance Ordinance



Land Disturbance Permit Preconstruction Meeting

Date: _____
Project Name: _____
Project Location: _____
Developer: _____
Developer Engineer: _____
Contractor: _____
(24 HR) Phone: _____ Fax: _____
City Engineer: _____ Phone: (801) 569-5072
City Inspector: _____ Phone: _____

Name	Company	Telephone Number	Function

MEETING AGENDA

Major Elements

1. Erosion Control Plan
2. Revegetation Bond

Personnel

1. Name of Owner Representative responsible for implementation and inspection of erosion control elements
2. Name of Project Manager
3. Name of Construction Representative responsible for the implementation and inspection of erosion control elements
4. Names of Subcontractors
5. Change of personnel

Construction Progress

1. Time and frequency of construction meetings
2. Construction sequencing plan (projected dates)
 - Mobilization
 - Initial disturbance per sub area
 - Sediment controls installed
 - Temporary/permanent seeding
 - Completion of project
 - Final stabilization

Scope of Work

1. Area of disturbance identified
2. Subareas identified

Best Management Practices

1. Limits of disturbance identified
2. Construction entrance
3. Concrete disposal area (notification of concrete supplier)
4. Staging areas
5. Refueling areas

6. Storm drainage patterns and design during construction
7. Sedimentation traps
8. Sedimentation basins capacity and design
9. Protection barriers for stockpile areas for soil
10. Dust control
11. Temporary seeding
12. Permanent seeding

Maintenance Schedule

1. Inspection sheet – A copy of inspection will be given to:
 - Construction office
 - Project Manager
 - City Inspector
2. Scheduled inspections
 - The end of each scheduled work week (one per week minimum)
 - After a Best Management structure is maintained
3. Non-scheduled inspections
 - Within 24-hours prior to anticipated rainfall event
 - Immediately following a rainfall event
 - Daily – in the event of heavy snow melt

Land Disturbance Preconstruction Notes

This notice is to familiarize the permittee, contractors and subcontractors with the general sediment controls and storm water management requirements of all projects. Site-specific requirements contained on the City approved construction plans are in addition to these requirements. Please review your plans and permit thoroughly.

1. Read and follow the sequence of construction shown on the approved plans. Any modification to this sequence must be obtained from the City inspector prior to deviating from the sequence of construction.
2. The limits of disturbance must be field marked prior to any land disturbance.
3. The sediment control measures must be installed prior to or the day of the beginning of land disturbance.
4. Provisions to control dust are to be on-site and operational prior to any land disturbance.
5. A land disturbance preconstruction meeting is required to be held prior to any land disturbance.
6. At the land disturbance preconstruction meeting, a review of the area disturbance and the proposed vegetation to be removed will be reviewed and approved by the City inspector.
7. The permittee must obtain written approval from the City inspector certifying that the limits of disturbance, dust control measures and tree protection are correctly marked and installed or ready to implement prior to commencing any land clearing.
8. The permit is for clearing activities only. Written approval from the City must be obtained prior to any grading work or site development (typically given at the site development preconstruction meeting). A work stop will be issued immediately if grading proceeds without written approval from the City.
9. Sedimentation facilities will remain in good working order through the entire project and until all disturbed soils has been stabilized to prevent erosion. Written approval must be obtained by the City inspector certifying all disturbed areas.
10. All disturbed areas will be reestablished as per the City's effective planting plan within 21-days of reaching final grade.
11. Sedimentation basins and storm water management facilities require mandatory, periodic inspections throughout the construction and until all disturbed areas have been stabilized.
12. Inspection of sedimentation basins and storm water management facilities require regular inspections of not less than 7-days or within 24-hours of a stormwater event or a snow melt. Inspections will be documented by submitting the Land Disturbance, Inspection and Maintenance form. Failure to fill out and submit this form to the City's inspector will result in the issuance of a work stop order until the form has been submitted. Work stop order will not be released until a field inspection by the City's inspector and permittee has been held.

13. Keep streets clean from dirt, mud, and vegetative material at all times.
14. A land disturbance permit does not transfer with a transfer in ownership of the project. The permittee is required to notify the City within 48-hours of any change in ownership or construction management.
15. A land disturbance construction meeting is required if a change in ownership occurs.
16. A copy of these Land Disturbance Preconstruction Notes is required to be posted at the job site at all times. Failure to post said notes will result in a stop work order for the project.
17. Should you have any questions, please contact your assigned City inspector.
18. Additional City requirements: _____
- _____
- _____
- _____

Project Name: _____ Permit No. _____

Project Owner: _____

Printed Name	Signature	Phone No.	Date

Project Owner: _____

Printed Name	Signature	Phone No.	Date

Appendix K

Land Disturbance Ordinance



**Land Disturbance Permit
Erosion and Sediment Control Plan
Inspection and Maintenance Form**
(To be completed every 7-days and within 24-hours
of a rainfall and/or heavy snow melt event)

Project Name: _____
Project Location: _____
Developer: _____
Developer Engineer: _____
Contractor: _____
Name of Contractor's Inspector: _____
Title of Contractor's Inspector: _____

Inspection Date	Reason	Area

Best Management Practice Inspections

Silt Fence – Construction Entrance – Sediment Basin – Catch Basin Inlet Protection –
Staging Area Berms – Swales – Concrete Truck Disposal Area

Area	Best Management Practices	Condition	Date of Maintenance

Best Management Practice – Suggested Corrective Action

Best Management Practice	Description of Problem	Suggested Solution

Appendix L

Land Disturbance Ordinance

APPENDIX L
MUD TRACKING/EROSION CONTROL GUIDELINES
FOR INSPECTORS

Mud Tracking/Erosion Control Guidelines for Inspectors
Photographs of Acceptable/Borderline Situations
Photographs of Non-Acceptable Situations

MUD TRACKING/EROSION CONTROL GUIDELINES FOR INSPECTORS

REQUIREMENT	RESIDENTIAL PROJECT	NON-RESIDENTIAL PROJECT
Project Design and Approval Phase		
<u>Land Disturbance Ordinance</u> – The City will soon be adopting this ordinance, which will require that developers/contractors meet various requirements for the City to meet its UPDES permit.	Applies	Applies
<u>Stormwater Discharge and Stormwater Quality Management Ordinance</u> - The City will soon be adopting this ordinance, which will require that developers/contractors meet various requirements for the City to meet its UPDES permit.	Applies	Applies
<u>Land Disturbance Design and Construction Standards</u> – Engineering staff is in the process of finalizing these standards, which we are hoping to have adopted on March 30, 2004. They address all aspects of land disturbance/grading, mud tracking, erosion control, and revegetation.	Applies	Applies
<u>Storm Water Pollution Prevention Plan (SWPPP)</u> – Each project is required to design a SWPPP by a certified erosion control specialist and have it approved by the City. The project will not be approved until it has a SWPPP.	Applies	Applies
Project Preconstruction Phase		
<u>Preconstruction Meeting</u> – Developer, contractor, construction manager, building and engineering inspectors are to attend the preconstruction meeting for the project construction. Engineering staff will present a ‘Land Disturbance Permit – Preconstruction Meeting’ packet to them indicating City requirements which includes drawings, inspection checklist, etc.	Applies	Applies
<u>Storm Water Pollution Prevention Plan (SWPPP)</u> – As part of the preconstruction meeting, the SWPPP will be reviewed and it will be indicated that the SWPPP must be in place before the contractor can begin construction of the project. This includes limits of disturbance fencing, silt fencing, storm drain inlet protection, and construction entrance/exit(s).	Applies	Applies
Project Construction Phase		
<u>Preconstruction Meeting</u> – Contractor must have attended a preconstruction meeting for the project, met all City requirements, prior to beginning construction.	Applies	Applies
<u>Storm Water Pollution Prevention Plan</u> – During the design and approval process, each project is required to prepare and get approved, a storm water pollution prevention plan (SWPPP) which addresses all erosion control/mud tracking issues. Inspector must review the SWPPP and meet with the contractor on-site, make sure the SWPPP is complete, prior to beginning construction. This will include the following:	Applies	Applies
<u>Limits of Disturbance Fencing</u> – This may be silt fencing but may also be orange construction fencing, depending upon whether water/sediment is anticipated to go in this direction.	Applies	Applies
<u>Silt Fences</u> – Required for areas where known drainage will go. Silt fence allows the water to penetrate the fencing, leaving the sediment on the upstream side of the fence. See Dwg. No. 5100.	Applies	Applies

Construction Entrance/Exit – Contractor must take all of his/her traffic through this type of facility. They may have one or several; it all depends upon their SWPPP. See Dwg. No. 5105.	Applies	Applies
Storm Drain Inlet Protection – Existing storm drain inlets must be protected from sediment entering them. The protection provided will depend on the type of inlet being protected. See Dwg. Nos. 5300, 5315, 5320, 5325, 5330.	Applies	Applies
Other Protection Measures per the SWPPP – Other measures may be required as part of the SWPPP. These measures must also be in place prior to the beginning of construction.	Applies	Applies
Project Roadways – As project roadways are asphalted, they must then be cleaned if they have mud clods or a lot of dirt/debris on these roadways. This may require daily cleaning, or cleaning once, twice, or three times a week. Please see the attached photographs to determine what is acceptable and what is not.	Applies	Does not apply
Adjacent Roadways - No debris/mud tracking is allowed on adjacent roadways during construction. Adjacent roadways must be cleaned if they have mud clods or dirt/debris on these roadways. This may require daily cleaning, or cleaning once, twice, or three times a week. Please see the attached photographs to determine what is acceptable and what is not.	Applies	Applies
SWPPP Maintenance – All measures identified in the SWPPP must be inspected at least weekly and the inspection form turned in to the inspector on the Monday, for the previous week. If it rains or if snow is melting, the SWPPP must be inspected daily and a report prepared and turned into the inspector. Inspectors need to follow up with the contractors to make sure this is happening. Spot inspections of the SWPPP need to be made to check the contractor and corrections made if not being done correctly.	Applies	Applies
Project Final Inspection – A final inspection will be conducted which will involve the Infrastructure Maintenance and Operations Department (IMO) staff and which the contractor will be required to televise the storm drain lines in the project as well as lines adjacent to the project. The contractor will be required to clean out these lines and also clean out any sediment/detention basins affected by the project.	Applies	Applies
Project Warranty Inspection – At the end of the warranty period, the project and affected facilities will again be required to be televised and cleaned as indicated above.	Applies	Applies
Structure Construction Phase		
Individual Lot Ramp – Each lot to be accessed must have a ramp constructed into the lot, which protects the curb, gutter and sidewalk from damage and also acts to prevent mud/debris from being tracked onto paved roadways. These ramps are to be constructed of approved roadbase materials that can later be used for construction of driveways, etc. As these ramps become soiled and begin allowing excess tracking of debris onto the project roadway, they must be cleaned or new roadbase installed to rejuvenate them. See Dwg. No. 5106.	Applies	Does not apply
Storm Water Pollution Prevention Plan – The SWPPP remains in force until all construction is completed within the project, all disturbed areas have been revegetated or otherwise protected from erosion.	Applies	Applies

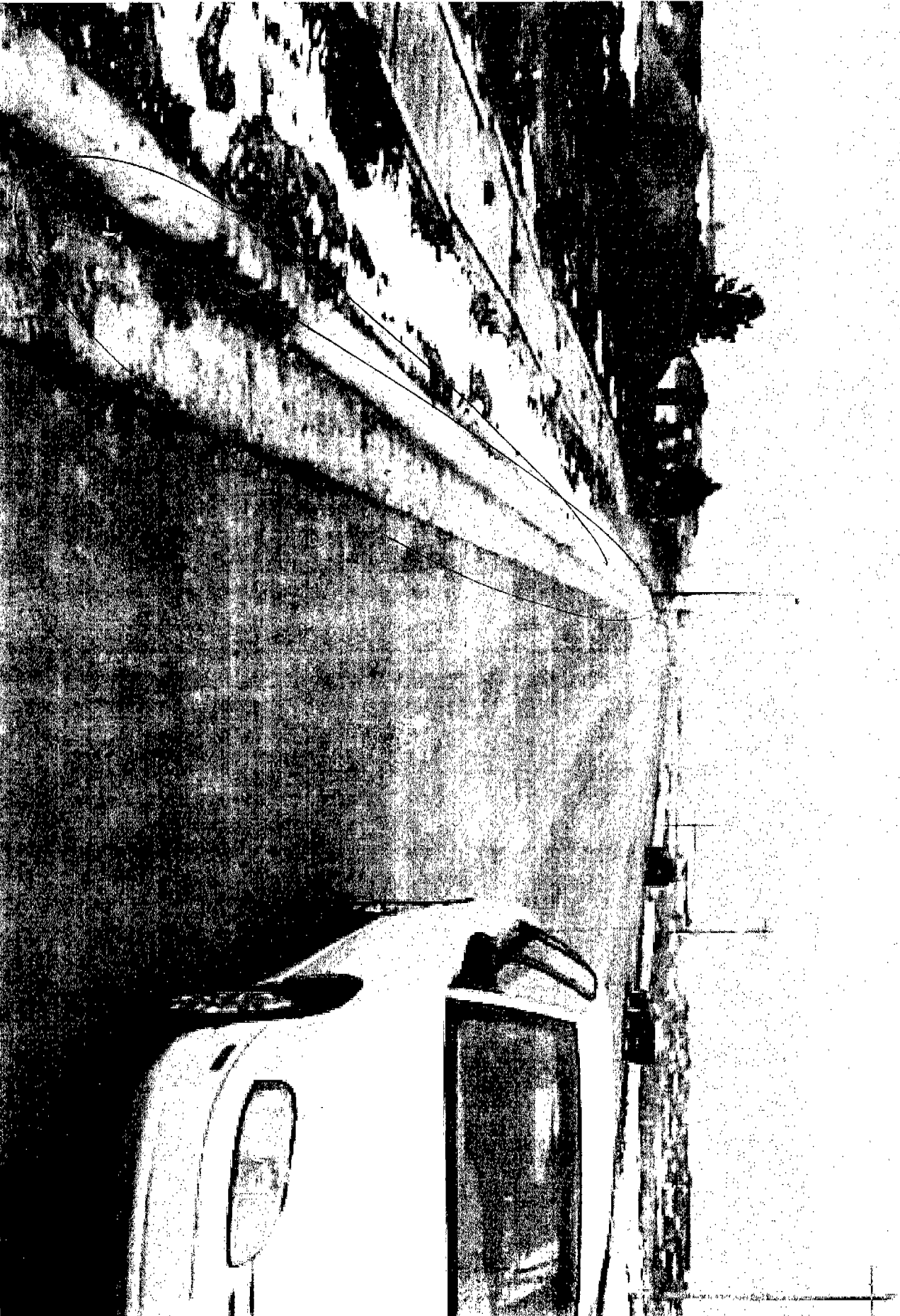
Limits of Disturbance Fencing – These fences must remain in place until all construction is completed.	Applies	Applies
Silt Fencing – These fences must remain in place until the end of the revegetation bond period. A final inspection will be conducted for the revegetation bond, and then these fences may be removed.	Applies	Applies
Construction Entrance/Exit(s) – These must remain in place as long as construction is proceeding. If there are just a few lots left in a subdivision, which has not been constructed on, the project construction entrance/exit may be removed if individual lots are then required to construct an entrance for that specific lot.	Applies	Applies
Storm Drain Inlet Protection – Once the project stormwater system is constructed, additional protection will be required to protect the next inlets and stormwater system. These must be in place and be inspected weekly as was done during the project construction.	Applies	Applies
Other Protection Measures per the SWPPP – The construction of the project stormwater system may also require revisions to the original SWPPP measures to protect the new facilities. The Engineering inspector will make sure the SWPPP is in place once the project final inspection is complete and will visit the project regularly to collect the SWPPP inspection checklists.	Applies	Applies
Project Roadways – Project roadways must be cleaned if they have mud clods or a lot of dirt/debris on these roadways. This may require daily cleaning, or cleaning once, twice, or three times a week. Please see the attached photographs to determine what is acceptable and what is not.	Applies	Does not apply
Adjacent Roadways – No debris/mud tracking is allowed on adjacent roadways during construction. Adjacent roadways must be cleaned if they have mud clods or dirt/debris on these roadways. This may require daily cleaning, or cleaning once, twice, or three times a week. Please see the attached photographs to determine what is acceptable and what is not.	Applies	Applies
SWPPP Maintenance – Maintenance of the SWPPP is required through the end of the revegetation bond period. This includes construction, which is on going during the project and structure construction. The Engineering inspectors will be responsible for collecting the weekly inspection checklists and the Building inspectors will be responsible for addressing mud tracking/erosion control issues as they see them and as they are affected by their inspection activities. All City staff has a responsibility for reporting mud tracking/erosion control issues as they see them.	Applies	Applies
Structure Inspections – If the lot or project is not meeting the requirements of the City's ordinances or their SWPPP, the Building inspectors need to indicate they cannot make the next inspection until the necessary corrections are made. Problems need to be reported to the Engineering inspector responsible for the specific project.	Applies	Applies
c:\CWJ Design and Construction Standards\and Disturbance\Insp. Train.Pres.-Mud Track. 3-5-2004		

**PHOTOGRAPHS OF
ACCEPTABLE/BORDERLINE SITUATIONS**

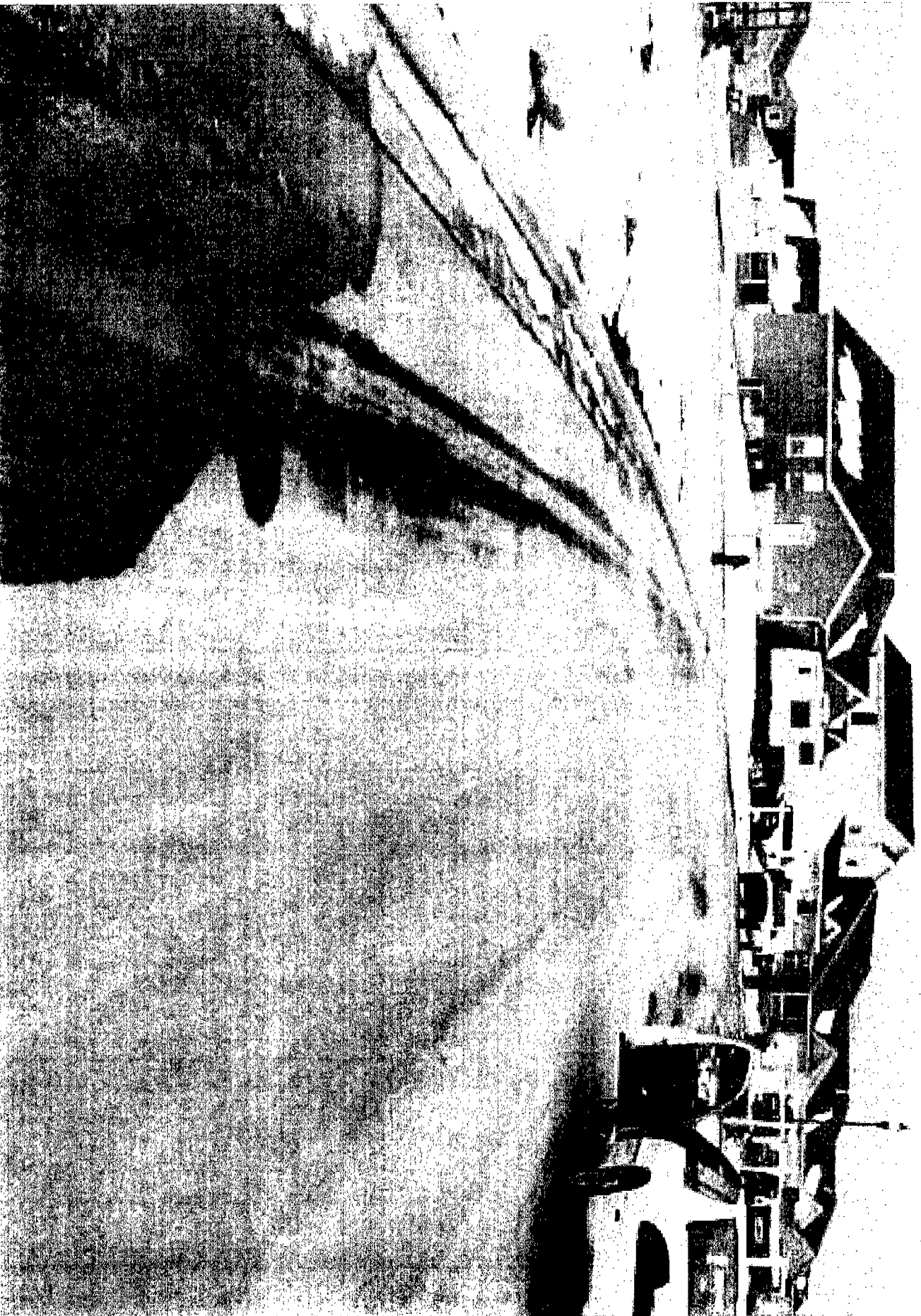
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Case #03H047828



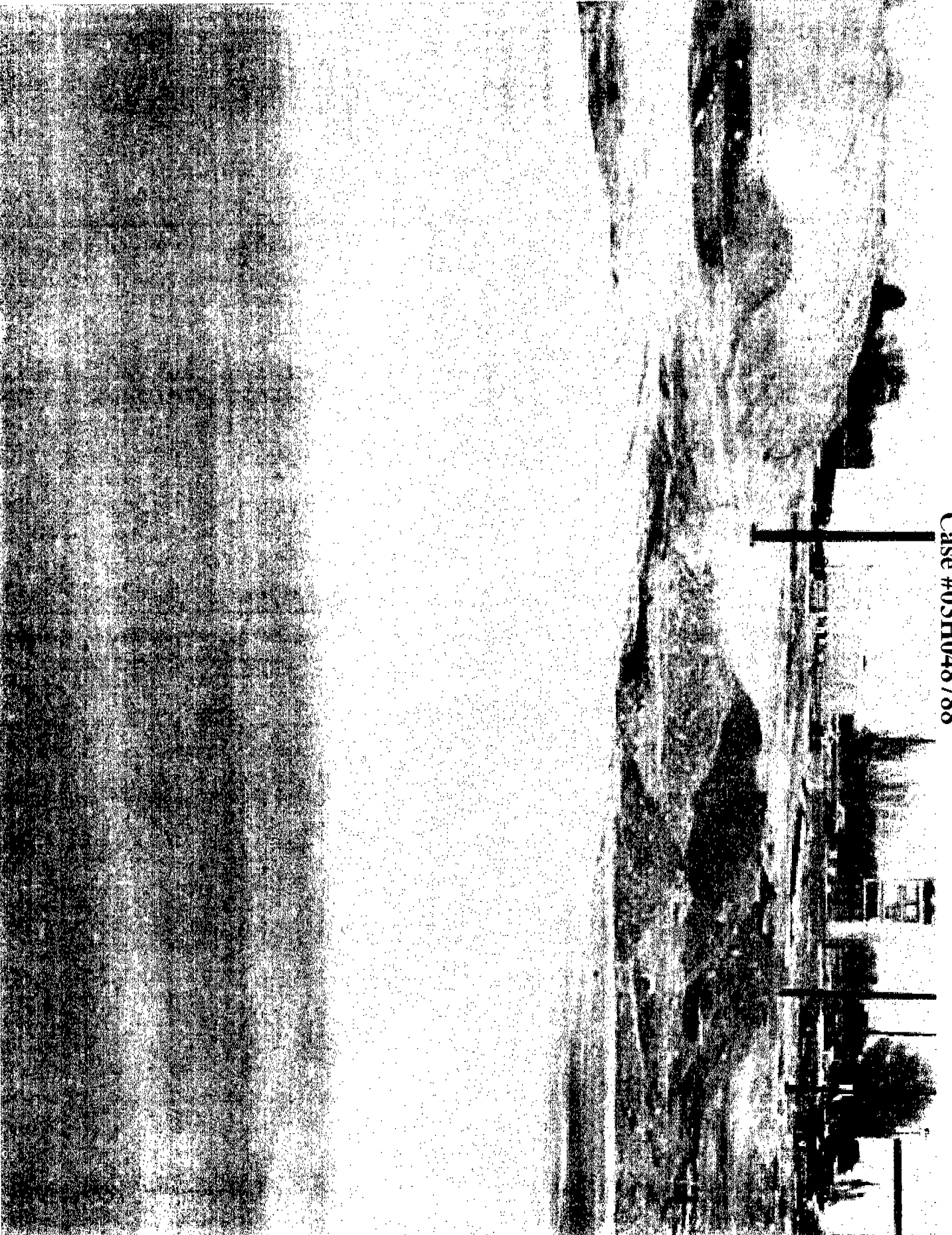
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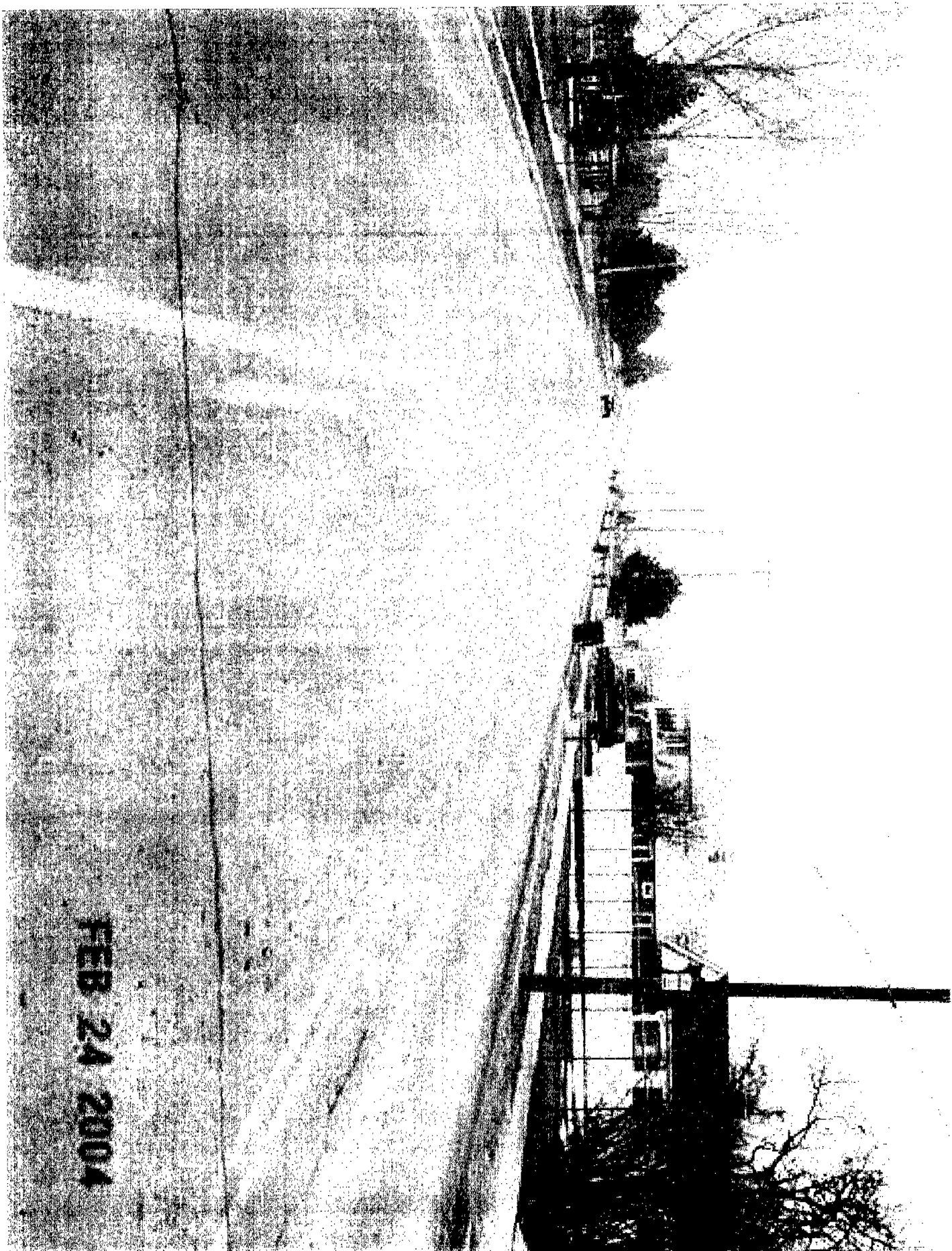


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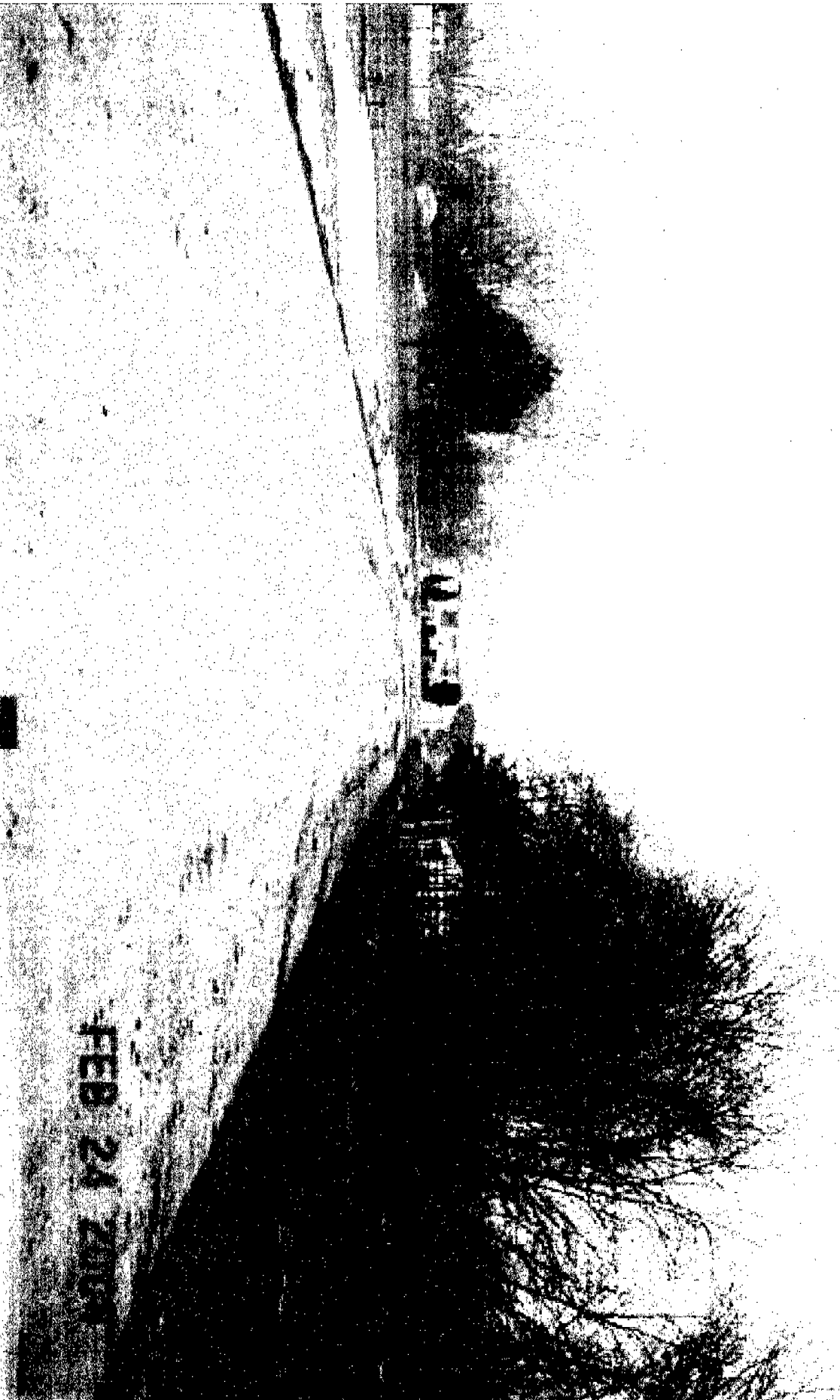
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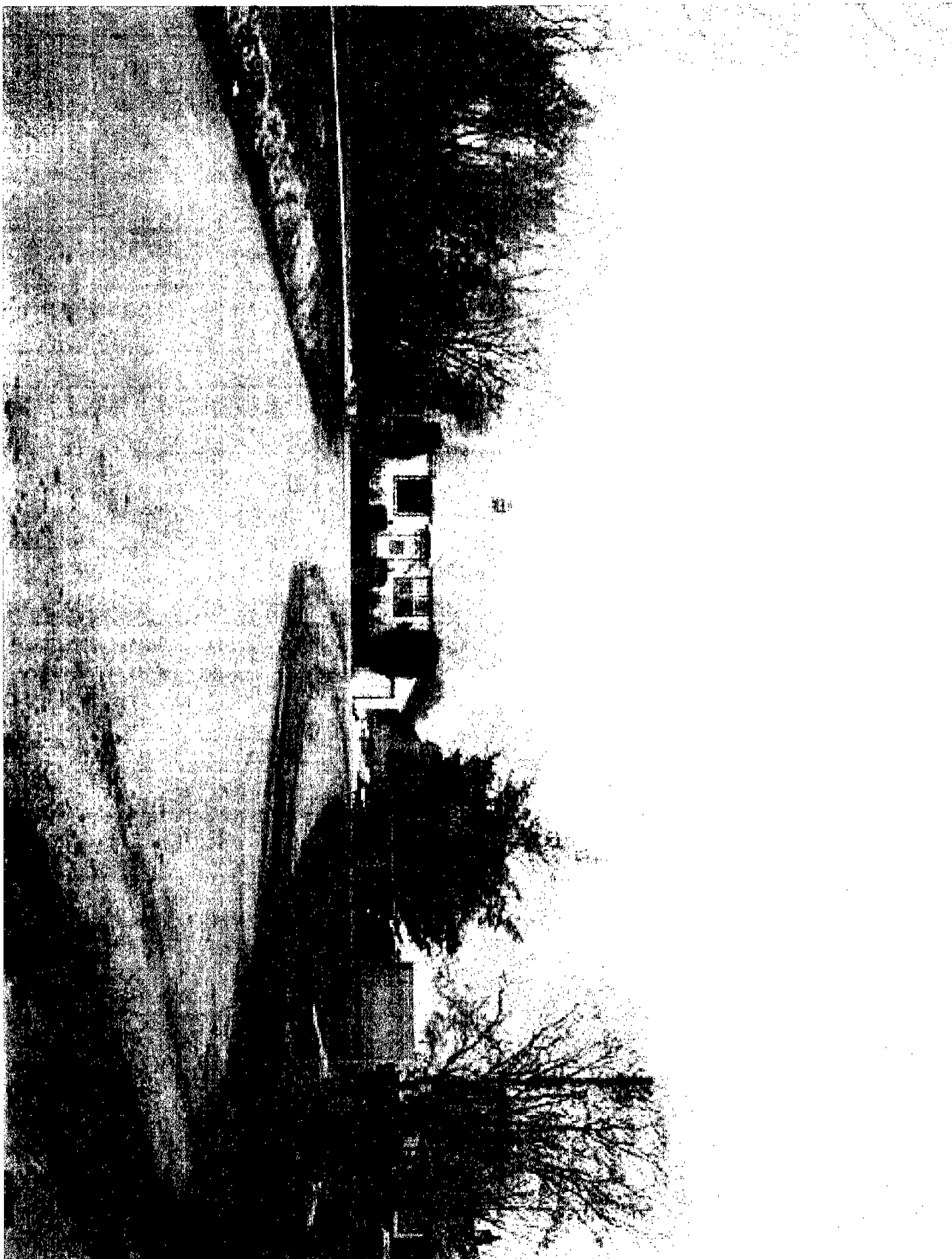


Case #03H048239





Case #04H008077



Case #04H008077



FEB 24 2004

Case #04H008077



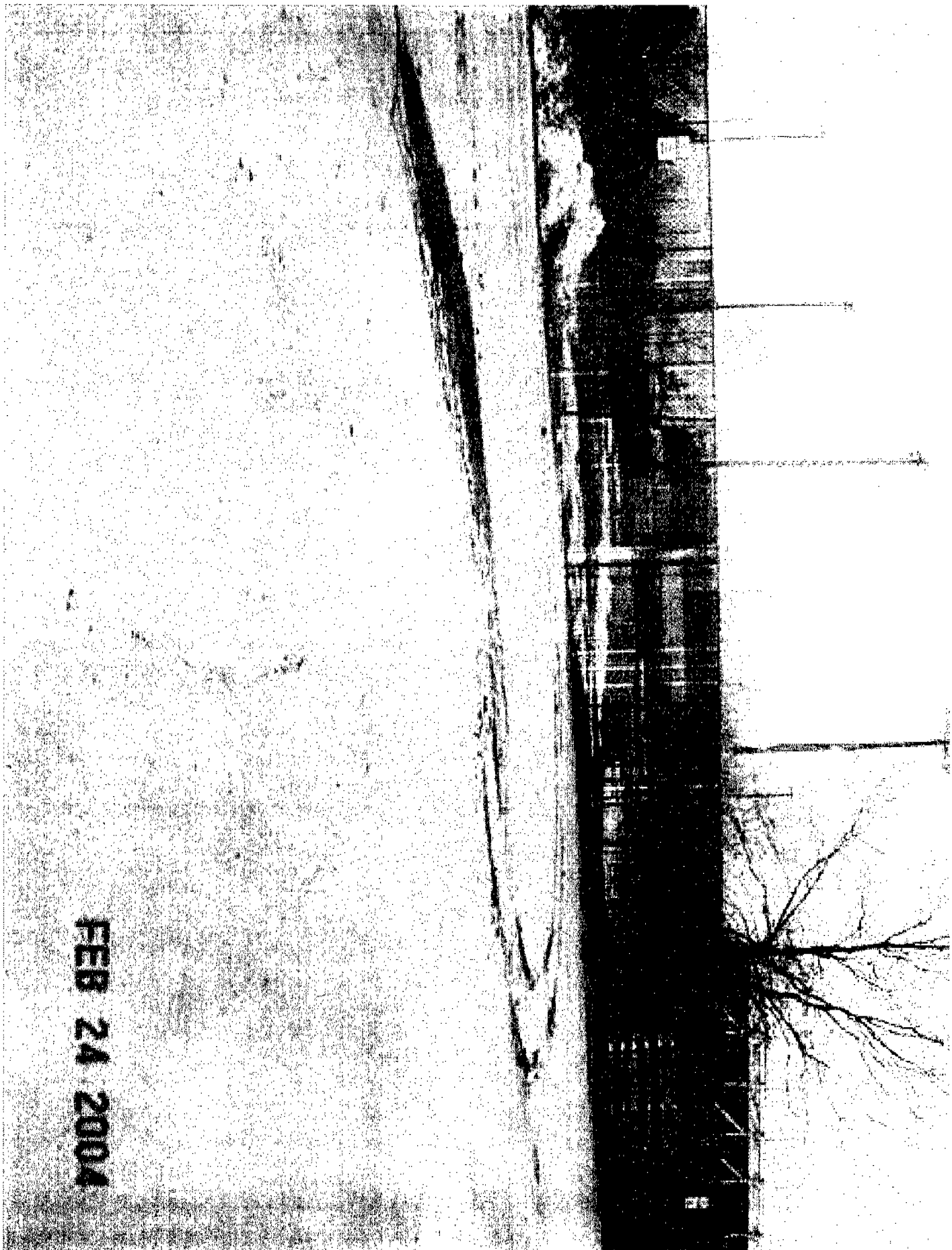
**PHOTOGRAPHS OF
NON-ACCEPTABLE SITUATIONS**

Case #04H008077



FEB 24 2004

Case #04H008077



FEB 24 2004

Case #04H008077



FEB 24

Case #03H048239



Case #03H048785



Case #03H048239



Case #03H048785

