STORMWATER MANAGEMENT PLAN (SWMP)

FOREST LAKES METROPOLITAN DISTRICT RAW WATER INTAKE AND TREATMENT PLANT

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Appendix A – Site Map
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STORMWATER MANAGEMENT PLAN (SWMP)

FOREST LAKES METROPOLITAN DISTRICT – WATER INTAKE AND TREATMENT PLANT

1.0 NAME, ADDRESS, AND TELEPHONE NUMBER OF THE APPLICANTS

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2.0 SITE MAP

See Appendix A for a site map.

3.0 DESCRIPTION OF CONSTRUCTION ACTIVITIES

This project, located in Monument, Colorado, consists of the construction of a 6,600 sq. ft. surface water treatment plant building and associated raw water intake structure which will deliver water from Bristlecone Reservoir to the treatment plant building. The building will house various water treatment systems designed to provide the Forest Lakes Metropolitan District (FLMD) with a drinking water supply. This treatment plant will serve as the FLMD's primary domestic water supply to both the residential and commercial areas which are currently being developed in the immediate vicinity of the treatment plant.

Construction activities associated with the water treatment plant will include to following:

- Installation of a below ground concrete chlorine contact basin.
- Installation of a below ground concrete backwash reclaim basin.
- Installation of various utilities and associated appurtenances including but not limited to a drinking water supply line, backwash reclaim basin piping, gas service line, power, and onsite stormwater drainage infrastructure.

- Construction of an approximately 6,600 square foot water treatment plant building and associated foundations.
- Construction related to site work and landscaping including an asphalt road and parking area, site drainage conveyances, an irrigation system, and plantings.

Construction activities associated with the raw water intake structure will include to following:

- Installation of a below ground pump vault located approximately 1,800 feet west of the water treatment plant which will house pumps and associated appurtenances to deliver raw water from Bristlecone Reservoir to the treatment plant.
- Land disturbing activates will include dewatering of the area in the immediate vicinity of the pump station and an associated excavation to facilitate construction of the pump station.

The total disturbance area associated with the water treatment plant, including temporary disturbance, is expected to be approximately 3.5 acres. The total disturbance area associated with the raw water intake structure, including temporary disturbance, is expected to be approximately 0.7 acres, for an expected total project area disturbance area of 4.2 acres.

The project centroid is located at approximately 39° 3'43.27" North, 104°52'31.93" West. The project is located in Section 27, Township 11S, Range 67W of the 6th Principle Meridian.

The residential and commercial development in the area around this water treatment plant have a separate Grading and Erosion Control Plan. Portions of the project will require construction access to areas outside of the FLMD WTP property boundary. A Temporary Access License Agreement for Construction Access for the FLMD WTP project is provided in Appendix G.

4.0 CONSTRCUTION TIMING

Estimated Project Start Date:	11/30/2017
Estimated End of Construction Date:	10/16/2018
Estimated Final Stabilization Date:	10/16/2018

This project is expected to generally adhere to the following sequence of events:

Pre-Construction Phase – The project is designed and site visits are arranged to determine site-specific BMPs, pre-construction vegetative cover, existing drainages and outfalls, and sensitive features. These features are incorporated into site-specific BMP maps. Site perimeter sediment controls are required prior to initial disturbance.

Construction Phase – GESC drawings are developed to indicate the BMP associated with each phase of construction: initial, interim, and final. During this project, areas will be stabilized through seeding and blanketing as soon as possible due to the proximity to the reservoir.

Construction activities for the water treatment plant are expected to follow the sequence outlined below.

- Establish staging area and vehicle tracking controls and perimeter controls. Install initial perimeter control BMPs (primarily silt fence) downgradient from areas to be disturbed. Install BMPs at existing stormwater inlets around the site. There is no existing topsoil at this site.

- Mobilize equipment and bring construction materials on-site. Install concrete washout areas.

- Clear and grub the site and begin earthwork activities to facilitate construction and installation of the below ground concrete structures. Stockpile soil in designated stockpile areas with perimeter controls around the downgradient side of the pile. Haul any excess material offsite and dispose of legally.

- Once below ground structures are installed begin construction of building, and begin rough grading of site. Stockpile soil in designated stockpile areas with perimeter controls around the downgradient side of the pile. Haul any excess material offsite and dispose of legally.

- Install below ground utility piping, service lines, and stormwater drainage infrastructure. Once stormwater infrastructure is installed install interim phase BMPs around all inlets and within onsite open channel drainage conveyances.

- After installation of below ground utility piping fine grade site in preparation for final site work.

- Install all site work and landscaping times including asphalt roadway, parking area, sidewalks, and driveway.

- Demobilize equipment and install all final stabilization BMPs. Ensure all areas not covered as part of the landscaping plan have been reseeded or stabilized with a non-erosive material.

Construction activities for the raw water intake are expected to follow the sequence outlined below.

- Establish staging area and vehicle tracking controls and perimeter controls. Install initial perimeter control BMPs (primarily silt fence) downgradient from areas to be disturbed. Install BMPs at existing stormwater inlets around the site.

- Clear and grub existing vegetation and strip existing topsoil and stockpile. Stockpile topsoil in designated stockpile area with perimeter controls around the downgradient side of the pile.

- Mobilize equipment and bring construction materials on-site.

- Begin earthwork activities to facilitate construction and installation of the below ground raw water intake structure. Stockpile soil in designated stockpile areas with perimeter controls around the downgradient side of the pile. Haul any excess material offsite and dispose of legally.

- Install a concrete washout or provide adequate signage to notify concrete truck drivers a concrete washout area is located at the water treatment plant construction area.

- Once below ground structure is installed begin construction of pipeline and associated appurtenances to connect the raw water pump station to the existing raw water pipeline. Stockpile soil in designated stockpile areas with perimeter controls around the downgradient side of the pile. Haul any excess material offsite and dispose of legally.

- After installation of below ground utility piping return the site to the existing grades, replace topsoil and reseed or stabilize all disturbed area with a non-erosive material.

- Once all areas have been seeded, continue required inspections until final stabilization is reached and permits may be closed out.

Post-Construction - BMPs will be maintained or modified as needed until final stabilization is achieved. The site-specific figures will be updated to reflect field conditions. After construction has been completed and final stabilization is achieved, all temporary non-biodegradable BMPs will be removed and all appropriate forms will be completed and sent to the applicable regulatory agencies.

5.0 AREAS

The total disturbance area associated with the water treatment plant, including temporary disturbance, is expected to be approximately 3.5 acres. The total permanent disturbance area (area of the site that will be cleared, and excavated or graded) associated with the construction of the water treatment plant is approximately 0.2 acres.

The total disturbance area associated with the raw water intake structure, including temporary disturbance, is expected to be approximately 0.7 acres. The total permanent disturbance area (area of the site that will be cleared, and excavated or graded) associated with the construction of the raw water intake is less than 0.1 acres.

6.0 SOILS INFORMATION

The soils in the vicinity of the water treatment plant and raw water intake structure, as defined by the NRSC soil report, are generally described as sandy loams and have a relatively low Kf factor. The area with Alamosa loam, a clay loam soil, is located south of the disturbance area associated with this project.

The geotechnical report for the site identifies primarily silty sands and clayey sand overburden soil underlain by sandstone bedrock. The thickness of the overburden soils range from approximately 11 to 20 feet.

These soils have moderate infiltration and low runoff potential. Stormwater Best Management Practices (BMPs) will be used to minimize erosion and sediment transport during construction of this project. The soils in the project area, per mapping from the Natural Resources Conservation Service Web Soil Survey (see Appendix B), are summarized in Table 1:

Table 1. Soils in Project Area

Map Unit Symbol	Soil Name	Hydrologic Soil Group	Kf
1	Alamosa Loam 1 to 3 percent slopes	D	0.20
38	Jarre-Tecolote complex, 8 to 65 percent slopes	B	0.10
68	Peyton-Pring complex, 3 to 8 percent slopes	B	0.20
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	0.17

The existing conditions runoff coefficient for the drainage area which includes the water treatment plant, as identified in the 2016 Preliminary and Final Drainage Report for Forest Lakes Filings 2A & 2B is approximately 0.35.

After construction of the water treatment plant, the runoff coefficient for this drainage area is expected to be 0.57.

The total imperious area added to the drainage area associated with raw water intake is less than 200 square feet, and will have negligible effect on the runoff coefficient for this drainage area.

7.0 EXISTING SITE CONDITIONS

The water treatment site is characterized by rolling terrain immediately adjacent to an existing reservoir. Vegetation in the vicinity of the water treatment plant consists of native grasses with approximately 45% vegetative cover. This area was previously disturbed as part of the construction of the now existing well treatment building located immediately south of the proposed water treatment plant. The areas adjacent to this site are generally in an active state of construction as part of the proposed residential development which will be located immediately east of the water treatment plant. Long Valley Drive, located immediately east of the site is currently an undeveloped dirt road.

A portion of the stormwater conveyance associated with the water treatment plant will disturb an existing wetland swale. As a result, disturbance to this area will be covered Nationwide Permit 29: Residential Developments (NWP 29) and a Pre-Construction Notification (PCN) was sent to the U.S Army Corps of Engineers dated August 3, 2017. As stated in the PCN, the Project will result in less than 0.10 acre loss of potential Waters of the U.S., and will not require mitigation.

The raw water intake portion of this project is located along the bank of Bristlecone Reservoir. Vegetation in the area of the raw water intake primarily consists of scrub oak and native grasses with approximately 90% vegetative cover. As identified in the PCN, there are no wetland areas in the vicinity of the raw water intake.

8.0 OTHER POLLUTANT SOURCES

Other pollutant sources which will be considered as part of this project include:

- Vehicle fueling areas,
- Storage of chemicals, and
- Concrete washout water.

Throughout construction, BMPs will be used to control run-on and run-off from and through the site. Perimeter controls will be initiated prior to any disturbance activities occurring. BMPs will be routinely assessed for proper installation and function. Additional non-structural BMPs such as material storage and spill containment and will be added as determined necessary due to site-specific conditions and changes as construction progresses.

9.0 RECEIVING WATERS

Receiving waters for this project include Bristlecone Reservoir and Beaver Creek.

10.0 BEST MANAGEMENT PRACTICES

The following provides a summary of the BMPs that will be used as part of this project to minimize the potential for construction activities to negatively impact the water quality.

10.1 Construction Fence and Construction Markers (All Construction Phases)

Construction fence consists of orange plastic fencing or other accepted material attached to support posts and used to delineate limits of construction and to control access to the construction site. These visual markers will limit the disturbance, protect existing vegetation that is not anticipated to be disturbed, and limit access at the work site. Construction fence and markers will be utilized throughout all phases of the project. Construction will be removed once all construction activities have ceased and the area is awaiting final stabilization.

<u>Key Installation and Maintenance Requirements:</u>

- Steel tee posts will be utilized for support of construction fence.
- Maximum spacing of tee posts is 15 feet.
- Any damaged fence or markers will be repaired on a daily basis.

10.2 Inlet Protection (All Construction Phases)

Inlet protection consists of barrier material placed in front, around, or immediately up-gradient from an inlet or culvert. This project requires protection of existing inlets located on Forest Lakes Drive and Long Valley Drive. The most common forms of inlet protection are wire or fabric socks filled with rock.

Inlet protection will be inspected for damage, structural integrity, proper installation and need for sediment removal. Maintenance includes repairing or replacing as needed, repositioning the protection and/or removing accumulated sediment.

Key Installation and Maintenance Requirements:

- Crushed rock will be fractured face (all sides) and shall comply with gradation shown on Grading and Erosion Control Plan.
- Wire mesh will be fabricated of 10-gauge wire twisted into a mesh with a maximum opening of 1.0-inch (commonly termed "Chicken Wire"). Roll width shall be 48-inches.
- Wire mesh will be secured using "Hog Rings" or wire ties at 6-inch centers along all joints and at 2-inch centers on ends of berm.
- For concentrated flow areas, the ends of the reinforced rock berm will be 12 inches higher than the center of the berm.
- The inspection manager will inspect the reinforced rock berm weekly and during and after any significant storm event and make repairs or clean out as necessary.
- Sediment accumulated upstream of the reinforced rock berm shall be removed when the sediment depth upstream of the rock filter is one half (1/2) the height of the crest.

10.3 Perimeter Control (All Construction Phases)

Perimeter control serves as sediment control and, where appropriate, access control. Perimeter controls will be installed where overland sheet flow has the potential to leave the site or enter a waterway. Perimeter control may consist of any number of BMPs, including, but not limited to rock reinforced berms, sediment control logs, and silt fence. Perimeter control will be used around the downgradient side of work and staging areas where soil is exposed and may be transported offsite or into a waterway. Perimeter control will remain in place until areas adjacent or proximate to controls are stabilized. Perimeter control will be inspected for proper installation, structural integrity and accumulated sediment. Maintenance will include repairing or replacing damaged sections and removing accumulated sediment. Key installation and maintenance requirements are listed under the specific type of BMP used as perimeter control.

10.4 Reinforced Rock Berm (Initial and Interim Construction Phases)

A reinforced rock berm consists of a linear mass of gravel enclosed in wire mesh to form a porous filter, able to withstand overtopping. The berm is heavy and stable and promotes sediment deposition on its upstream side.

Key Installation and Maintenance Requirements:

Key installation requirements for a reinforced rock berm are listed above in Section 10.2.

10.5 Check Dam (Interim Construction Phase)

Check dams or reinforced check dams are temporary grade control structures composed of rock or rock gabions, respectively, placed in existing or temporary drainage channel to help reduce the potential for channel scour. While the primary function of check dams is to help reduce channel flow velocities, check dams provide some water quality benefit by trapping sediment upstream of the impoundment. Check dams will be used during the interim construction phase after grading of the onsite drainage channels have been completed.

Key Installation and Maintenance Requirements:

- Check dams should be placed at regularly spaced intervals along the drainage channel, and be located such that the top of the downstream check dam is at the approximately same elevation as the check dam upstream from it.

- When rock is used, rock should be placed mechanically or by hand, and not dumped into the channel.

- Reinforced check dams should be installed with erosion control fabric underneath and around the perimeter of the check dam to help reduce the potential for undermining of and erosion around the check dam. A rock apron upstream and downstream of the reinforced check dam should be considered if there is noticeable erosion on either side of the structure.

- Sediment deposits upstream of the check dam should be removed once the sediment reaches a depth within ½ of the total crest height.

- After each event check dams should be inspected for void spaces or damage to the gabion wire. Void spaces should be filled with new rock, and gabions should be replaced if damage to the wire mesh is beyond repair and the structural integrity of the gabion is compromised.

10.6 Silt Fence (All Construction Phases)

Silt fence consists of geotextile fabric installed with an anchor trench into the soil and with wooden stakes attached on the downgradient side of the fence material. Wire-backed fence may

be used or additional stakes or lathe may be added for strengthening the fence around corners or in high wind conditions. Silt fence provides sediment control by reducing water velocity and ponding water to facilitate the deposition of sediment on the up-gradient side of the fence. Silt fence applications include, but are not limited to: project perimeter control, secondary containment, back of curb protection and containment for any disturbed or staging area. Silt fence will be inspected regularly for sediment accumulation, tears or holes in the fabric, broken stakes, gaps in the fabric, or areas where the fabric needs to be reattached to the wooden stakes. Maintenance includes repairing the items noted, removing sediment accumulation to keep the silt fence in an effective and operable state, or replacing the fence as needed.

Key Installation and Maintenance Requirements:

- The bottom portion of the silt fence shall be trenched in and compacted so that the silt fence resists being pulled out by hand. Silt fence installation machines that use trenching or slicing may be utilized to install the silt fence.

- Use of road graders, backhoes and similar equipment for installation of silt fence is prohibited.

- The GESC Manager shall inspect silt fence daily and during and after any significant storm event and make repairs or clean out as necessary.

- Sediment accumulated upstream of silt fence shall be removed when the upstream sediment reaches a depth of 6-inches.

- Silt fence shall also be installed following additional criteria listed in Section 10.8

10.7 Vehicle Tracking Control (VTC) (All Construction Phases)

Vehicle tracking control consists of a 12-inch thick rock pad, composed of 3-inch to 6-inch diameter rock, located at all site entrance and exit points, with the intent to help strip mud from tires prior to vehicles leaving the construction site. Access to the site may only occur at a permitted access point, as approved in the Grading and Erosion Control Plans.

Key Installation and Maintenance Requirements:

- Vehicle tracking control pads will be installed at every access point to or from the site.

- Vehicle tracking control pads will consist of hard, dense, durable stone, angular in shape and resistant to weathering. Rounded stone or boulders will not be acceptable. The stones will be approximately 3 inches in average diameter and have a specific gravity of at least 2.6.

- A stop sign installed in accordance with the MUTCD, as amended, will be installed for exiting traffic from the vehicle tracking control pad.

- The inspection manager will inspect the VTC daily and during and after any significant storm event.

The most common maintenance items include the removal of accumulated soil and addition of gravel/rock.

10.8 Sediment Control Log (Initial and Interim Construction Phases)

A sediment control log consists of a net or geotextile fabric filled with straw, excelsior, wood mulch or other fillers. Sediment control log applications include, but are not limited to, slope stabilization, perimeter control, check dams in swales, back of curb protection and temporary secondary containment for stockpiles, materials storage, or masonry. Erosion/sediment control logs reduce water velocity which causes sediment to accumulate on the upgradient side of the log. The general installation method for a net-wrapped sediment control log is to prepare a shallow trench and secure the log in the trench using a stake or landscape pin. Sediment control logs should be installed as shown on the approved Grading and Erosion Control Plans. Logs should be inspected for proper installation, structural integrity and sediment accumulation.

Key Installation and Maintenance Requirements:

- The sediment control log will be trenched into the ground a minimum of 2 inches.

- The GESC Manager will inspect sediment control logs daily and during and after any storm event and make repairs or clean out as necessary.

Additionally both silt fence and sediment control logs will be installed following the criteria listed below:

- Silt fence and sediment control logs shall not be used across swales or drainageways.

- Silt fence and sediment control logs shall be installed along a contour. Silt fence may be shown running up or down slight slopes (up to 5-percent), but shall not be placed in a location where the fence slope exceeds five percent.

- The average upslope length of the area draining to an individual section of silt fence or sediment control log shall not exceed 100 disturbed feet and the total area draining to a section of silt fence or sediment control log shall not exceed 10,000 square feet of disturbed area.

- Silt fence or sediment control logs located transverse to a slope shall be staggered. The end of a downslope section of silt fence or sediment control log shall extend a minimum of 15 feet into the drainage “shadow” of the adjacent upslope section to ensure capture of all approaching sheet flow.

- In all cases, the ends of individual sections of silt fence or sediment control log shall be placed upslope at least one foot higher vertically than the low point in the fence or log.

10.9 Stockpile Management (Initial and Interim Construction Phases)

Stockpile areas for stripped topsoil, excess excavated material, and other materials will be located within the limits of construction and at least 100-feet from the banks of a drainageway or to the maximum extent practicable. Stockpile areas shall be sized to fully contain the material based on maximum allowable stockpile side slopes of 3H:1V. Soils that will be stockpiled for more than 30-days will be seeded and mulched within 14 days of stockpile construction. Topsoil, when present, will be stripped from all disturbed areas of a site, and stockpiled.

10.10 Sediment Basin (Interim Construction Phase)

A sediment basin is a temporary pond built to capture disturbed soil transported from the site. The location of this basin will be located in the same location as the proposed bioretention facility. The basin shall be a minimum of 3,600 cubic feet in size during construction, less than the required final volume of the bioretention facility. Both the bioretention facility outlet works and its connection to the adjacent storm drain network shall be installed prior major grading taking place on-site.

Key Installation and Maintenance Requirements

- Provide a storage volume of at least 3,600 cubic feet per acre of drainage area.
- Install basin with a minimum length-to-width ratio of 2:1 (L:W).
- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- When converting to a permanent bioretention facility, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the facility.

10.11 Concrete Washout (Initial and Interim Construction Phases)

A Concrete Washout Area (CWA) is a shallow excavation with a small perimeter berm to isolate concrete truck washout operations. The washout area shall be combined with a Vehicle Tracking Control pad to control tracking of mud.

Key Installation and Maintenance Requirements:

- Vehicle Tracking Control is required at the access point to the concrete washout area.
- Signs will be placed at the construction entrance, at the washout area, and elsewhere as necessary to clearly indicate the location of the concrete washout area to operators of concrete trucks and pump rigs.
- Excavated material will be utilized in perimeter berm construction.
- The concrete washout area will be inspected weekly and during and after any significant storm event. The concrete washout area shall be repaired and enlarged or cleaned out as necessary to maintain capacity for wasted concrete.
- At the end of construction, all concrete will be removed from the site and disposed of at an approved waste disposal facility.

10.12 Stabilized Staging Area (Initial and Interim Construction Phases)

A Stabilized Staging Area (SSA) consists of stripping topsoil and spreading a layer of granular material in the area to be used for a construction trailer, parking, storage, and unloading and loading of materials. A stabilized staging area reduces the likelihood that the vehicles most frequently entering a site will come in contact with mud.

10.13 Seed and Mulch (Temporary and Permanent Ground Cover) (Interim Construction and Final Stabilization Phases)

Seeding involves the mechanical or hand application of specific seed mixes appropriate for the site location and soil type. Seeding provides plant growth to stabilize the soil reducing the likelihood of erosion or sediment transport. The choice of seed mix will dictate application rates and methods. The approved Seed Mix is listed on the drawings and in Table 2 and Table 3 of this SWMP narrative. Seeding should always be accompanied by an additional BMP, such as mulching, to protect the seed and soil from erosion during the germination and growth process. Seeded areas will be inspected to ensure that the soil stabilization method was applied correctly and has not been compromised. The area will also be inspected for erosion and/or sediment deposition. Maintenance items include regrading and seeding bare or areas of thin vegetative growth and/or adding additional BMPs as appropriate.

Key Installation and Maintenance Requirements:

- All areas to be seeded and mulched must have native or imported topsoil spread to a depth of at least 6-inches (loose depth). All disturbed areas must be loosened to a depth of six inches prior to spreading topsoil. If quantities of on-site topsoil are inadequate to provide a replaced depth of six-inches, topsoil must be imported or existing soil may be amended if approved by the Engineer.

- Soil will be thoroughly loosened (tilled) to a depth of at least six inches prior to seeding. The top six inches of the seed bed will be free of rocks greater than 4-inches and soil clods greater than 2 inches. Seeding over any compacted areas that haven't been loosened to a depth of at least six inches may be rejected.

- Seed must be applied using a mechanical drill to a depth of not less than 1/4-inch and not more than 3/4-inch. Row spacing will be no more than 6-inches. In small or steep areas that are not possible to drill seed, hand broadcast seeding may be allowed at twice the drilled rate, with light raking to cover the seed and crimp mulch.

- Material used for mulch will consist of long-stemmed straw. At least 50 percent of the straw, by weight, will be 10 inches or more in length. Mulch will be applied and mechanically anchored to a depth of at least 4 inches. Mulch will be applied at a rate of 4000 pounds of straw per acre.

- Copies of seed tickets will be provided to the inspection manager upon request and include pure live seed (PLS) percentage.

- Seeded and mulched areas will be inspected for required coverage monthly for a period of two years following initial seeding. Repairs and re-seeding and mulching will be undertaken after the first growing season for any areas failing to meet the required coverage.

10.14 Erosion Control Blankets (Interim Construction and Final Stabilization Phases)

Erosion control blanket is a fibrous blanket of straw, jute, excelsior, or coconut material trenched in and staked down over prepared, seeded soil. The blanket reduces both wind and water erosion. ECB will be used on slopes steeper than 4:1 and may also be used on 4:1 slopes due to the location proximate to a waterbody.

Key Installation and Maintenance Requirements:

- All erosion control blankets and netting will be made of 100% natural and biodegradable material. No plastic or other synthetic material, even if photodegradable, will be allowed.

- In areas where erosion control blanket is shown on the plans, the Permittee(s) will place topsoil and perform final grading, surface preparation and seeding below the blanket in accordance with the requirements of the SWMP, Seeding and Mulching. Subgrade will be smooth and moist prior to blanket installation and the blanket shall be in full contact with the subgrade. No gaps or voids will exist under the blanket.

- A perimeter anchor trench will be used at the outside perimeter of all blanket areas.

- A joint anchor trench will be used to join rolls of blankets together (longitudinally and transversely) for all blankets except 100% straw, which may use an overlapping joint.

- The inspection manager will inspect erosion control blankets weekly and during and after any significant storm event and make repairs as necessary.

10.15 Street Sweeping (Interim Construction Phase)

Soils deposited on paved surfaces will be swept or cleaned as needed to reduce the potential of sediment transport and tracking. Sweeping operations consist of scraping sediment from pavement and/or sweeping, via hand or mechanical means, to remove as much deposited sediment as possible. All streets within and immediately surrounding a construction site will be cleaned of earth material when sediment has been deposited on the roadway and is being tracked off-site due to construction activities associated with the project. Scraped or swept material will not be deposited in the storm sewer. Sweeping and vacuuming may not be effective when soil is wet or muddy. Street sweeping will be performed daily and as needed during active construction.

10.16 Surface Roughening (Interim Construction and Final Stabilization Phases)

Surface roughening consists of grooves or tracks installed in the soil surface, parallel to the slope. This is a temporary soil stabilization technique that works well in areas that will remain inactive for a short time. Surface roughening works by reducing water velocity and promoting infiltration, thus decreasing the potential for erosion to occur. Surface roughening may be applied by creating a continuous furrow parallel to the slope. This can be done with the teeth on a loader bucket, ripping, disking or plowing equipment. Surface roughening can also be created by running tracked equipment up and down the slope. Inspection of surface-roughened areas includes an evaluation of proper implementation, structural integrity and areas of erosion or sediment accumulation. Maintenance for surface roughening may include re-applying the technique or installation of new or additional BMPs.

Key Installation and Maintenance Requirements:

- Disturbed surfaces will be roughened using ripping or tilling equipment along the contour or tracking up and down a slope using equipment tracks.

- The inspection manager shall inspect surface roughening weekly and during and after any significant storm event and make repairs (re-roughen soil or repair rill erosion) as necessary.

10.17 Material and Waste Management (Initial and Interim Construction Phases)

Many potential pollutants other than sediment are associated with construction site activities. Potential pollutants include petrochemicals (oils, gasoline, and asphalt degreasers); construction chemicals such as concrete products and sealers; wash water associated with these products; pesticides (insecticides, fungicides, herbicides, and rodenticides); fertilizers used for vegetative

stabilization; paper; wood; garbage; and sanitary wastes. Construction site management practices for proper chemical control will be followed. If petroleum products are stored onsite they will follow the guidelines listed below:

- Create a shelter around the area with cover and wind protection.
- Line the storage area with a double layer of plastic sheeting or similar material or have double walled tanks or other proper secondary containment.
- Create an impervious berm around the perimeter with a capacity of 110 percent of the capacity of the largest container or provide other appropriate secondary containment.
- Clearly label all products.
- Keep tanks off the ground.
- Keep lids securely fastened.

Additionally, sanitary facilities (portable toilets) will be placed on level surfaces, away from drainageways and inlets. Portable toilets will be anchored to the ground or a trailer.

10.18 Site Management Practices and Spill Response Measures (Initial and Interim Construction Phases)

Good housekeeping will be used to keep areas where pollutants exist clean and orderly. Containers, drums, and bags will be stored away from direct traffic routes to reduce the risk of accidental spills. Containers must be stacked according to manufacturer's instructions to avoid damaging the containers from improper weight distribution. Containers will be stored on pallets or similar devices to prevent corrosion of containers that results from contact with moisture on the ground. Liquids will be stored within curbed areas or secondary containment.

If a spill does occur, then the Construction Project Manager will be notified, the spill will be assessed, the material that has been spilled will be identified and it will be determined whether it can be cleaned up safely. If it is safe to do so, the spill will be cleaned up, contained and properly disposed of. The contractor personnel will receive training to properly clean up spills if they do occur.

11.0 DETAIL DRAWINGS

See the Grading and Erosion Control Plans detail drawings for each Best Management Practice.

12.0 PLANS FOR ALL DRAINAGE FEATURES

See the Grading and Erosion Control Plans for all drainage features.

13.0 FINAL STABILIZATION AND LONG-TERM STORMWATER MANAGEMENT

Final stabilization includes those measures taken to control stormwater pollutants after soil disturbing activities are complete. Practices implemented to achieve final stabilization may include:

- Selection of appropriate seed mix and application methods for areas that are seeded.
- Hardscaping along the stormwater drainage conveyance channel using riprap.
- Maintenance of appropriate erosion and sediment control BMPs, including ECBs and SCLs, and Silt Fence until final stabilization is achieved.
- Removal of temporary BMPs once work is completed and final stabilization is achieved.

Final stabilization is considered to have been achieved when vegetative cover density is at least 70 percent of pre-disturbed levels. The proposed seed mix for the water treatment plant area of the project is the City of Colorado Springs Upland Area Seed Mix shown in Table 2.

Table 2. City of Colorado Springs Upland Area Permanent Seed Mix

Common Name (Variety)	Scientific Name	Seeds/LB	LBs PLS/ Acre Drilled	LBs PLS/Acre Broadcast or Hydroseeded
Sheep fescue	*Festuca ovina*	680,000	0.6	1.2
Canby bluegrass	*Poa canbyi*	926,000	0.5	1.0
Thickspike wheatgrass (Critana)	*Elymus lanceolatus*	154,000	5.7	11.4
Western wheatgrass (Arriba)	*Pascopyrum smithii*	110,000	7.9	15.8
Blue grama (Hachita)	*Chondrosum gracile*	825,000	1.1	2.2
Switchgrass (Pathfinder)	*Panicum virgatum*	389,000	1.0	2.0
Side-oats grama (Butte)	*Boutelou curtipendula*	191,000	2.0	4.0
Annual rye	*Lolium multiflorum*	227,000	10.0	20.0
		TOTAL	28.8	57.6
Wildflowers				
Blanket flower	*Faillardia aristata*	132,000	0.25	0.50
Prairie coneflower	*Ratibida columnaris*	1,230,000	0.20	0.40
Purple prairie clover	*Petalostemum purpurea*	210,000	0.20	0.40
Gayfeather	*Liatris punctata*	138,000	0.06	0.12
Flax	*Linum lewisii*	293,000	0.20	0.40
Penstemon	*Penstemon strictus*	592,000	0.20	0.40
Yarrow	*Achillea millefolium*	2,770,000	0.03	0.06
		TOTAL	1.14	2.28

The proposed seed mix for the raw water intake area of the project is the City of Colorado Springs Transition Area Seed Mix shown in Table 3.

Table 3. City of Colorado Springs Transition Area Permanent Seed Mix

Common Name (Variety)	Scientific Name	Growth Season	Growth Form	Seeds/Lb	Lbs PLS/Acre Drilled	Lbs PLS/Acre Broadcast or Hydroseeded
Sheep fescue (Durar)	*Festuca ovina*	Cool	Bunch	680,000	1.3	2.6
Western wheatgrass (Arriba)	*Pascopyrum smithii*	Cool	Sod	110,000	7.9	15.8
Alkali sacaton	*Spolobolus airoides*	Warm	Bunch	1,758,000	0.5	1.0
Slender wheatgrass	*Elymus trachycaulus*	Cool	Bunch	159,000	5.5	11.0
Canadian bluegrass (Ruebens)1	*Poa compressa*	Cool	Sod	2,500,000	0.3	0.6
Switchgrass (Pathfinder)	*Panicum virgatum*	Warm	Sod/ Bunch	389,000	1.3	2.6
Annual rye	*Lolium multiflorum*	Cool	Cover crop	227,000	10.0	20.0
				TOTAL	26.8	53.6
Wildflowers						
Blanket flower	*Faillardia aristata*	---	---	132,000	0.25	0.50
Prairie coneflower	*Ratibida columnaris*	---	---	1,230,000	0.20	0.40
Purple prairie clover	*Petalostemum purpurea*	---	---	210,000	0.20	0.40
Gayfeather	*Liatris punctata*	---	---	138,000	0.06	0.12
Flax	*Linum lewisii*	---	---	293,000	0.20	0.40
Penstemon	*Penstemon strictus*	---	---	592,000	0.20	0.40
Yarrow	*Achillea millefolium*	---	---	2,770,000	0.03	0.06
				TOTAL	1.14	2.28

The proposed seed mix for the bioretention area of the project is the Urban Drainage and Flood Control Distrcit Native Seed Mix for Rain Gardens (Bioretention) shown in Table 4.

Table 4. Native Seed Mix for Rain Gardens (Bioretention)

Common Name	Scientific Name	Variety	PLS lbs per Acre	Ounces per Acre
Sand bluestem	*Andropogon hallii*	Garden	3.5	
Sideoats grama	*Bouteloua curtipendula*	Butte	3	
Prairie sandreed	*Calamovilfa longifolia*	Goshen	3	
Indian ricegrass	*Oryzopsis hymenoides*	Paloma	3	
Switchgrass	*Panicum virgatum*	Blackwell	4	
Western wheatgrass	*Pascopyrum smithii*	Ariba	3	
Little bluestem	*Schizachyrium scoparium*	Patura	3	
Alkali sacaton	*Sporobolus airoides*		3	
Sand dropseed	*Sporobolus cryptandrus*		3	
Pasture sage	*Artemisia frigida*			2
Blue aster	*Aster laevis*			4
Blanket flower	*Gaillardia aristata*			8
Prairie coneflower	*Ratibida columnifera*			4
Purple prairieclover	*Dalea (Petalostemum) purpurea*			4
		Sub-Totals:	27.5	22
		Total lbs per acre:	28.9	

All disturbed areas will be drill-seeded (or broadcast seeded if drill seeding is not practicable) and crimp mulched within 30 days of initial exposure or within 7 days of substantial completion, whichever is less. Hydroseeding and hydromulching will not be allowed,

Final stabilization is achieved when all ground surface disturbing activities at the site have been completed and uniform vegetative cover has been established and meets the following criteria:

- Three plants per square foot with a minimum height of 3 inches. The 3 plants per square foot must be of the variety and species found in the approved seed mixes.
- There cannot be bare areas larger than 4 square feet present.
- The project site must be free of eroded areas.
- The project site must be free from infestation of noxious weeds.

When final stabilization is achieved, temporary erosion and sediment control measures will be removed.

14.0 CONSTRCUTION STAGING AND SEQUENCING

An overall anticipated construction schedule was provided in Section 4.0 of this Plan. Construction is generally expected to occur in three primary phases, Initial Construction, Interim Construction, and Final Stabilization.

Initial Construction Phase – expected duration: 11/1/2017 to 3/29/2018

The initial construction phase is expected to consist of the construction of below ground facilities including the raw water intake, the chlorine contact basin, and the backwash reclaim basin. During this phase stormwater BMPs will primarily consist of perimeter BMPs (construction and silt fence), VTC's, concrete washout area(s), stockpile management area(s), stabilized staging areas, and protection of existing inlets.

Interim Construction Phase – expected duration: 3/29/2018 to 8/13/2018

The interim Construction Phase will take place after all below ground structures are installed. This phase will include construction of building, rough grading of site, installation of underground utilities and stormwater drainage infrastructure. During this phase stormwater BMPs will primarily consist of perimeter BMPs (construction and silt fence), VTC's, concrete washout area(s), stockpile management area(s), stabilized staging areas, protection of existing inlets, protection of new inlets, and check dams.

Final Stabilization Phase – expected duration: 8/13/2018 to 10/16/2018

After the interim phase is complete the site will be fine graded and installation of permanent hardscaping and landscaping features will be installed, including asphalt roadway and parking lot, sidewalks, sod, landscape vegetation, riprap and final seeding and mulching for all disturbed areas not covered under the landscaping plan.

It is expected that permanent closeout of the Erosion and Stormwater Quality Control Permit will take place a year after the final stabilization phase is complete to allow vegetation to reestablish, expected 10/16/2019.

15.0 OWNER INSPECTIONS

Inspections will take place by the designated inspection manager, who will be designated by the Contractor prior to construction will conduct inspections at least every 14 days and after storm events during active construction. An inspection form, which will be filled out during each inspection is provided in Appendix C.

At a minimum the inspections will consist of the following:

- Inspect the construction site perimeter. Inspector will look for disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants to enter the drainage system. Erosion and sediment control measures identified in the plan shall be observed to ensure that they are operating correctly.

- Based on the results of the inspection, the description of potential pollutant sources, and the pollution prevention and control measures that are identified in the plan shall be revised and modified as appropriate as soon as practicable after such inspection. Modification to control measures shall be implemented in a timely manner, but in no case more than seven (7) calendar days after the inspection.

- The inspection manager shall keep a record of inspections, and inspection forms. Uncontrolled releases of mud or muddy water or measurable quantities of sediment found off the site shall be recorded with a brief explanation as to the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site.

Once construction activities have ceased, the Owner will continue to make inspections at least once every month for sites until planted vegetative cover has become established.

16.0 MAINTENANCE

BMPs shall be maintained in accordance with the BMP factsheets provided in Appendix D of this report. Inspections will take place by the designated inspection manager, and will conduct inspections at least every 14 days and after storm events during active construction. BMPs which are identified as in need of maintenance shall be maintained within 7-days of the date of the inspection. Key installation and maintenance requirements for each BMP are also discussed in Section 10.0 of this Plan.

17.0 SOIL BORINGS/TESTS AND GROUNDWATER

Appendix E provides a copy of the geotechnical report for this Project. The Contractor will be responsible for developing any necessary dewatering plans, obtaining the necessary dewatering permits, and adhering to the requirements of the approved permit.

18.0 COST ESTIMATE

The opinion of probable cost for the installation of erosion and sediment control measures is $84,304 using the El Paso County 2015 Financial Assurance Estimate EC Form (see Appendix F).

19.0 MODIFICATIONS TO THIS SWMP AND THE EROSION AND STORMWATER CONTROL PLANS

It is understood that revisions to proposed or additional BMPs may be required in the event construction site observations indicate that the proposed BMPs are not adequately controlling

erosion, sedimentation or stormwater runoff from equipment fueling/maintenance, material staging areas or other land disturbance activities. Minor field modifications to the Erosion and Stormwater Control Plans may be approved by the permittee inspector. Minor changes include adjustments to BMP field locations or a change to a similar erosion and sediment control BMP to better correspond to actual site conditions or to improve BMP performance. No formal written approval will be required, expect that the inspector shall initial the changes on the on-site copy of the Erosion and Stormwater Control Plans.

All other requested major modifications to the Erosion and Stormwater Control Plans shall be in writing and submitted to El Paso County. Examples of major modifications include changes to temporary drainage pipe sizes or materials, or changes to peak discharges resulting from a change to drainage basin size(s) or characteristics. Changes of temporary BMP types or locations on the site are not considered major modifications.

An onsite copy of the Erosion and Stormwater Control Plans shall be kept on-site at all times, and shall incorporate any field changes made to the locations and type of any proposed or additional BMPs that are identified in the field.

20.0 SIGNATORY REQUIREMENTS

For landowner/authorized agent acknowledging the review and acceptance of responsibility, and for the professional engineer acknowledging responsibility for the preparation of the Stormwater Management Plan, the statements are as follows:

"This Owner will comply with the requirements of the Stormwater Management Plan. I acknowledge the responsibility to determine whether the construction activities on these plans require Colorado Discharge Permit System (CDPS) permitting for Stormwater Discharges associated with Construction Activity"

Owner or Authorized Agent ADAM NICHOLS - DISTRICT MANAGER

Authorized Signature

"This Stormwater Management Plan was prepared under my direction and supervision and is correct to the best of my knowledge and belief. If such work is performed in accordance with the Grading and Erosion Control Plans, the work will not become a hazard to life and limb, endanger property, or adversely affect the safety, use, or stability of a public way, drainage channel, or other property."

Registered Professional Engineer HAYES A. LENHART

State of Colorado No. 46527

(Stamp)

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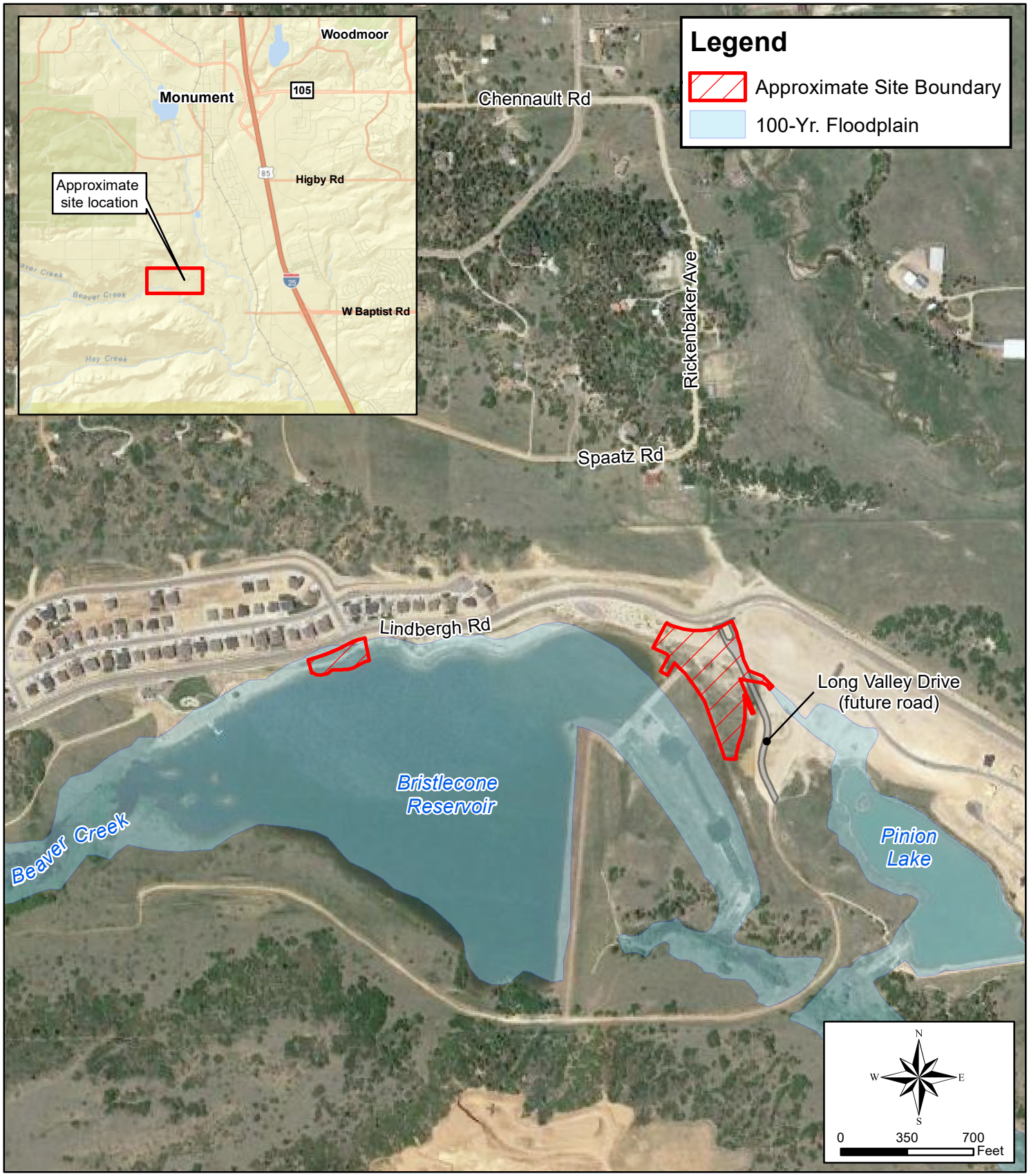
Appendix A



Path: Z:\Project Files\02-03\031-090\031-090.300\CAD-GIS\GIS\01_mxd\Location_Map.mxd

WRIGHT WATER ENGINEERS, INC.

EL PASO COUNTY, COLORADO

LOCATION MAP

FOREST LAKES METROPOLITAN DISTRICT

SECTION 27, TOWNSHIP 11S, RANGE 67W, 6TH P.M.

PROJECT NO. 031-090.300

FIGURE 1

Appendix B

United States Department of Agriculture

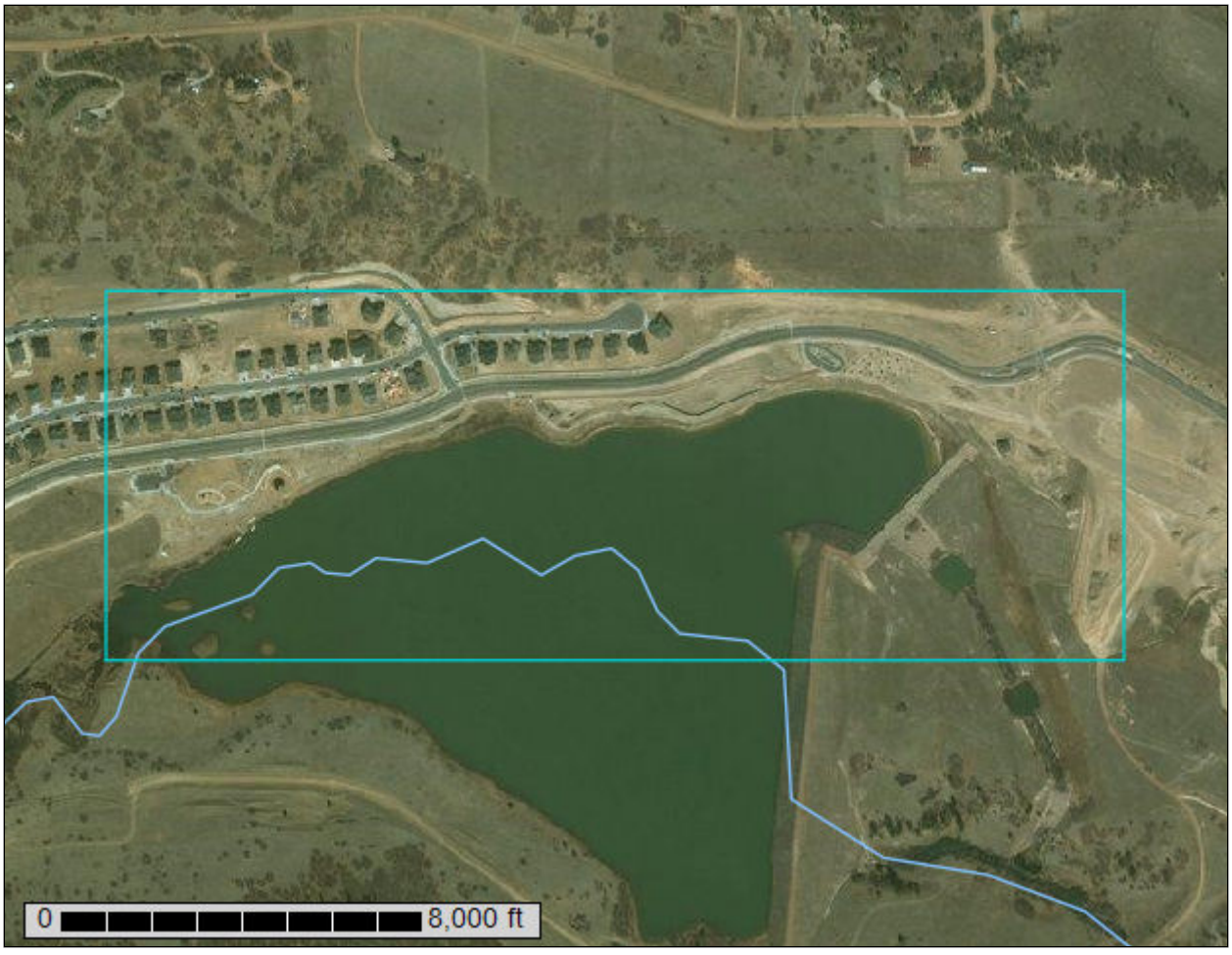
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado

FLMD Water Intake and Treatment Plant Project



August 19, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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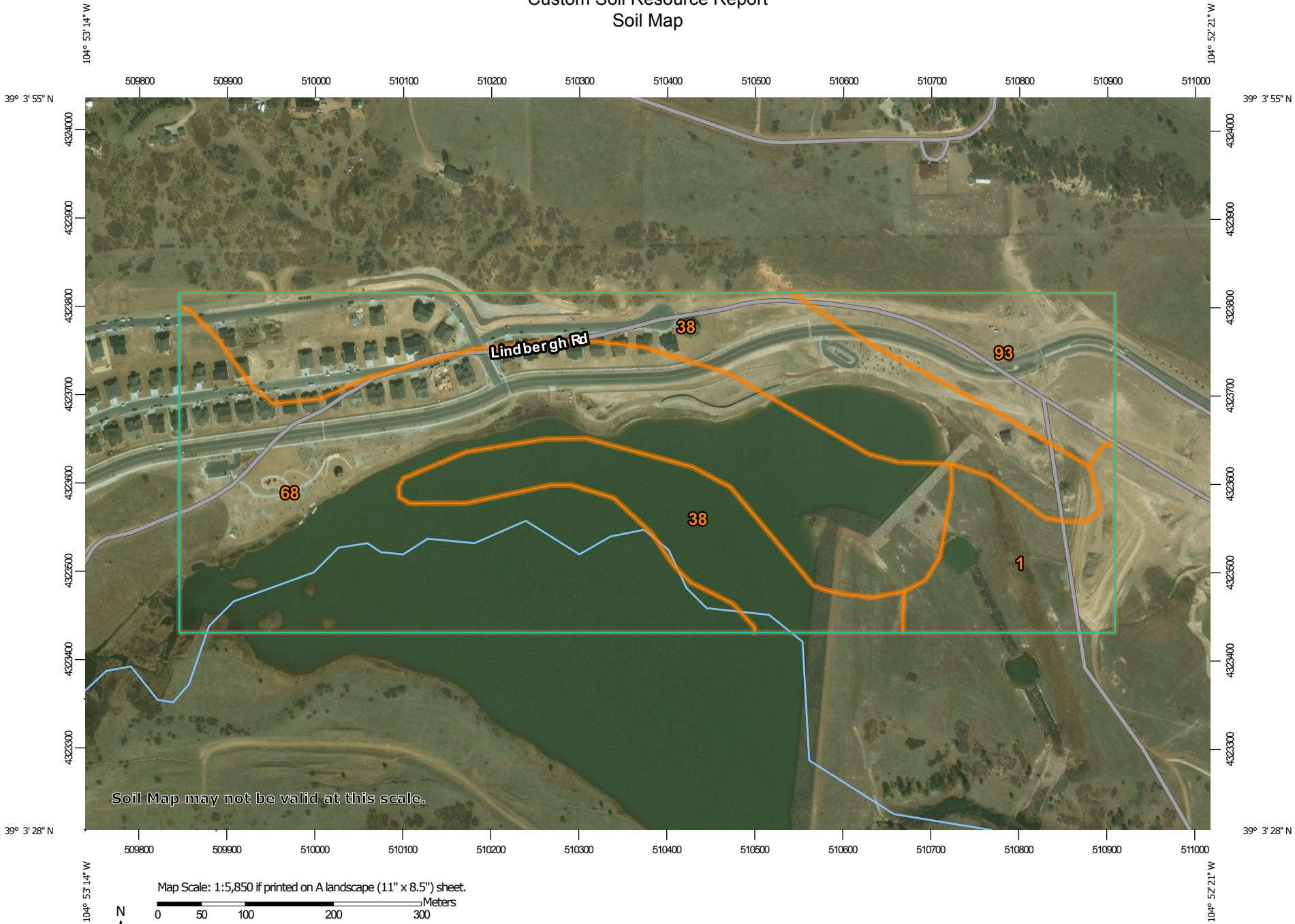
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:5,850 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 22, 2014—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1	Alamosa loam, 1 to 3 percent slopes	8.4	8.2%
38	Jarre-Tecolote complex, 8 to 65 percent slopes	32.5	32.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	50.9	50.2%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	9.7	9.5%
Totals for Area of Interest		**101.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

1—Alamosa loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3670
Elevation: 7,200 to 7,700 feet
Farmland classification: Prime farmland if irrigated and reclaimed of excess salts and sodium

Map Unit Composition

Alamosa and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alamosa

Setting

Landform: Flood plains, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 6 inches: loam
Bt - 6 to 14 inches: clay loam
Btk - 14 to 33 inches: clay loam
Cg1 - 33 to 53 inches: sandy clay loam
Cg2 - 53 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: Mountain Meadow (R048AY241CO)
Hydric soil rating: Yes

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

38—Jarre-Tecolote complex, 8 to 65 percent slopes

Map Unit Setting

National map unit symbol: 368c
Elevation: 6,700 to 7,500 feet
Frost-free period: 90 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Jarre and similar soils: 40 percent
Tecolote and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Jarre

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 5 inches: gravelly sandy loam
Bt - 5 to 22 inches: gravelly sandy clay loam
2C - 22 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 8 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Description of Tecolote

Setting

Landform: Alluvial fans
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 3 inches: very stony loam
E - 3 to 12 inches: very gravelly loamy sand
Bt - 12 to 45 inches: extremely gravelly sandy clay loam
C - 45 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 65 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

68—Peyton-Pring complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369f
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit:
Hydric soil rating: No

Pleasant
Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

93—Tomah-Crowfoot complex, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 36bb
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition
Tomah and similar soils: 50 percent
Crowfoot and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tomah

Setting
Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile
A - 0 to 10 inches: loamy sand
E - 10 to 22 inches: coarse sand
C - 48 to 60 inches: coarse sand

Properties and qualities
Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand
E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Erosion Factors

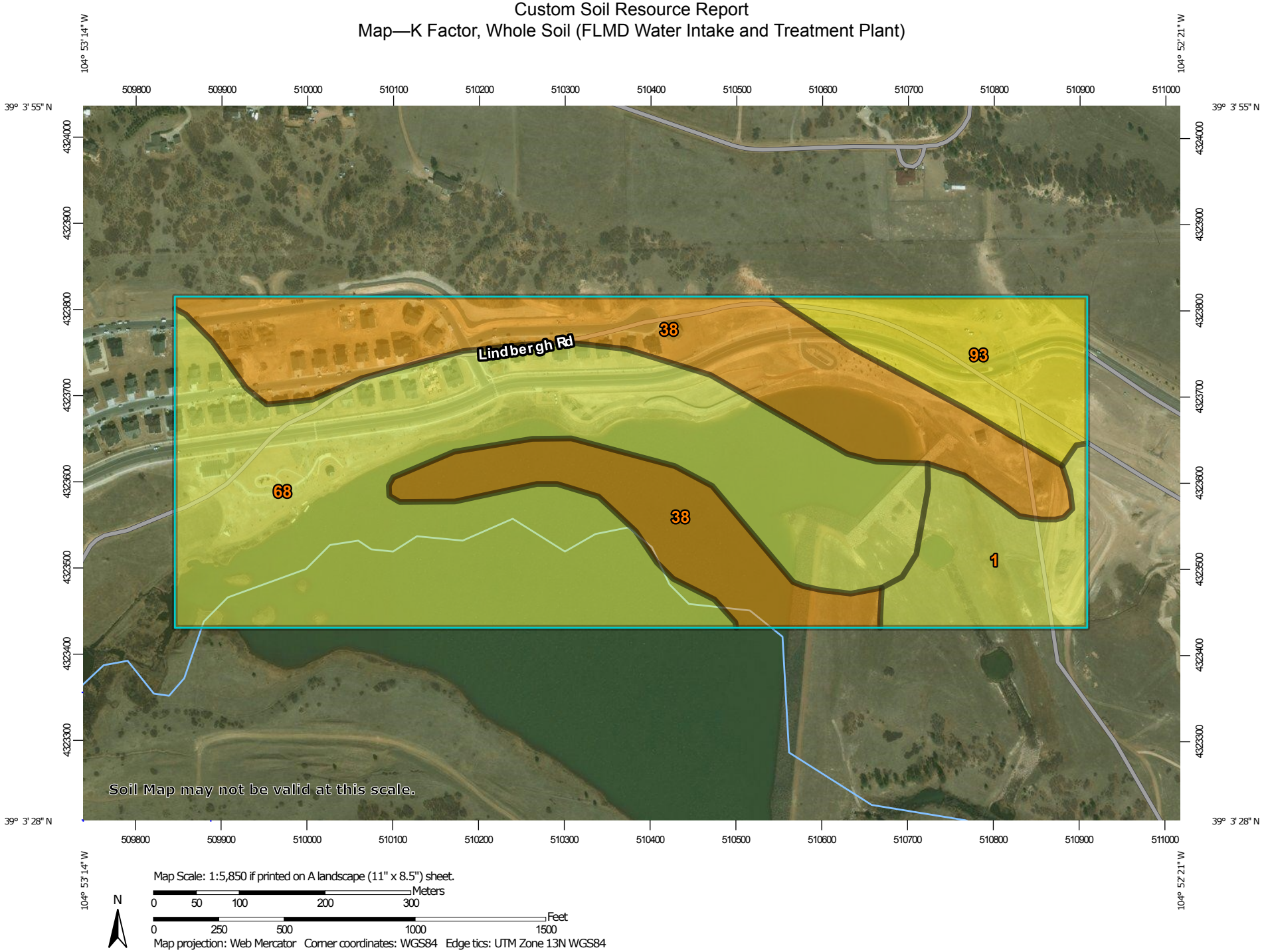
Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

K Factor, Whole Soil (FLMD Water Intake and Treatment Plant)

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Custom Soil Resource Report
Map—K Factor, Whole Soil (FLMD Water Intake and Treatment Plant)



Map Scale: 1:5,850 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Lines

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Soil Rating Points

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
.43
.49
.55
.64
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 22, 2014—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—K Factor, Whole Soil (FLMD Water Intake and Treatment Plant)

K Factor, Whole Soil— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1	Alamosa loam, 1 to 3 percent slopes	.20	8.4	8.2%
38	Jarre-Tecolote complex, 8 to 65 percent slopes	.10	32.5	32.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	.20	50.9	50.2%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	.17	9.7	9.5%
Totals for Area of Interest			**101.5**	**100.0%**

Rating Options—K Factor, Whole Soil (FLMD Water Intake and Treatment Plant)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

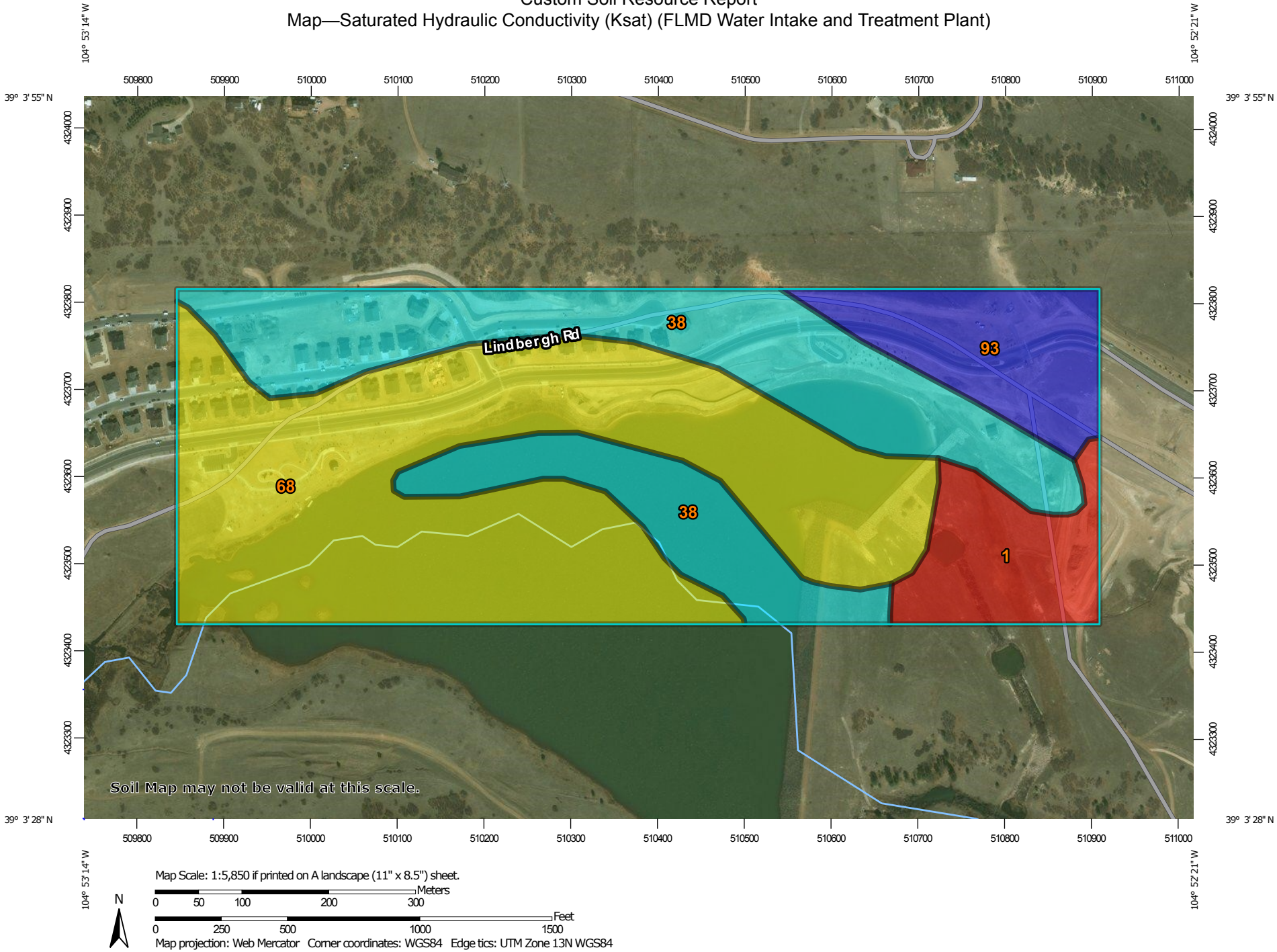
Saturated Hydraulic Conductivity (Ksat) (FLMD Water Intake and Treatment Plant)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat) (FLMD Water Intake and Treatment Plant)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- <= 6.2763
- > 6.2763 and <= 10.4210
- > 10.4210 and <= 20.9276
- > 20.9276 and <= 65.9540
- Not rated or not available

Soil Rating Lines
- <= 6.2763
- > 6.2763 and <= 10.4210
- > 10.4210 and <= 20.9276
- > 20.9276 and <= 65.9540
- Not rated or not available

Soil Rating Points
- <= 6.2763
- > 6.2763 and <= 10.4210
- > 10.4210 and <= 20.9276
- > 20.9276 and <= 65.9540
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 22, 2014—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat) (FLMD Water Intake and Treatment Plant)

Saturated Hydraulic Conductivity (Ksat)— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
1	Alamosa loam, 1 to 3 percent slopes	6.2763	8.4	8.2%
38	Jarre-Tecolote complex, 8 to 65 percent slopes	20.9276	32.5	32.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	10.4210	50.9	50.2%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	65.9540	9.7	9.5%
Totals for Area of Interest			**101.5**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat) (FLMD Water Intake and Treatment Plant)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (FLMD Water Intake and Treatment Plant)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

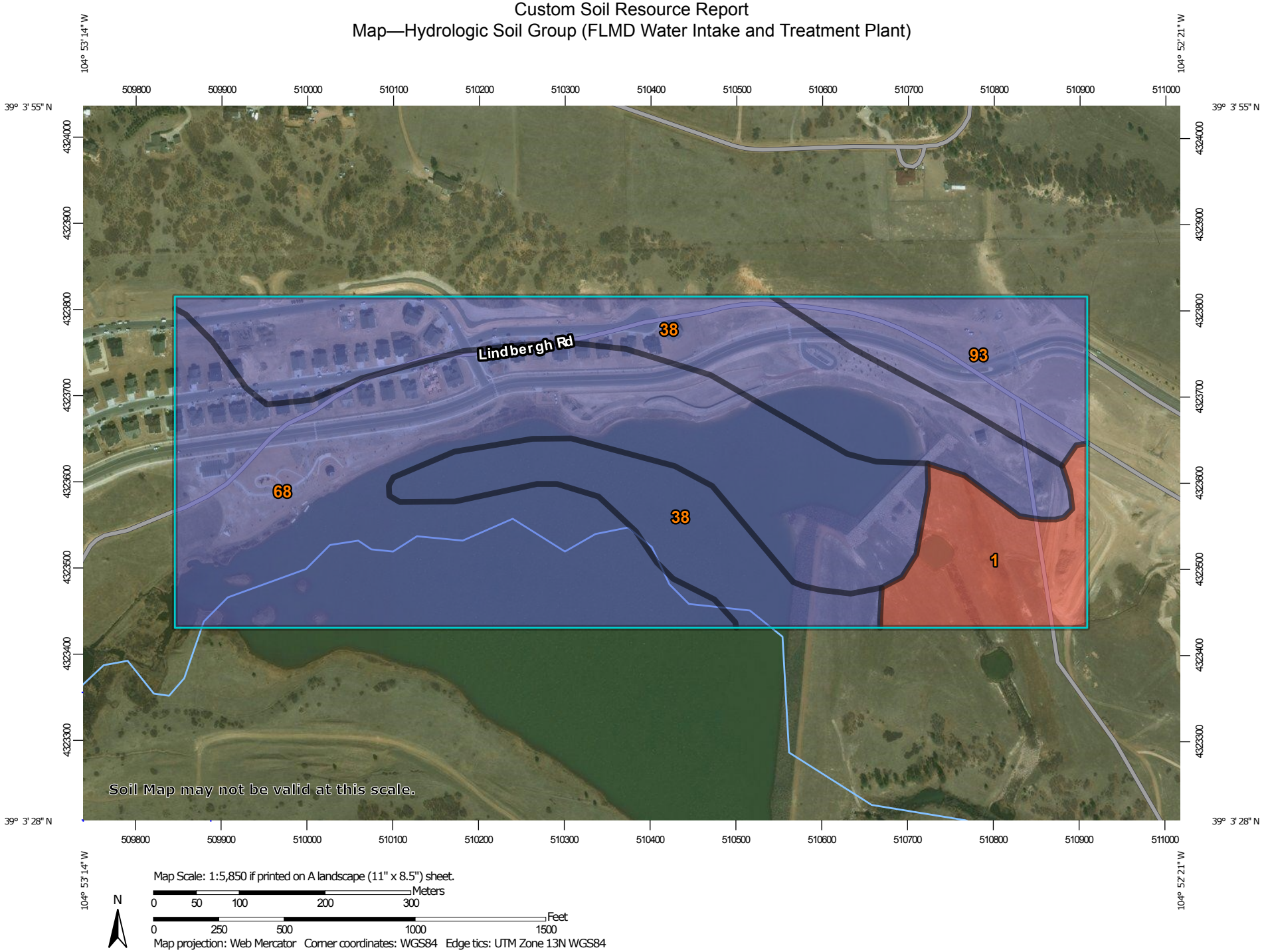
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group (FLMD Water Intake and Treatment Plant)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 22, 2014—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group (FLMD Water Intake and Treatment Plant)

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1	Alamosa loam, 1 to 3 percent slopes	D	8.4	8.2%
38	Jarre-Tecolote complex, 8 to 65 percent slopes	B	32.5	32.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	50.9	50.2%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	9.7	9.5%
Totals for Area of Interest			**101.5**	**100.0%**

Rating Options—Hydrologic Soil Group (FLMD Water Intake and Treatment Plant)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

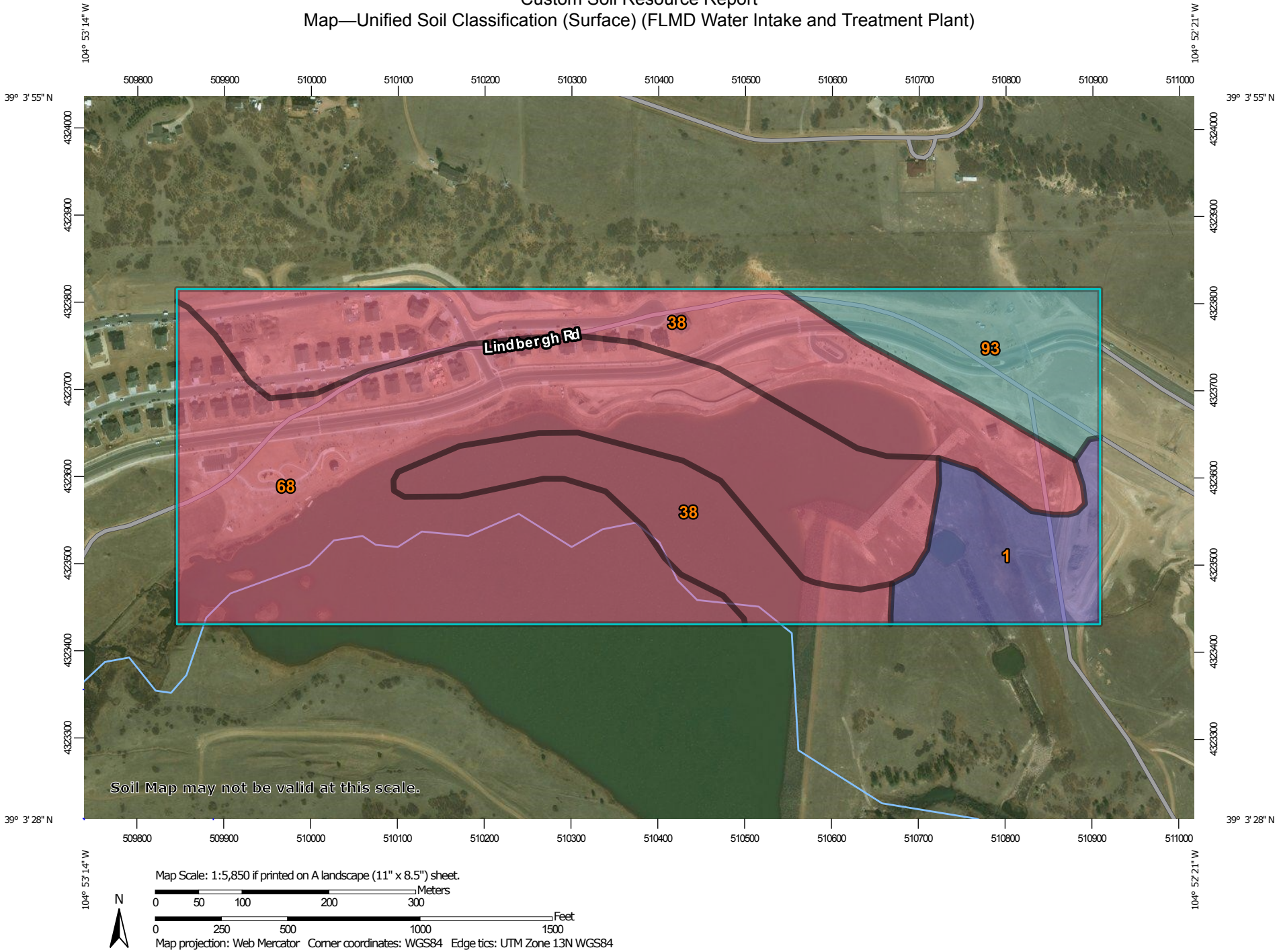
Unified Soil Classification (Surface) (FLMD Water Intake and Treatment Plant)

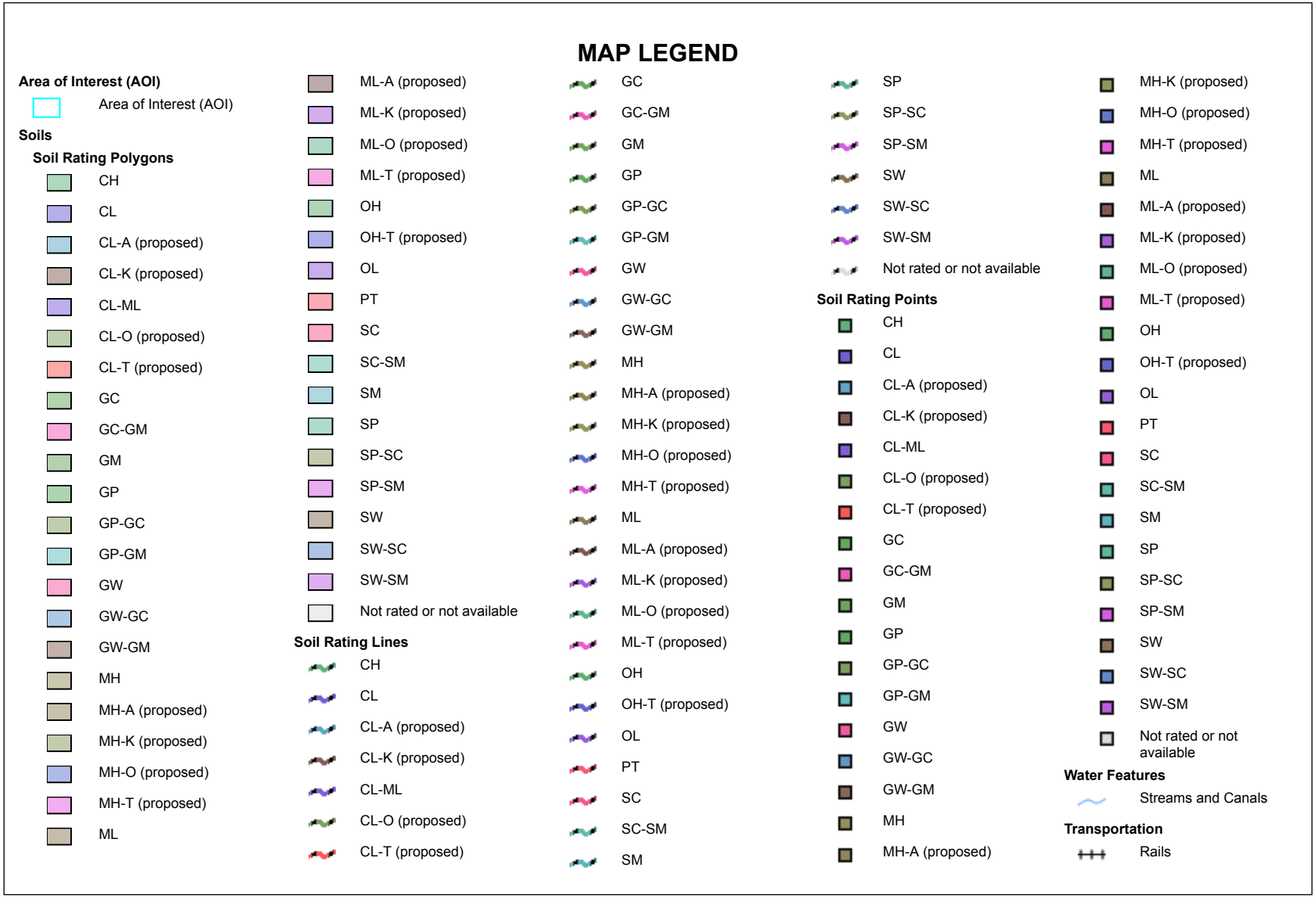
The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Map—Unified Soil Classification (Surface) (FLMD Water Intake and Treatment Plant)




MAP LEGEND
Area of Interest (AOI)
Area of Interest (AOI)
Soils
Soil Rating Polygons
CH
CL
CL-A (proposed)
CL-K (proposed)
CL-ML
CL-O (proposed)
CL-T (proposed)
GC
GC-GM
GM
GP
GP-GC
GP-GM
GW
GW-GC
GW-GM
MH
MH-A (proposed)
MH-K (proposed)
MH-O (proposed)
MH-T (proposed)
ML
ML-A (proposed)
ML-K (proposed)
ML-O (proposed)
ML-T (proposed)
OH
OH-T (proposed)
OL
PT
SC
SC-SM
SM
SP
SP-SC
SP-SM
SW
SW-SC
SW-SM
Not rated or not available
Soil Rating Lines
CH
CL
CL-A (proposed)
CL-K (proposed)
CL-ML
CL-O (proposed)
CL-T (proposed)
GC
GC-GM
GM
GP
GP-GC
GP-GM
GW
GW-GC
GW-GM
MH
MH-A (proposed)
MH-K (proposed)
MH-O (proposed)
MH-T (proposed)
ML
ML-A (proposed)
ML-K (proposed)
ML-O (proposed)
ML-T (proposed)
OH
OH-T (proposed)
OL
PT
SC
SC-SM
SM
SP
SP-SC
SP-SM
SW
SW-SC
SW-SM
Not rated or not available
Soil Rating Points
CH
CL
CL-A (proposed)
CL-K (proposed)
CL-ML
CL-O (proposed)
CL-T (proposed)
GC
GC-GM
GM
GP
GP-GC
GP-GM
GW
GW-GC
GW-GM
MH
MH-A (proposed)
MH-K (proposed)
MH-O (proposed)
MH-T (proposed)
ML
ML-A (proposed)
ML-K (proposed)
ML-O (proposed)
ML-T (proposed)
OH
OH-T (proposed)
OL
PT
SC
SC-SM
SM
SP
SP-SC
SP-SM
SW
SW-SC
SW-SM
Not rated or not available
Water Features
Streams and Canals
Transportation
Rails

MAP INFORMATION


Interstate Highways


US Routes

Major Roads

Local Roads

Background


Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:24,000.

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Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 22, 2014—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Unified Soil Classification (Surface) (FLMD Water Intake and Treatment Plant)

Unified Soil Classification (Surface)— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1	Alamosa loam, 1 to 3 percent slopes	CL	8.4	8.2%
38	Jarre-Tecolote complex, 8 to 65 percent slopes	SC	32.5	32.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	SC	50.9	50.2%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	SM	9.7	9.5%
Totals for Area of Interest			**101.5**	**100.0%**

Rating Options—Unified Soil Classification (Surface) (FLMD Water Intake and Treatment Plant)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Appendix C

Appendix C Inspection Checklist – Grading Erosion, and Stormwater Quality Controls

CITY OF COLORADO SPRINGS

DATE/TIME:
INSPECTOR:
TYPE OF INSPECTION: Self-Monitoring_____ Initial _____ Compliance_____ Follow-Up_____ Reconnaissance_____ Complaint_____ Final____

SITE:	DATE OF PERMIT:
ADDRESS:	
CONTRACTOR: CONTACT: PHONE:	OWNER/OWNER'S REPRESENTATIVE: CONTACT: PHONE:
STAGE OF CONSTRUCTION: Initial BMP Installation/Prior to Construction_____ Clearing & Grubbing_____ Rough Grading_____ Finish Grading_____ Utility Construction_____ Building Construction_____ Final Stabilization_____	

OVERALL SITE INSPECTION	YES/NO/N.A.	REMARKS/ACTIONS
Is there any evidence of sediment leaving the construction site? If so, note areas.		
Have any adverse impacts such as flooding, structural damage, erosion, spillage, or accumulation of sediment, debris or litter occurred on or within public or private property, wetlands or surface waters –to include intermittent drainageways and the City's stormwater system (storm sewers, gutters, ditches, etc.)?		
Are the BMPs properly installed and maintained?		
Have the BMPs been placed as shown on approved plans?		
Are the BMPs functioning as intended?		
Is work being done according to approved plans and any phased construction schedule?		
Is the construction schedule on track?		
Are drainage channels and outlets adequately stabilized?		
Is there any evidence of discharges or spills of fuels, lubricants, chemicals, etc.?		

BMP MAINTENANCE CHECKLIST	YES/NO/N.A.	REMARKS/ACTIONS NECESSARY
CHECK DAM Has accumulated sediment and debris been removed per maintenance requirements?		
EROSION CONTROL BLANKET Is fabric damaged, loose or in need of repairs?		
INLET PROTECTION Is the inlet protection damaged, ineffective or in need of repairs? Has sediment been removed per maintenance requirements?		
MULCHING Distributed uniformly on all disturbed areas? Is the application rate adequate? Any evidence of mulch being blown or washed away? Has the mulched area been seeded, if necessary?		
SEDIMENT BASIN Is the sediment basin properly constructed and operational? Has sediment and debris been cleaned out of the basin?		
SILT FENCE Is the fence damaged, collapsed, unentrenched or ineffective? Has sediment been removed per maintenance requirements? Is the silt fence properly located?		
SLOPE DRAIN Is water bypassing or undercutting the inlet or pipe? Is erosion occurring at the outlet of the pipe?		
STRAW BALE BARRIER Are the straw bales damaged, ineffective or unentrenched? Has sediment been removed per maintenance requirements? Are the bales installed and positioned correctly?		

BMP MAINTENANCE CHECKLIST	YES/NO/N.A.	REMARKS/ACTIONS NECESSARY
SURFACE ROUGHENING Is the roughening consistent/uniform on slopes?? Any evidence of erosion?		
TEMPORARY SEEDING Are the seedbeds protected by mulch? Has any erosion occurred in the seeded area? Any evidence of vehicle tracking on seeded areas?		
TEMPORARY SWALES Has any sediment or debris been deposited within the swales? Have the slopes of the swale eroded or has damage occurred to the lining? Are the swales properly located?		
VEHICLE TRACKING Is gravel surface clogged with mud or sediment? Is the gravel surface sinking into the ground? Has sediment been tracked onto any roads and has it been cleaned up? Is inlet protection placed around curb inlets near construction entrance?		
OTHER		

FINAL INSPECTION CHECKLIST	YES/NO/N.A.	REMARKS/ACTIONS NECESSARY
Has all grading been completed in compliance with the approved Plan, and all stabilization completed, including vegetation, retaining walls or other approved measures?		
Has final stabilization been achieved – uniform vegetative cover with a density of at least 70 percent of pre-disturbance levels, and cover capable of adequately controlling soil erosion; or permanent, physical erosion methods?		
Have all temporary measures been removed?		
Have all stockpiles, construction materials and construction equipment been removed?		
Are all paved surfaces clean (on-site and off-site)?		
Has sediment and debris been removed from drainage facilities (on-site and off-site) and other off-site property, including proper restoration of any damaged property?		
Have all permanent stormwater quality BMPs been installed and completed?		

ADDITIONAL COMMENTS:

The items noted as needing action must be remedied no later than _____. The contractor shall notify the inspector when all the items noted above have been addressed.

By signing this inspection form, the owner/owner's representative and the contractor acknowledge that they have received a copy of the inspection report and are aware it is their responsibility to take corrective actions by the date noted above. Failure to sign does not relieve the contractor and owner/owner's representative of their responsibility to take the necessary corrective action and of their liability for any damages that have occurred or may occur.

INSPECTOR'S SIGNATURE:	DATE:
OWNER/OWNER'S REPRESENTATIVE SIGNATURE:	DATE:
CONTRACTOR'S SIGNATURE:	DATE:

Appendix D

Check Dam

What it is

Check dams are small, temporary or permanent dams constructed across a drainage ditch, swale or channel to reduce the velocity of concentrated flows and to trap sediment eroded from upstream. Check dams can be constructed out of rocks, gravel-filled sandbags or straw bales.

When and Where to use it

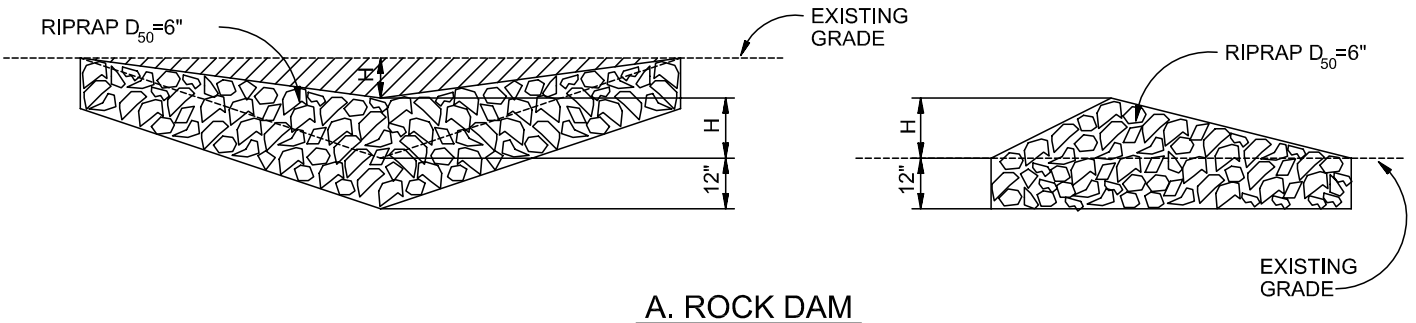
- In open channels that receive flow from drainage between 1 and 10 acres.
- In steeply sloped swales.
- In swales that need protection during the establishment of grasses or prior to installation of a non-erodible lining.

When and Where NOT to use it

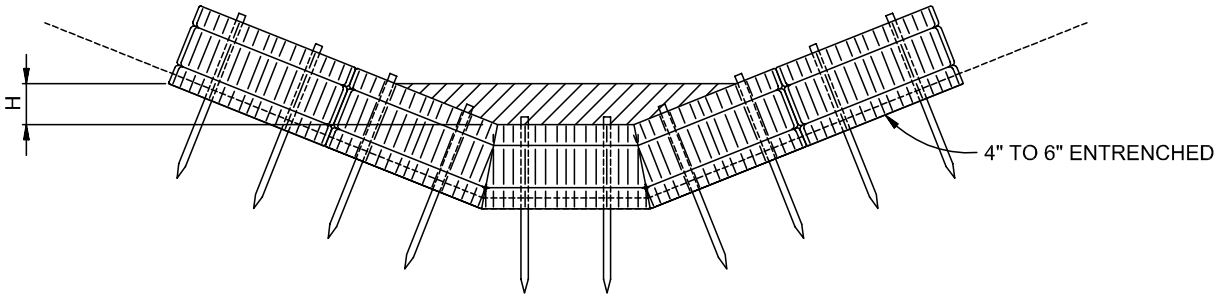
- In live streams.
- In channels that receive flow from drainage areas greater than 10 acres.
- In channels that will be overtopped by flow once the dams are constructed.

Construction Detail and Maintenance Requirements

Figure CD-1 provides a construction detail and maintenance requirements for a check dam.

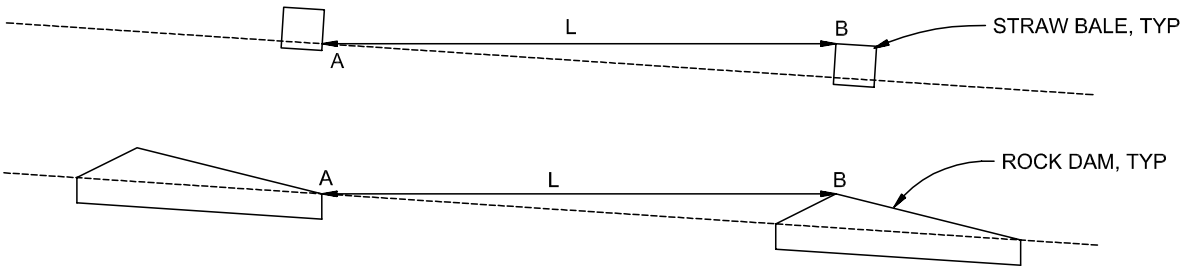


A. ROCK DAM



B. STRAW BALE CHECK DAM

(SEE STRAW BALE BARRIER INSTALATION)



L= THE DISTANCE SUCH THAT POINTS A AND B ARE AT THE SAME ELEVATION.

C. SPACING CHECK DAMS

CHECK DAM

NTS

CHECK DAM NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALES USED AS CHECK DAMS ARE TO MEET THE REQUIREMENTS STATED IN FIGURE SBB-2.

2. THE "H" DIMENSION SHALL BE SELECTED TO PROVIDE WEIR FLOW CONVEYANCE FOR 2-YEAR FLOW OR GREATER.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL CHECK DAMS, ESPECIALLY AFTER STORM EVENTS.

2. REPLACE STONE AS NECESSARY TO MAINTAIN THE CORRECT HEIGHT OF THE DAM.

3. ACCUMULATED SEDIMENT AND DEBRIS IS TO BE REMOVED FROM BEHIND THE DAMS AFTER EACH STORM OR WHEN 1/2 OF THE ORIGINAL HEIGHT OF THE DAM IS REACHED.

3. CHECK DAMS ARE TO REMAIN IN PLACE AND OPERATIONAL UNTIL THE DRAINAGE AREA AND CHANNEL ARE PERMANENTLY STABILIZED.

4. WHEN CHECK DAMS ARE REMOVED THE CHANNEL LINING OR VEGETATION IS TO BE RESTORED.

City of Colorado Springs Stormwater Quality	Figure CD-1 Check Dam Construction Detail and Maintenance Requirements

Temporary Outlet Protection (TOP) EC-8

Description

Outlet protection helps to reduce erosion immediately downstream of a pipe, culvert, slope drain, rundown or other conveyance with concentrated, high-velocity flows. Typical outlet protection consists of riprap or rock aprons at the conveyance outlet.

Photograph TOP-1. Riprap outlet protection.

Appropriate Uses

Outlet protection should be used when a conveyance discharges onto a disturbed area where there is potential for accelerated erosion due to concentrated flow. Outlet protection should be provided where the velocity at the culvert outlet exceeds the maximum permissible velocity of the material in the receiving channel.

Note**:** This Fact Sheet and detail are for temporary outlet protection, outlets that are intended to be used for less than 2 years. For permanent, long-term outlet protection, see the *Major Drainage* chapter of Volume 1.

Design and Installation

Design outlet protection to handle runoff from the largest drainage area that may be contributing runoff during construction (the drainage area may change as a result of grading). Key in rock, around the entire perimeter of the apron, to a minimum depth of 6 inches for stability. Extend riprap to the height of the culvert or the normal flow depth of the downstream channel, whichever is less. Additional erosion control measures such as vegetative lining, turf reinforcement mat and/or other channel lining methods may be required downstream of the outlet protection if the channel is susceptible to erosion. See Design Detail OP-1 for additional information.

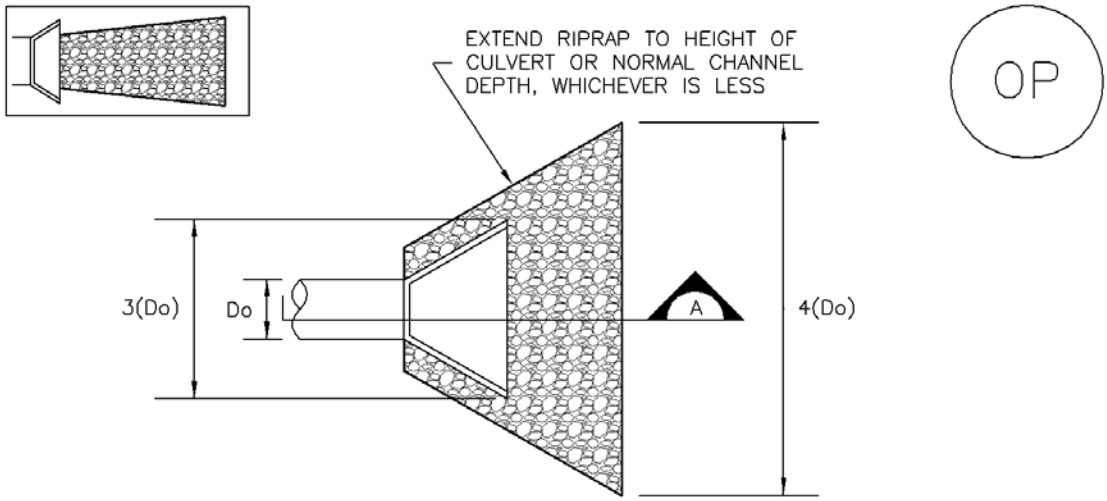
Maintenance and Removal

Inspect apron for damage and displaced rocks. If rocks are missing or significantly displaced, repair or replace as necessary. If rocks are continuously missing or displaced, consider increasing the size of the riprap or deeper keying of the perimeter.

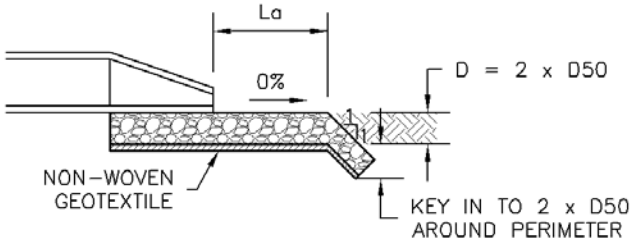
Remove sediment accumulated at the outlet before the outlet protection becomes buried and ineffective. When sediment accumulation is noted, check that upgradient BMPs, including inlet protection, are in effective operating condition.

Outlet protection may be removed once the pipe is no longer draining an upstream area, or once the downstream area has been sufficiently stabilized. If the drainage pipe is permanent, outlet protection can be left in place; however, permanent outlet protection should be designed and constructed in accordance with the requirements of the *Major Drainage* chapter of Volume 2.

Outlet Protection	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No



TEMPORARY OUTLET PROTECTION PLAN



SECTION A

TABLE OP-1. TEMPORARY OUTLET PROTECTION SIZING TABLE			
PIPE DIAMETER, Do (INCHES)	DISCHARGE, Q (CFS)	APRON LENGTH, La (FT)	RIPRAP D50 DIAMETER MIN (INCHES)
8	2.5 5	5 10	4 6
12	5 10	10 13	4 6
18	10 20 30 40	10 16 23 26	6 9 12 16
24	30 40 50 60	16 26 26 30	9 9 12 16

OP-1. TEMPORARY OUTLET PROTECTION

TEMPORARY OUTLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF OUTLET PROTECTION.
   –DIMENSIONS OF OUTLET PROTECTION.

2. DETAIL IS INTENDED FOR PIPES WITH SLOPE ≤ 10%. ADDITIONAL EVALUATION OF RIPRAP SIZING AND OUTLET PROTECTION DIMENSIONS REQUIRED FOR STEEPER SLOPES.

3. TEMPORARY OUTLET PROTECTION INFORMATION IS FOR OUTLETS INTENDED TO BE UTILIZED LESS THAN 2 YEARS.

TEMPORARY OUTLET PROTECTION INSPECTION AND MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM AURORA, COLORADO AND PREVIOUS VERSION OF VOLUME 3, NOT AVAILABLE IN AUTOCAD)

Erosion Control Blankets

What it is

Erosion control blankets are geotextiles or filter fabrics that are used to stabilize soils, steep slopes and drainage channels.

TYPES OF EROSION CONTROL BLANKETS

- WOVEN OR BONDED SYNETHETIC MATERIALS SUCH AS POLYPROPELENE, POLYESTER, POLYETHEYLENE, NYLON, POLYVINYL CHLORIDE, GLASS AND VARIOUS MIXTURES OF THESE.
- MULCH MATTING MADE FROM JUTE OR OTHER WOOD FIBER THAT HAS BEEN FORMED INTO SHEETS.
- NETTING MADE FROM JUTE OR OTHER WOOD FIBER, PLASTIC, PAPER, OR COTTON USED TO HOLD MULCH AND MATTING TO THE GROUND.
- BLANKETS OF WOVEN STRAW MULCH WITH A SYNTHETIC LAYER OR NET.

When and Where to use it

- In temporary and permanent swales.
- To protect recently seeded slopes.
- In drainageway channels.

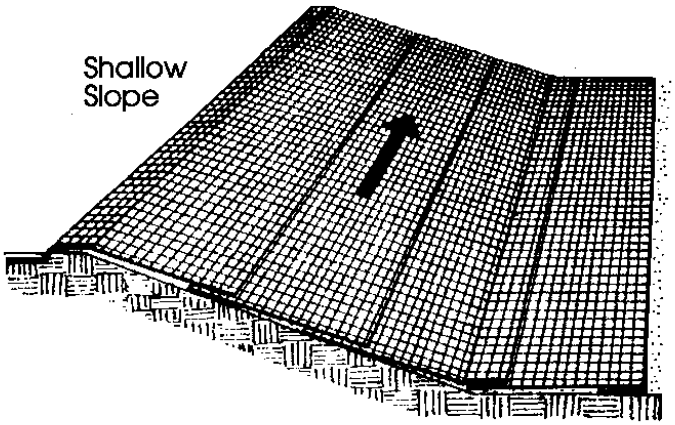
When and Where NOT to use it

- In swales with slopes greater than 5 percent or with stormwater velocities > 8 feet per second.

Installation and Maintenance Requirements

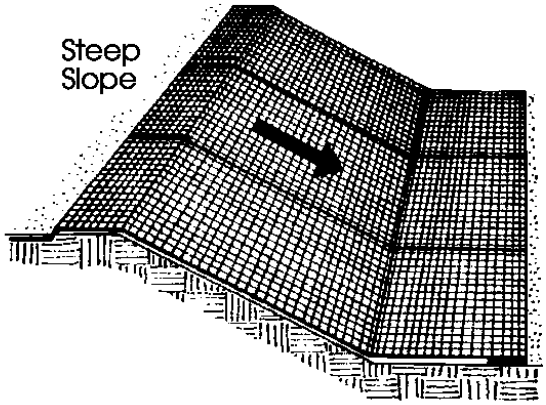
Installation requirements are provided in Figures ECB-1 and ECB-2.

Maintenance requirements include regular inspections to determine if fabric is damaged or has come loose, and appropriate repairs or replacement of damaged materials.



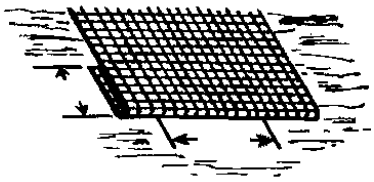
On shallow slopes, strips of netting may be applied across the slope.

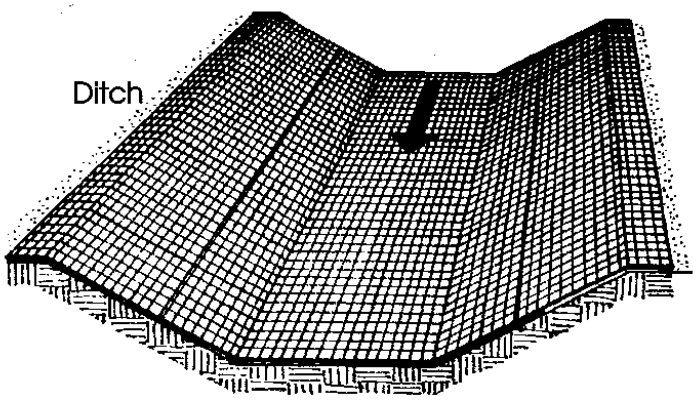
Where there is a berm at the top of the slope, bring the netting over the berm and anchor it behind the berm.



On steep slopes, apply strips of netting parallel to the direction of flow and anchor securely.

Bring netting down to a level area before terminating the installation. Turn the end under 6" and staple at 12" intervals.





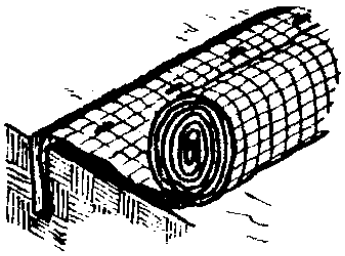
In ditches, apply netting parallel to the direction of flow. Use check slots every 15 feet. Do not join strips in the center of the ditch.

From: Virginia Soil and Water Conservation Commission, 1985

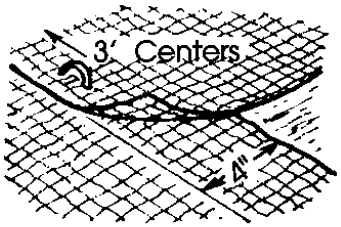
City of Colorado Springs
Storm Water Quality

Figure ECB-1
Erosion Control Blanket
Application Examples

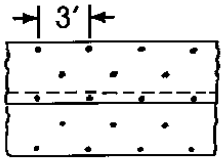
DEN/M/153722.CS.CB/FigECB-1/9-99

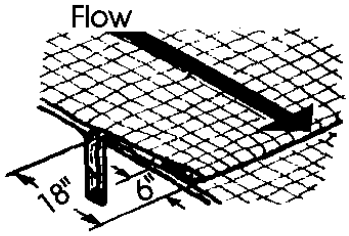


Anchor Slot: Bury the up-channel end of the net in a 6" deep trench. Tamp the soil firmly. Staple at 12" intervals across the net.

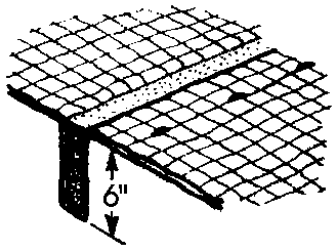


Overlap: Overlap edges of the strips at least 4". Staple every 3 feet down the center of the strip.

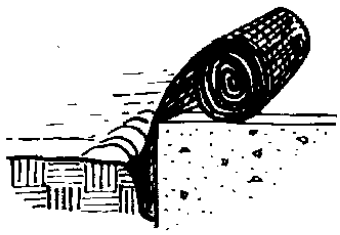




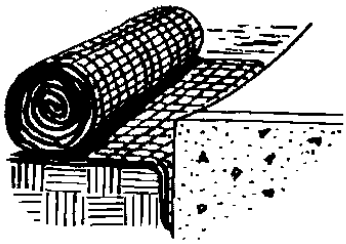
Joining Strips: Insert the new roll of net in a trench, as with the Anchor Slot. Overlap the up-channel end of the previous roll 18" and turn the end under 6". Staple the end of the previous roll just below the anchor slot and at the end at 12" intervals.



Check Slots: On erodible soils or steep slopes, check slots should be made every 15 feet. Insert a fold of the net into a 6" trench and tamp firmly. Staple at 12" intervals across the net. Lay the net smoothly on the surface of the soil - do not stretch the net, and do not allow wrinkles.



Anchoring Ends At Structures: Place the end of the net in a 6" slot on the up-channel side of the structure. Fill the trench and tamp firmly. Roll the net up the channel. Place staples at 12" intervals along the anchor end of the net.



From: Virginia Soil and Water Conservation Commission, 1985

City of Colorado Springs Storm Water Quality	Figure ECB-2 Erosion Control Blanket Installation Requirements

DEN/M/153722.CS.CB/FigECB-2/9-99

Inlet Protection

What it is

Inlet protection is a sediment control barrier formed around a storm drain inlet. A number of alternative inlet protection designs are available, including:

- Silt Fence Inlet Protection.
- Straw Bale Barrier Inlet Protection.
- Block and Gravel Bag Inlet Protection.
- Curb Socks Inlet Protection.

When and Where to use it

Application of inlet protection differs by design.

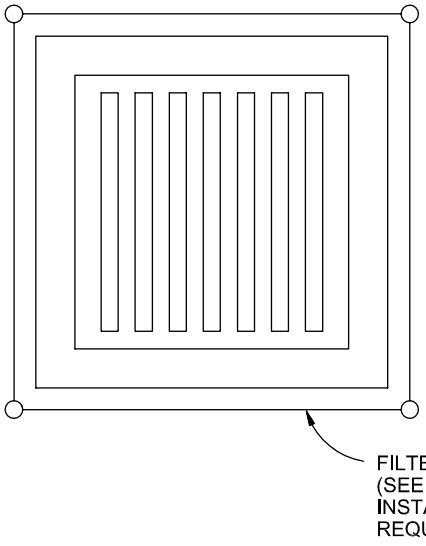
- Filter fabric and straw bale inlet protection are used for area inlets (not located within streets).
- Block and gravel bag curb inlet protection is used for street inlets in sumps.
- Curb sock protection is used for street inlets in sumps or on continuous grade.

When and Where NOT to use it

- Filter fabric and straw bale inlet protection cannot be used for drain inlets that are paved because these designs require excavation and/or staking of materials.
- Block and gravel bag inlet protection is not recommended for continuous grade inlets due to concerns about damage from bypassed flow.

Construction Detail and Maintenance Requirements

Figures IP-1 through IP-4 provide a construction detail and maintenance requirements for each inlet protection design alternative.



FILTER FABRIC INLET PROTECTION

NTS

FILTER FABRIC INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.

2. SEE SILT FENCE FIGURE SF-2 FOR INSTALLATION REQUIREMENTS.

3. POSTS ARE TO BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.

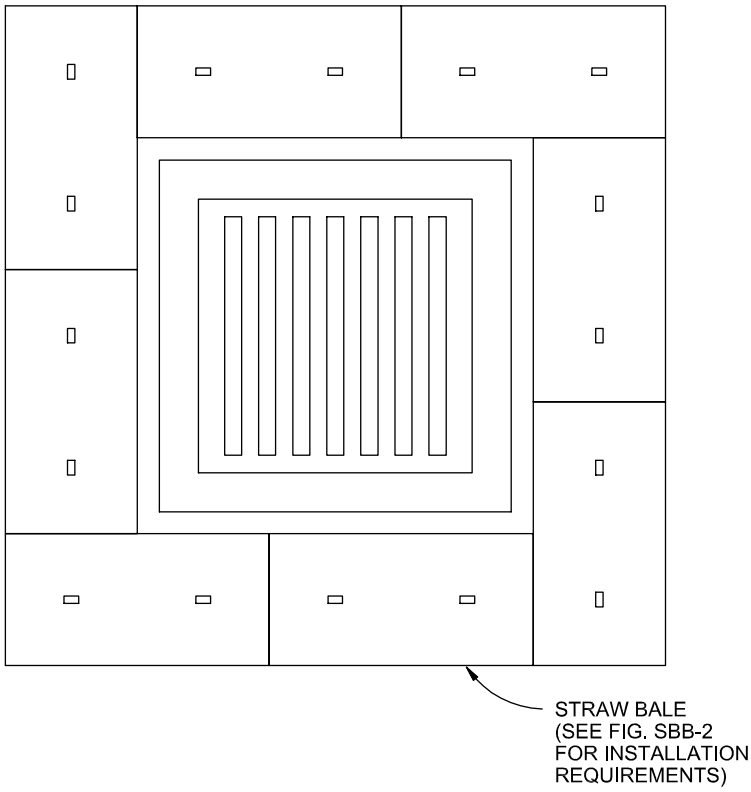
MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

2. DAMAGED, COLLAPSED, UNENTRENCHED OR INEFFECTIVE INLET PROTECTION SHALL BE PROMPTLY REPAIRED OR REPLACED.

3. SEDIMENT SHALL BE REMOVED FROM BEHIND FILTER FABRIC WHEN IT ACCUMULATES TO HALF THE EXPOSED GEOTEXTILE HEIGHT.

4. FILTER FABRIC PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED IN THE DRAINAGE AREA AS APPROVED BY THE CITY.



STRAW BALE INLET PROTECTION

NTS

STRAW BALE INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.

2. BALES ARE TO BE PLACED IN A SINGLE ROW AROUND THE INLET WITH THE END OF THE BALES TIGHTLY ABUTTING ONE ANOTHER.

3. SEE STRAW BALE BARRIER FIGURE SBB-2 FOR INSTALLATION REQUIREMENTS.

MAINTENANCE REQUIREMENTS

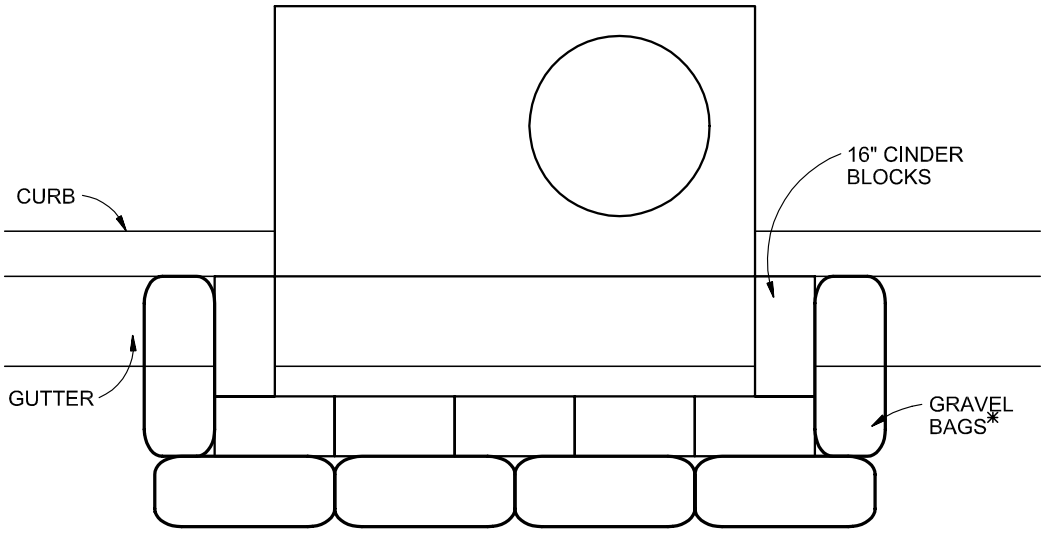
1. CONTRACTOR SHALL INSPECT STRAW BALE INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.

.

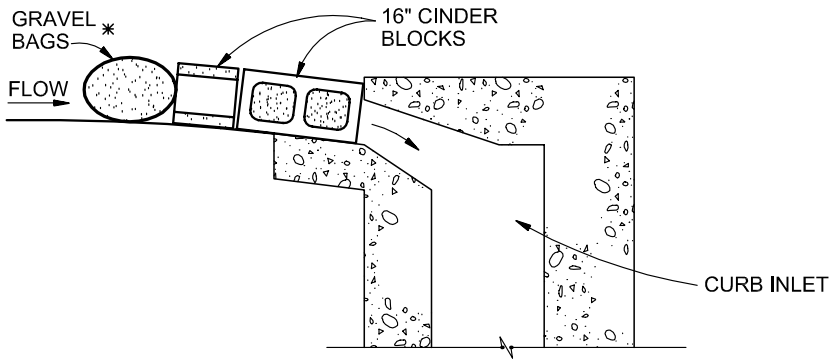
2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED, REPLACING BALES IF NECESSARY, AND UNENTRENCHED BALES NEED TO BE REPAIRED WITH COMPACTED BACKFILL MATERIAL.

3. SEDIMENT SHALL BE REMOVED FROM BEHIND STRAW BALES WHEN IT ACCUMULATES TO APPROXIMATELY 1/3 THE HEIGHT OF THE BARRIER.

4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE DRAINAGE AREA AS APPROVED BY THE CITY.



PLAN



SECTION

BLOCK AND GRAVEL BAG* CURB INLET PROTECTION

NTS

BLOCK AND GRAVEL BAG* CURB INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.

2. CONCRETE BLOCKS ARE TO BE LAID AROUND THE INLET IN A SINGLE ROW ON THEIR SIDES, ABUTTING ONE ANOTHER WITH THE OPEN ENDS OF THE BLOCK FACING OUTWARD.

3. GRAVEL BAGS ARE TO BE PLACED AROUND THE CONCRETE BLOCKS CLOSELY ABUTTING ONE ANOTHER SO THERE ARE NO GAPS.

4. GRAVEL BAGS ARE TO CONTAIN WASHED SAND OR GRAVEL APPROXIMATELY 3/4 INCH IN DIAMETER.

5. BAGS ARE TO BE MADE OF 1/4" INCH WIRE MESH (USED WITH GRAVEL ONLY) OR GEOTEXTILE.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.
.

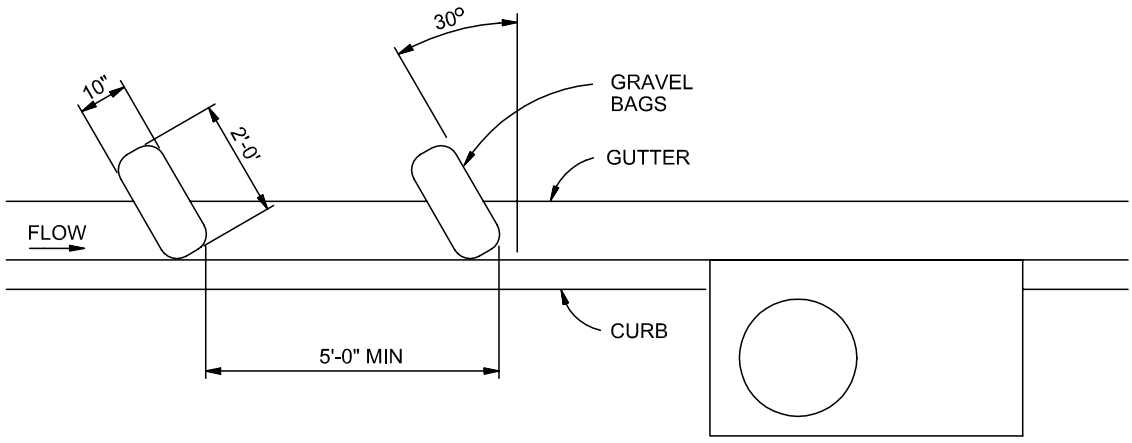
2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED OR REPLACED.

3. SEDIMENT SHALL BE REMOVED WHEN SEDIMENT HAS ACCUMULATED TO APPROXIMATELY 1/2 THE DESIGN DEPTH OF THE TRAP.

4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE DRAINAGE AREA AS APPROVED BY THE CITY.

* AN ALTERNATE 3/4" TO 1" GRAVEL FILTER OVER A WIRE SCREEN MAY BE USED IN PLACE OF GRAVEL BAGS. THE WIRE MESH SHALL EXTEND ABOVE THE TOP OF THE CONCRETE BLOCKS AND THE GRAVEL PLACED OVER THE WIRE SCREEN TO THE TOP OF THE CONCRETE BLOCKS.

City of Colorado Springs Stormwater Quality	Figure IP-3 Block & Gravel Bag Curb Inlet Protection Construction Detail and Maintenance Requirements



CURB SOCK INLET PROTECTION

NTS

CURB SOCK INLET PROTECTION NOTES

INSTALLATION REQUIREMENTS

1. INLET PROTECTION SHALL BE INSTALLED IMMEDIATELY AFTER CONSTRUCTION OF INLET.

2. SOCK IS TO BE MADE OF 1/4 INCH WIRE MESH (USED WITH GRAVEL ONLY) OR GEOTEXTILE.

3. WASHED SAND OR GRAVEL 3/4 INCH TO 4 INCHES IN DIAMETER IS PLACED INSIDE THE SOCK.

4. PLACEMENT OF THE SOCK IS TO BE 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.

5. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED AT A MINIMUM 5 FEET APART.

6. AT LEAST 2 CURB SOCKS IN SERIES IS REQUIRED.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL AND WEEKLY DURING PERIODS NO RAINFALL.

2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED OR REPLACED.

3. SEDIMENT SHALL BE REMOVED FROM BEHIND THE SOCK WHEN GUTTER WIDTH IS FILLED.

4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE DRAINAGE AREA AS APPROVED BY THE CITY.

Concrete Washout Area (CWA) MM-1

Description

Concrete waste management involves designating and properly managing a specific area of the construction site as a concrete washout area. A concrete washout area can be created using one of several approaches designed to receive wash water from washing of tools and concrete mixer chutes, liquid concrete waste from dump trucks, mobile batch mixers, or pump trucks. Three basic approaches are available: excavation of a pit in the ground, use of an above ground storage area, or use of prefabricated haul-away concrete washout containers. Surface discharges of concrete washout water from construction sites are prohibited.

Photograph CWA-1. Example of concrete washout area. Note gravel tracking pad for access and sign.

Appropriate Uses

Concrete washout areas must be designated on all sites that will generate concrete wash water or liquid concrete waste from onsite concrete mixing or concrete delivery.

Because pH is a pollutant of concern for washout activities, when unlined pits are used for concrete washout, the soil must have adequate buffering capacity to result in protection of state groundwater standards; otherwise, a liner/containment must be used. The following management practices are recommended to prevent an impact from unlined pits to groundwater:

- The use of the washout site should be temporary (less than 1 year), and
- The washout site should be not be located in an area where shallow groundwater may be present, such as near natural drainages, springs, or wetlands.

Design and Installation

Concrete washout activities must be conducted in a manner that does not contribute pollutants to surface waters or stormwater runoff. Concrete washout areas may be lined or unlined excavated pits in the ground, commercially manufactured prefabricated washout containers, or aboveground holding areas constructed of berms, sandbags or straw bales with a plastic liner.

Although unlined washout areas may be used, lined pits may be required to protect groundwater under certain conditions.

Do not locate an unlined washout area within 400 feet of any natural drainage pathway or waterbody or within 1,000 feet of any wells or drinking water sources. Even for lined concrete washouts, it is advisable to locate the facility away from waterbodies and drainage paths. If site constraints make these

Concrete Washout Area	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

setbacks infeasible or if highly permeable soils exist in the area, then the pit must be installed with an impermeable liner (16 mil minimum thickness) or surface storage alternatives using prefabricated concrete washout devices or a lined aboveground storage area should be used.

Design details with notes are provided in Detail CWA-1 for pits and CWA-2 for aboveground storage areas. Pre-fabricated concrete washout container information can be obtained from vendors.

Maintenance and Removal

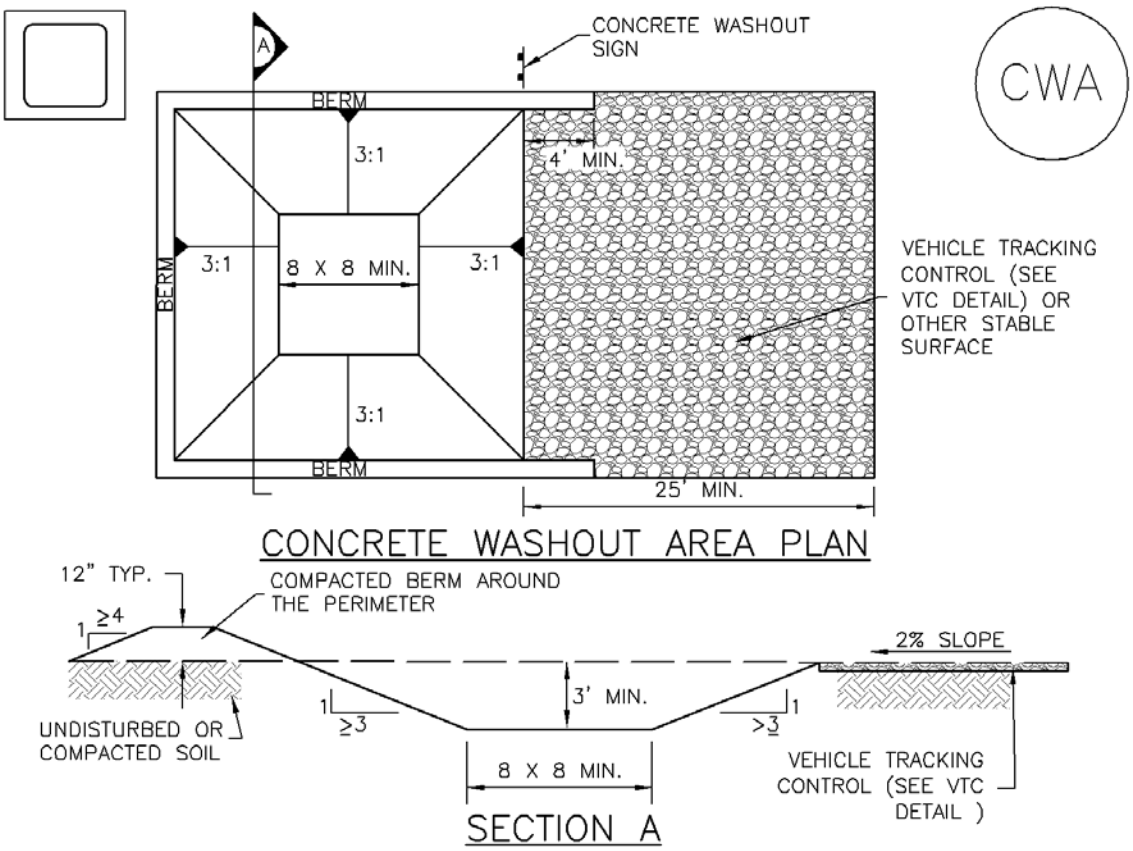
A key consideration for concrete washout areas is to ensure that adequate signage is in place identifying the location of the washout area. Part of inspecting and maintaining washout areas is ensuring that adequate signage is provided and in good repair and that the washout area is being used, as opposed to washout in non-designated areas of the site.

Remove concrete waste in the washout area, as needed to maintain BMP function (typically when filled to about two-thirds of its capacity). Collect concrete waste and deliver offsite to a designated disposal location.

Upon termination of use of the washout site, accumulated solid waste, including concrete waste and any contaminated soils, must be removed from the site to prevent on-site disposal of solid waste. If the wash water is allowed to evaporate and the concrete hardens, it may be recycled.

Photograph CWA-2. Prefabricated concrete washout. Photo courtesy of CDOT.

Photograph CWA-3. Earthen concrete washout. Photo courtesy of CDOT.



CWA–1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

CWA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. THE CWA SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE. CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.

5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER–TIGHT CONTAINER AND DISPOSED OF PROPERLY.

6. THE CWA SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACED.

7. WHEN THE CWA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD).

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Stockpile Management (SP) MM-2

Description

Stockpile management includes measures to minimize erosion and sediment transport from soil stockpiles.

Appropriate Uses

Stockpile management should be used when soils or other erodible materials are stored at the construction site. Special attention should be given to stockpiles in close proximity to natural or manmade storm systems.

Photograph SP-1. A topsoil stockpile that has been partially revegetated and is protected by silt fence perimeter control.

Design and Installation

Locate stockpiles away from all drainage system components including storm sewer inlets. Where practical, choose stockpile locations that that will remain undisturbed for the longest period of time as the phases of construction progress. Place sediment control BMPs around the perimeter of the stockpile, such as sediment control logs, rock socks, silt fence, straw bales and sand bags. See Detail SP-1 for guidance on proper establishment of perimeter controls around a stockpile. For stockpiles in active use, provide a stabilized designated access point on the upgradient side of the stockpile.

Stabilize the stockpile surface with surface roughening, temporary seeding and mulching, erosion control blankets, or soil binders. Soils stockpiled for an extended period (typically for more than 60 days) should be seeded and mulched with a temporary grass cover once the stockpile is placed (typically within 14 days). Use of mulch only or a soil binder is acceptable if the stockpile will be in place for a more limited time period (typically 30-60 days). Timeframes for stabilization of stockpiles noted in this fact sheet are "typical" guidelines. Check permit requirements for specific federal, state, and/or local requirements that may be more prescriptive.

Stockpiles should not be placed in streets or paved areas unless no other practical alternative exists. See the Stabilized Staging Area Fact Sheet for guidance when staging in roadways is unavoidable due to space or right-of-way constraints. For paved areas, rock socks must be used for perimeter control and all inlets with the potential to receive sediment from the stockpile (even from vehicle tracking) must be protected.

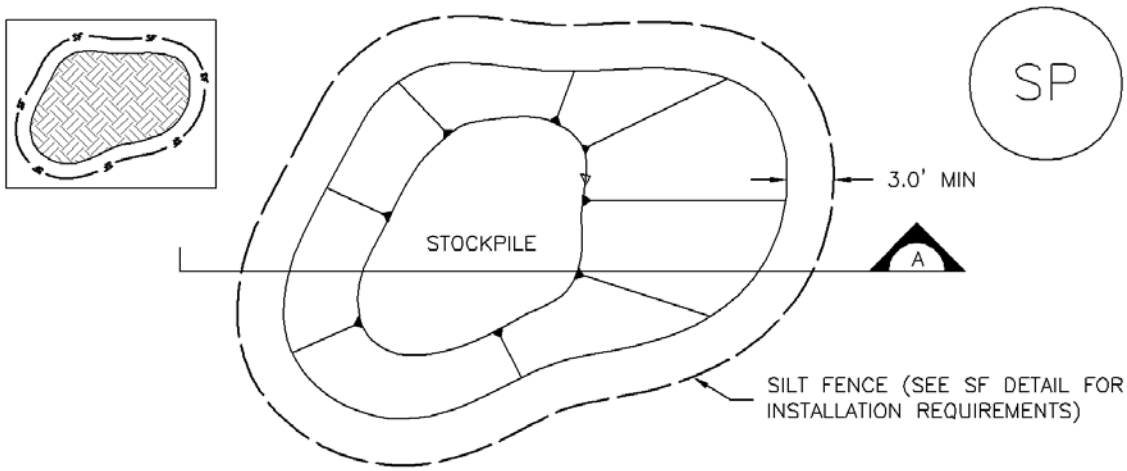
Maintenance and Removal

Inspect perimeter controls and inlet protection in accordance with their respective BMP Fact Sheets. Where seeding, mulch and/or soil binders are used, reseeding or reapplication of soil binder may be necessary.

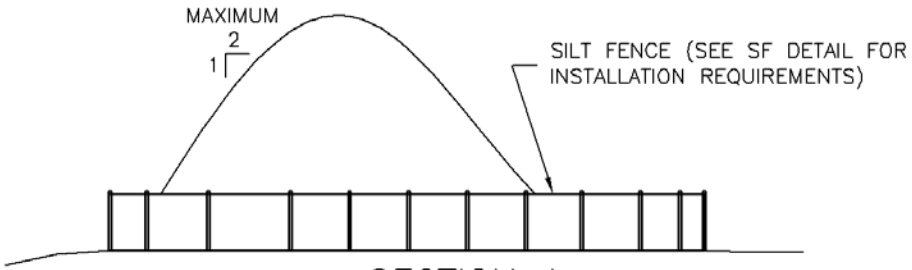
When temporary removal of a perimeter BMP is necessary to access a stockpile, ensure BMPs are reinstalled in accordance with their respective design detail section.

Stockpile Management	
Functions	
Erosion Control	Yes
Sediment Control	Yes
Site/Material Management	Yes

When the stockpile is no longer needed, properly dispose of excess materials and revegetate or otherwise stabilize the ground surface where the stockpile was located.



STOCKPILE PROTECTION PLAN



SECTION A

SP–1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF STOCKPILES.
   –TYPE OF STOCKPILE PROTECTION.

2. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SILT FENCE IS SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SEDIMENT CONTROL LOGS OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.

3. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHOULD BE SEEDED AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30–60 DAYS).

4. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

STOCKPILE PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

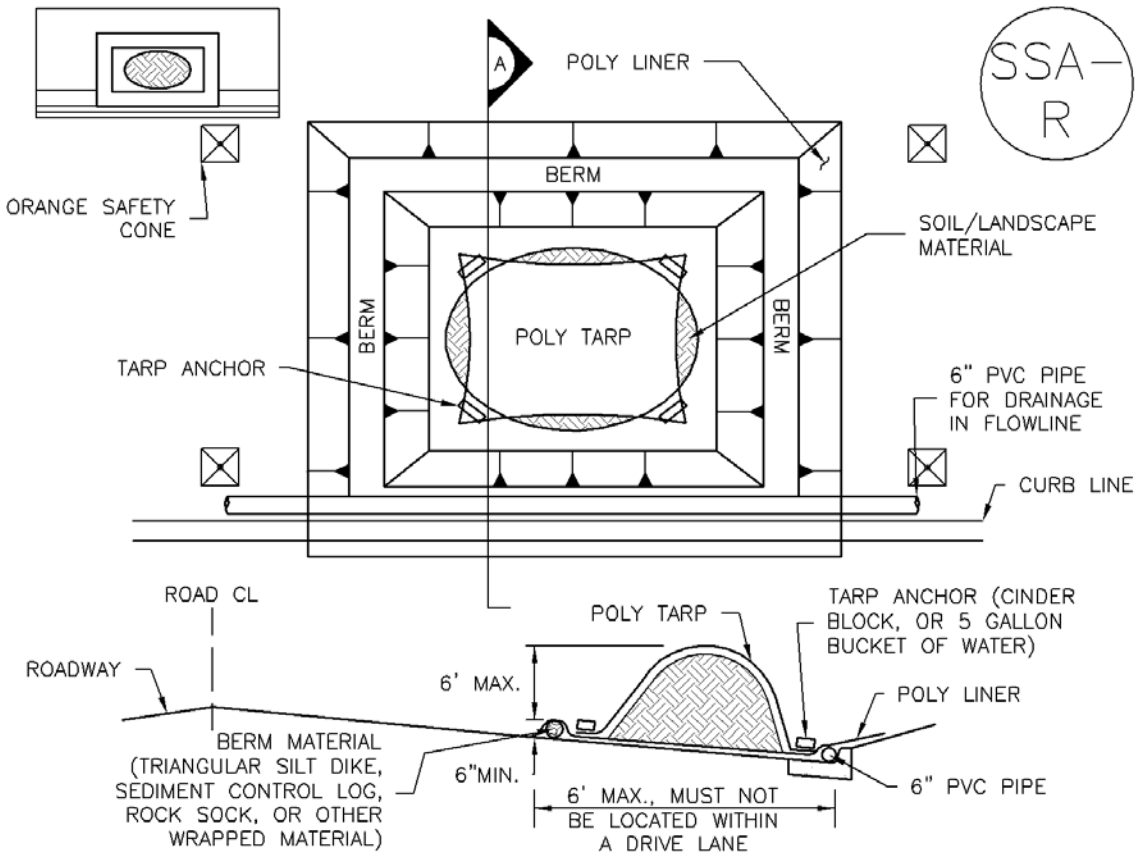
STOCKPILE PROTECTION MAINTENANCE NOTES

4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.

5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

(DETAILS ADAPTED FROM PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



SP–2. MATERIALS STAGING IN ROADWAY

MATERIALS STAGING IN ROADWAYS INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF MATERIAL STAGING AREA(S).
   –CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. FEATURE MUST BE INSTALLED PRIOR TO EXCAVATION, EARTHWORK OR DELIVERY OF MATERIALS.

3. MATERIALS MUST BE STATIONED ON THE POLY LINER. ANY INCIDENTAL MATERIALS DEPOSITED ON PAVED SECTION OR ALONG CURB LINE MUST BE CLEANED UP PROMPTLY.

4. POLY LINER AND TARP COVER SHOULD BE OF SIGNIFICANT THICKNESS TO PREVENT DAMAGE OR LOSS OF INTEGRITY.

5. SAND BAGS MAY BE SUBSTITUTED TO ANCHOR THE COVER TARP OR PROVIDE BERMING UNDER THE BASE LINER.

6. FEATURE IS NOT INTENDED FOR USE WITH WET MATERIAL THAT WILL BE DRAINING AND/OR SPREADING OUT ON THE POLY LINER OR FOR DEMOLITION MATERIALS.

7. THIS FEATURE CAN BE USED FOR:
   –UTILITY REPAIRS.
   –WHEN OTHER STAGING LOCATIONS AND OPTIONS ARE LIMITED.
   –OTHER LIMITED APPLICATION AND SHORT DURATION STAGING.

MATERIALS STAGING IN ROADWAY MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. INSPECT PVC PIPE ALONG CURB LINE FOR CLOGGING AND DEBRIS. REMOVE OBSTRUCTIONS PROMPTLY.

5. CLEAN MATERIAL FROM PAVED SURFACES BY SWEEPING OR VACUUMING.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM AURORA, COLORADO)

Good Housekeeping Practices (GH) MM-3

Description

Implement construction site good housekeeping practices to prevent pollution associated with solid, liquid and hazardous construction-related materials and wastes. Stormwater Management Plans (SWMPs) should clearly specify BMPs including these good housekeeping practices:

- Provide for waste management.
- Establish proper building material staging areas.
- Designate paint and concrete washout areas.
- Establish proper equipment/vehicle fueling and maintenance practices.
- Control equipment/vehicle washing and allowable non-stormwater discharges.
- Develop a spill prevention and response plan.

Acknowledgement: This Fact Sheet is based directly on EPA guidance provided in *Developing Your Stormwater Pollution Prevent Plan* (EPA 2007).

Photographs GH-1 and GH-2. Proper materials storage and secondary containment for fuel tanks are important good housekeeping practices. Photos courtesy of CDOT and City of Aurora.

Appropriate Uses

Good housekeeping practices are necessary at all construction sites.

Design and Installation

The following principles and actions should be addressed in SWMPs:

- **Provide for Waste Management.** Implement management procedures and practices to prevent or reduce the exposure and transport of pollutants in stormwater from solid, liquid and sanitary wastes that will be generated at the site. Practices such as trash disposal, recycling, proper material handling, and cleanup measures can reduce the potential for stormwater runoff to pick up construction site wastes and discharge them to surface waters. Implement a comprehensive set of waste-management practices for hazardous or toxic materials, such as paints, solvents, petroleum products, pesticides, wood preservatives, acids, roofing tar, and other materials. Practices should include storage, handling, inventory, and cleanup procedures, in case of spills. Specific practices that should be considered include:

  Solid or Construction Waste

  - Designate trash and bulk waste-collection areas on-site.

Good Housekeeping	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

- Recycle materials whenever possible (e.g., paper, wood, concrete, oil).
- Segregate and provide proper disposal options for hazardous material wastes.
- Clean up litter and debris from the construction site daily.
- Locate waste-collection areas away from streets, gutters, watercourses, and storm drains. Waste-collection areas (dumpsters, and such) are often best located near construction site entrances to minimize traffic on disturbed soils. Consider secondary containment around waste collection areas to minimize the likelihood of contaminated discharges.
- Empty waste containers before they are full and overflowing.

Sanitary and Septic Waste

- Provide convenient, well-maintained, and properly located toilet facilities on-site.
- Locate toilet facilities away from storm drain inlets and waterways to prevent accidental spills and contamination of stormwater.
- Maintain clean restroom facilities and empty portable toilets regularly.
- Where possible, provide secondary containment pans under portable toilets.
- Provide tie-downs or stake-downs for portable toilets.
- Educate employees, subcontractors, and suppliers on locations of facilities.
- Treat or dispose of sanitary and septic waste in accordance with state or local regulations. Do not discharge or bury wastewater at the construction site.
- Inspect facilities for leaks. If found, repair or replace immediately.
- Special care is necessary during maintenance (pump out) to ensure that waste and/or biocide are not spilled on the ground.

Hazardous Materials and Wastes

- Develop and implement employee and subcontractor education, as needed, on hazardous and toxic waste handling, storage, disposal, and cleanup.
- Designate hazardous waste-collection areas on-site.
- Place all hazardous and toxic material wastes in secondary containment.

Photograph GH-3. Locate portable toilet facilities on level surfaces away from waterways and storm drains. Photo courtesy of WWE.

- Hazardous waste containers should be inspected to ensure that all containers are labeled properly and that no leaks are present.

- **Establish Proper Building Material Handling and Staging Areas**. The SWMP should include comprehensive handling and management procedures for building materials, especially those that are hazardous or toxic. Paints, solvents, pesticides, fuels and oils, other hazardous materials or building materials that have the potential to contaminate stormwater should be stored indoors or under cover whenever possible or in areas with secondary containment. Secondary containment measures prevent a spill from spreading across the site and may include dikes, berms, curbing, or other containment methods. Secondary containment techniques should also ensure the protection of groundwater. Designate staging areas for activities such as fueling vehicles, mixing paints, plaster, mortar, and other potential pollutants. Designated staging areas enable easier monitoring of the use of materials and clean up of spills. Training employees and subcontractors is essential to the success of this pollution prevention principle. Consider the following specific materials handling and staging practices:

  - Train employees and subcontractors in proper handling and storage practices.

  - Clearly designate site areas for staging and storage with signs and on construction drawings. Staging areas should be located in areas central to the construction site. Segment the staging area into sub-areas designated for vehicles, equipment, or stockpiles. Construction entrances and exits should be clearly marked so that delivery vehicles enter/exit through stabilized areas with vehicle tracking controls (See Vehicle Tracking Control Fact Sheet).

  - Provide storage in accordance with Spill Protection, Control and Countermeasures (SPCC) requirements and plans and provide cover and impermeable perimeter control, as necessary, for hazardous materials and contaminated soils that must be stored on site.

  - Ensure that storage containers are regularly inspected for leaks, corrosion, support or foundation failure, or other signs of deterioration and tested for soundness.

  - Reuse and recycle construction materials when possible.

- **Designate Concrete Washout Areas**. Concrete contractors should be encouraged to use the washout facilities at their own plants or dispatch facilities when feasible; however, concrete washout commonly occurs on construction sites. If it is necessary to provide for concrete washout areas on-site, designate specific washout areas and design facilities to handle anticipated washout water. Washout areas should also be provided for paint and stucco operations. Because washout areas can be a source of pollutants from leaks or spills, care must be taken with regard to their placement and proper use. See the Concrete Washout Area Fact Sheet for detailed guidance.

  Both self-constructed and prefabricated washout containers can fill up quickly when concrete, paint, and stucco work are occurring on large portions of the site. Be sure to check for evidence that contractors are using the washout areas and not dumping materials onto the ground or into drainage facilities. If the washout areas are not being used regularly, consider posting additional signage, relocating the facilities to more convenient locations, or providing training to workers and contractors.

  When concrete, paint, or stucco is part of the construction process, consider these practices which will help prevent contamination of stormwater. Include the locations of these areas and the maintenance and inspection procedures in the SWMP.

- Do not washout concrete trucks or equipment into storm drains, streets, gutters, uncontained areas, or streams. Only use designated washout areas.
- Establish washout areas and advertise their locations with signs. Ensure that signage remains in good repair.
- Provide adequate containment for the amount of wash water that will be used.
- Inspect washout structures daily to detect leaks or tears and to identify when materials need to be removed.
- Dispose of materials properly. The preferred method is to allow the water to evaporate and to recycle the hardened concrete. Full service companies may provide dewatering services and should dispose of wastewater properly. Concrete wash water can be highly polluted. It should not be discharged to any surface water, storm sewer system, or allowed to infiltrate into the ground in the vicinity of waterbodies. Washwater should not be discharged to a sanitary sewer system without first receiving written permission from the system operator.

- **Establish Proper Equipment/Vehicle Fueling and Maintenance Practices**. Create a clearly designated on-site fueling and maintenance area that is clean and dry. The on-site fueling area should have a spill kit, and staff should know how to use it. If possible, conduct vehicle fueling and maintenance activities in a covered area. Consider the following practices to help prevent the discharge of pollutants to stormwater from equipment/vehicle fueling and maintenance. Include the locations of designated fueling and maintenance areas and inspection and maintenance procedures in the SWMP.
  - Train employees and subcontractors in proper fueling procedures (stay with vehicles during fueling, proper use of pumps, emergency shutoff valves, etc.).
  - Inspect on-site vehicles and equipment regularly for leaks, equipment damage, and other service problems.
  - Clearly designate vehicle/equipment service areas away from drainage facilities and watercourses to prevent stormwater run-on and runoff.
  - Use drip pans, drip cloths, or absorbent pads when replacing spent fluids.
  - Collect all spent fluids, store in appropriate labeled containers in the proper storage areas, and recycle fluids whenever possible.
- **Control Equipment/Vehicle Washing and Allowable Non-Stormwater Discharges.** Implement practices to prevent contamination of surface and groundwater from equipment and vehicle wash water. Representative practices include:
  - Educate employees and subcontractors on proper washing procedures.
  - Use off-site washing facilities, when available.
  - Clearly mark the washing areas and inform workers that all washing must occur in this area.
  - Contain wash water and treat it using BMPs. Infiltrate washwater when possible, but maintain separation from drainage paths and waterbodies.

- Use high-pressure water spray at vehicle washing facilities without detergents. Water alone can remove most dirt adequately.

- Do not conduct other activities, such as vehicle repairs, in the wash area.

- Include the location of the washing facilities and the inspection and maintenance procedures in the SWMP.

- **Develop a Spill Prevention and Response Plan.** Spill prevention and response procedures must be identified in the SWMP. Representative procedures include identifying ways to reduce the chance of spills, stop the source of spills, contain and clean up spills, dispose of materials contaminated by spills, and train personnel responsible for spill prevention and response. The plan should also specify material handling procedures and storage requirements and ensure that clear and concise spill cleanup procedures are provided and posted for areas in which spills may potentially occur. When developing a spill prevention plan, include the following:

  - Note the locations of chemical storage areas, storm drains, tributary drainage areas, surface waterbodies on or near the site, and measures to stop spills from leaving the site.

  - Provide proper handling and safety procedures for each type of waste. Keep Material Safety Data Sheets (MSDSs) for chemical used on site with the SWMP.

  - Establish an education program for employees and subcontractors on the potential hazards to humans and the environment from spills and leaks.

  - Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or municipal sewage treatment facilities to request assistance. Emergency procedures and contact numbers should be provided in the SWMP and posted at storage locations.

  - Describe the procedures, equipment and materials for immediate cleanup of spills and proper disposal.

  - Identify personnel responsible for implementing the plan in the event of a spill. Update the spill prevention plan and clean up materials as changes occur to the types of chemicals stored and used at the facility.

Spill Prevention, Control, and Countermeasure (SPCC) Plan

Construction sites may be subject to 40 CFR Part 112 regulations that require the preparation and implementation of a SPCC Plan to prevent oil spills from aboveground and underground storage tanks. The facility is subject to this rule if it is a non-transportation-related facility that:

- Has a total storage capacity greater than 1,320 gallons or a completely buried storage capacity greater than 42,000 gallons.
- Could reasonably be expected to discharge oil in quantities that may be harmful to navigable waters of the United States and adjoining shorelines.

Furthermore, if the facility is subject to 40 CFR Part 112, the SWMP should reference the SPCC Plan. To find out more about SPCC Plans, see EPA's website on SPPC at www.epa.gov/oilspill/spcc.htm.

Reporting Oil Spills

In the event of an oil spill, contact the National Response Center toll free at 1-800-424- 8802 for assistance, or for more details, visit their website: www.nrc.uscg.mil.

Maintenance and Removal

Effective implementation of good housekeeping practices is dependent on clear designation of personnel responsible for supervising and implementing good housekeeping programs, such as site cleanup and disposal of trash and debris, hazardous material management and disposal, vehicle and equipment maintenance, and other practices. Emergency response "drills" may aid in emergency preparedness.

Checklists may be helpful in good housekeeping efforts.

Staging and storage areas require permanent stabilization when the areas are no longer being used for construction-related activities.

Construction-related materials, debris and waste must be removed from the construction site once construction is complete.

Design Details

See the following Fact Sheets for related Design Details:

MM-1 Concrete Washout Area

MM-2 Stockpile Management

SM-4 Vehicle Tracking Control

Design details are not necessary for other good housekeeping practices; however, be sure to designate where specific practices will occur on the appropriate construction drawings.

Mulching

What it is

Mulching is used to temporarily stabilize soils by securely applying materials such as grass, hay, woodchips or wood fibers to the soil's surface. Mulching protects the soil from raindrop impact and reduces the velocity of overland runoff. Mulch also aids in the growth of temporary seeding by holding seeds and topsoil in place, retaining moisture, and insulating against extreme temperatures.

When and Where to use it

- All disturbed areas and stockpiles shall be mulched within 21 days after final grade is reached.
- Disturbed areas and stockpiles which are not at final grade but will remain dormant for longer than 30 days shall also be mulched within 21 days after interim grading.
- An area that is going to remain in an interim state for more than 60 days shall also be seeded.
- Mulching is always to be used when applying temporary or permanent seeding.
- Mulching is often used when temporary seeding cannot be used due to the season or climate.

When and Where NOT to use it

- In areas that will involve paving, building, or utility construction within 21 days after final grade is reached.

Application Techniques and Maintenance Requirements

Figure MU-1 provides application techniques and maintenance requirements for mulching.

MULCHING NOTES

INSTALLATION REQUIREMENTS

1. ALL DISTURBED AREAS MUST BE MULCHED WITHIN 21 DAYS AFTER FINAL GRADE AND SEEDED AREAS ARE TO BE MULCHED WITHIN 24 HOURS AFTER SEEDING.

2. MATERIAL USED FOR MULCH CAN BE CERTIFIED CLEAN, WEED- AND SEED-FREE LONG STEMMED FIELD OR MARSH HAY, OR STRAW OF OATS, BARLEY, WHEAT, RYE, OR TRITICALE CERTIFIED BY THE COLORADO DEPARTMENT OF AGRICULTURE WEED FREE FORAGE CERTIFICATION PROGRAM.

3. HYDRAULIC MULCHING MATERIAL SHALL CONSIST OF VIRGIN WOOD FIBER MANUFACTURED FROM CLEAN WHOLE WOOD CHIPS. WOOD CHIPS CANNOT CONTAIN ANY GROWTH OR GERMINATION INHIBITORS OR BE PRODUCED FROM RECYCLED MATERIAL. GRAVEL CAN ALSO BE USED.

4. MULCH IS TO BE APPLIED EVENLY AT A RATE OF 2 TONS PER ACRE.

5. MULCH IS TO BE ANCHORED EITHER BY CRIMPING (TUCKING MULCH FIBERS 4 INCHES INTO THE SOIL), USING NETTING (USED ON SMALL AREAS WITH STEEP SLOPES), OR WITH A TACKIFIER.

6. HYDRAULIC MULCHING AND TACKIFIERS ARE NOT TO BE USED IN THE PRESENCE OF FREE SURFACE WATER.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL MULCHED AREAS.

2. MULCH IS TO BE REPLACED IMMEDIATELY IN THOSE AREAS IT HAS BEEN REMOVED, AND IF NECESSARY THE AREA SHOULD BE RESEEDED.

Silt Fence

What it is

A silt fence is a temporary sediment barrier constructed of filter fabric stretched across supporting posts. The bottom edge of the fabric is entrenched and covered with backfill.

When and Where to use it

- On the down gradient perimeters of a construction site.
- On a contour to control overland sheet flow.
- At the top or toe of a steep slope.
- As a form of inlet protection (see inlet protection factsheet).

Figure SF-1 depicts five cases where the use of silt fence is appropriate.

When and Where NOT to use it

- In areas of concentrated flows such as in ditches, swales or channels that drain areas greater than 1.0 acre.
- At the top of a slope or at high points which do not receive any drainage flows.

This photo reveals a silt fence that has become unentrenched because it was not securely installed.

This photo illustrates what will happen to a silt fence if it is installed in an area of concentrated flow.

Construction Detail and Maintenance Requirements

Figure SF-2 provides a construction detail and maintenance requirements for a silt fence.

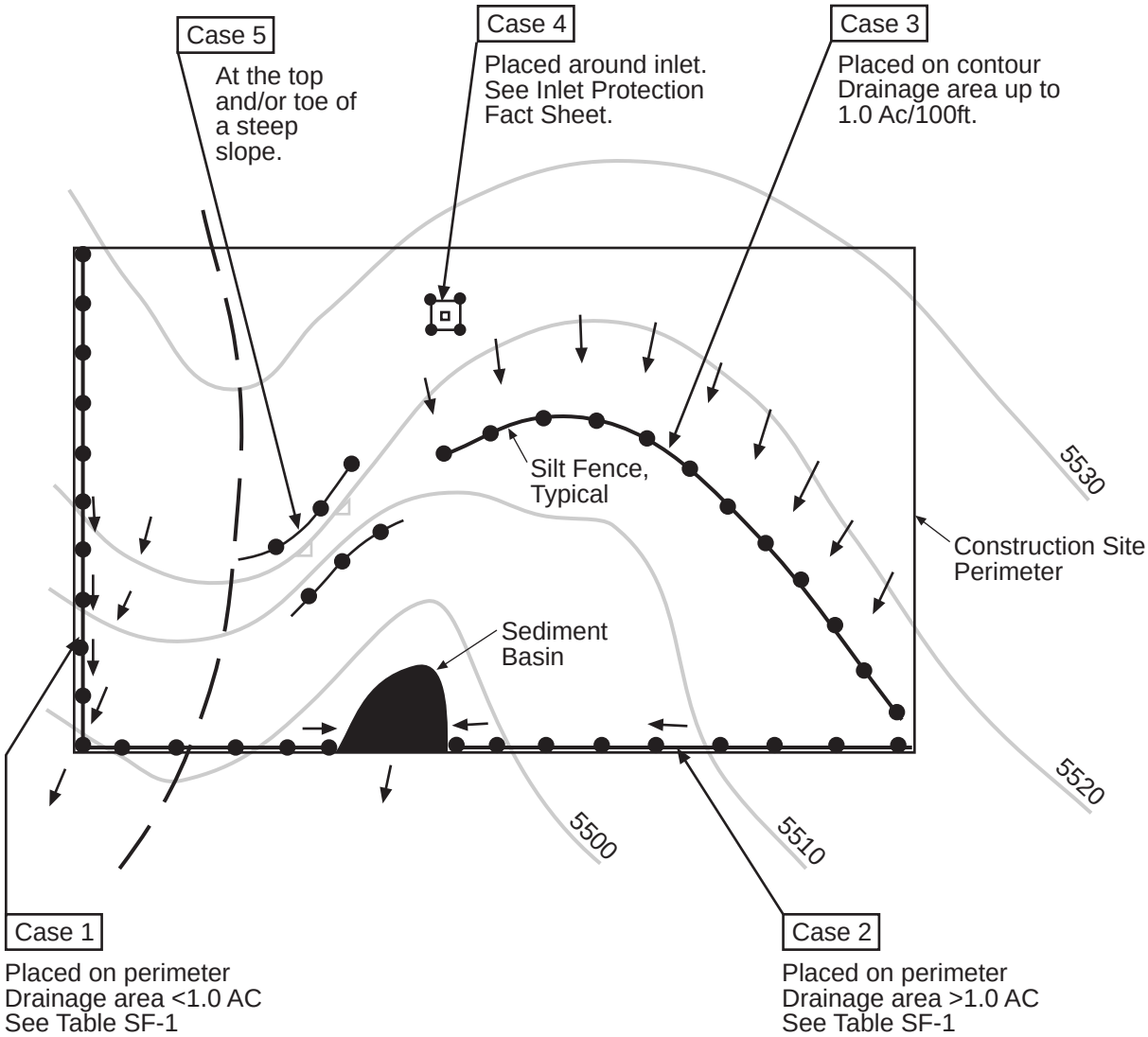


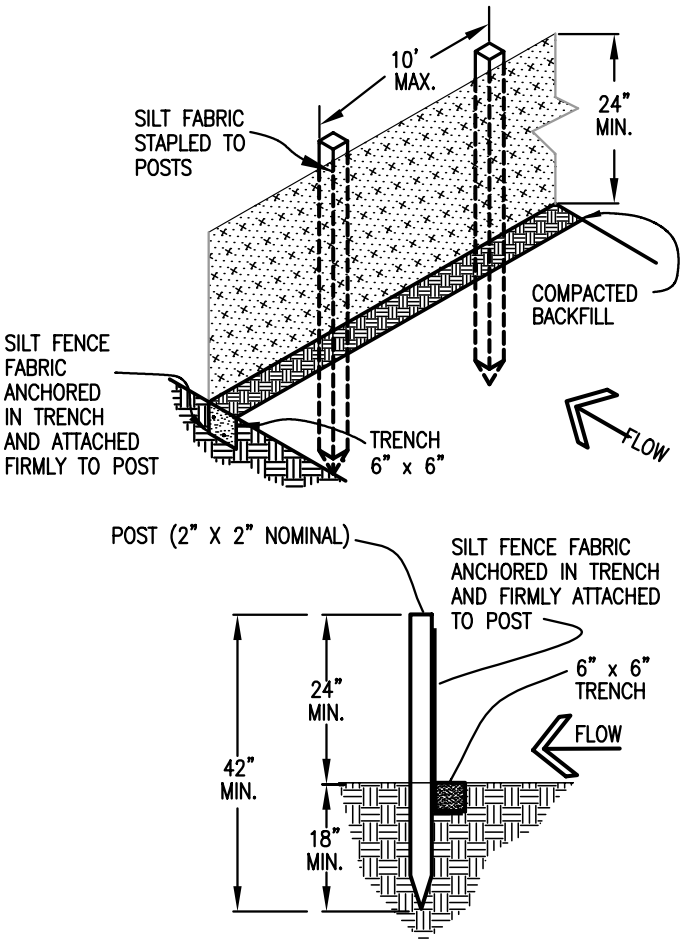
Table SF-1

Silt Fence Used as Perimeter Control	Case 1		Case 2 DA > 1.0 AC
	DA < 0.25 AC	0.25 < DA < 1 AC	
Continuous Grade	OK (1)	OK (1)	OK (1)
Area of Concentrated Flow	OK	NO (2)	NO (3)

(1) Temporary Swale or Straw Bale Barrier may be used as alternative to a Silt Fence.
(2) Check Dam may also be used as alternative to Silt Fence at low point.
(3) Sediment Basin is required for concentrated flow from drainage areas > 1.0 AC.

City of Colorado Springs Storm Water Quality	Figure SF-1 Silt Fence Application Examples

DEN/M/153722.CS.CB/FigSF-1/9-99



SILT FENCE

SILT FENCE NOTES

INSTALLATION REQUIREMENTS

1. SILT FENCES SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

2. WHEN JOINTS ARE NECESSARY, SILT FENCE GEOTEXTILE SHALL BE SPLICED TOGETHER ONLY AT SUPPORT POST AND SECURELY SEALED.

3. METAL POSTS SHALL BE "STUDDED TEE" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD POSTS SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.

4. THE FILTER MATERIAL SHALL BE FASTENED SECURELY TO METAL OR WOOD POSTS USING WIRE TIES, OR TO WOOD POSTS WITH 3/4" LONG #9 HEAVY-DUTY STAPLES. THE SILT FENCE GEOTEXTILE SHALL NOT BE STAPLED TO EXISTING TREES.

5. WHILE NOT REQUIRED, WIRE MESH FENCE MAY BE USED TO SUPPORT THE GEOTEXTILE. WIRE FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY-DUTY WIRE STAPLES AT LEAST 3/4" LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 6" AND SHALL NOT EXTEND MORE THAN 3' ABOVE THE ORIGINAL GROUND SURFACE.

6. ALONG THE TOE OF FILLS, INSTALL THE SILT FENCE ALONG A LEVEL CONTOUR AND PROVIDE AN AREA BEHIND THE FENCE FOR RUNOFF TO POND AND SEDIMENT TO SETTLE. A MINIMUM DISTANCE OF 5 FEET FROM THE TOE OF THE FILL IS RECOMMENDED.

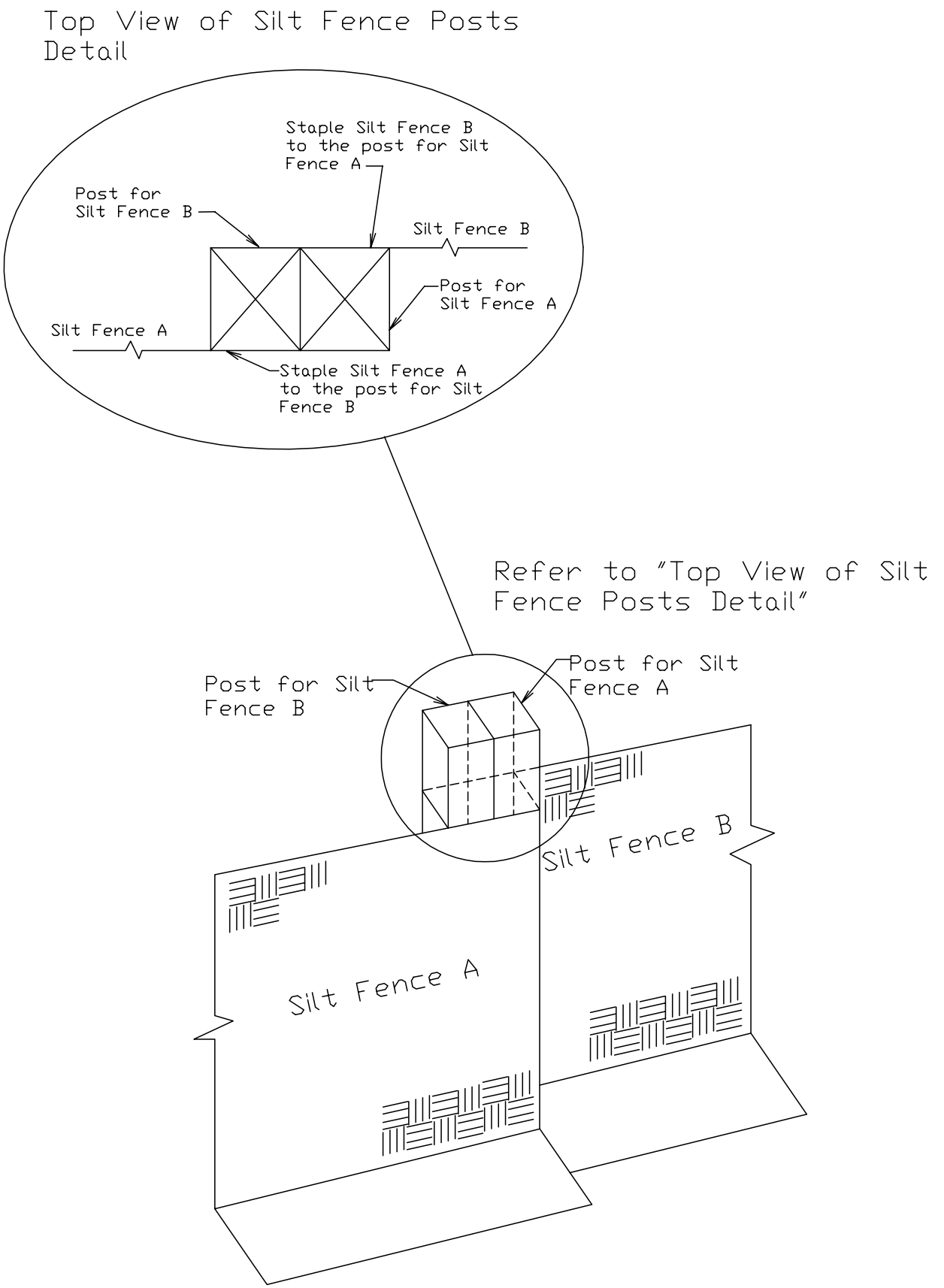
7. THE HEIGHT OF THE SILT FENCE FROM THE GROUND SURFACE SHALL BE MINIMUM OF 24 INCHES AND SHALL NOT EXCEED 36 INCHES; HIGHER FENCES MAY INPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT SILT FENCES IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS OF NO RAINFALL. DAMAGED, COLLAPSED, UNENTRENCHED OR INEFFECTIVE SILT FENCES SHALL BE PROMPTLY REPAIRED OR REPLACED.

2. SEDIMENT SHALL BE REMOVED FROM BEHIND SILT FENCE WHEN IT ACCUMULATES TO HALF THE EXPOSED GEOTEXTILE HEIGHT.

3. SILT FENCES SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED AS APPROVED BY THE CITY.



City of Colorado Springs
Stormwater Quality

Figure SF-3
Silt Fence Joint Tying
Construction Detail and Maintenance Requirements

Surface Roughening

What it is

Surface roughening is a temporary erosion control practice where the soil surface is roughened by the creation of grooves, depressions, or steps that run parallel to the contour of the land.

When and Where to use it

- Surface roughening is appropriate for all slopes and should be performed immediately after rough grades have been established in an area.
- Surface roughening can also be used to help establish vegetative cover by reducing runoff velocity and giving seed an opportunity to take hold and grow.
- Surface roughening can be used in combination with other erosion control measures such as mulching and seeding.

When and Where NOT to use it

- Slopes that are not smooth-graded and are left sufficiently rough after final grading do not need further roughening to control erosion.
- Surface roughening alone is not sufficient to stabilize a slope for long periods of times, further stabilization measures should be implemented within two weeks of grading.
- Extremely sandy or rocky soils are not well suited for surface roughening.

Application Techniques and Maintenance Requirements

Figure SR-1 provides application techniques and maintenance requirements for surface roughening.

SURFACE ROUGHENING NOTES

APPLICATION TECHNIQUES

1. STAIR STEP GRADING – USED ON SLOPES WITH GRADIENTS BETWEEN 3:1 AND 2:1 AND FOR SOIL CONTAINING A LARGE AMOUNT OF SMALL ROCKS. STAIRS ARE TO BE WIDE ENOUGH TO WORK WITH STANDARD EARTH MOVING EQUIPMENT.
2. GROOVE CUTTING – USED ON SLOPES WITH GRADIENTS BETWEEN 3:1 AND 2:1. GROOVES ARE TO BE AT LEAST 3 INCHES DEEP AND NO MORE THAN 15 INCHES APART.
3. TRACKING – USED ON SOILS WITH HIGHER SAND CONTENT DUE TO COMPACTION BY HEAVY MACHINERY.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL SURFACE ROUGHENED AREAS.
2. SURFACE ROUGHENING IS TO BE REPEATED AS OFTEN AS NECESSARY.
3. VEHICLES OR EQUIPMENT IS NOT TO BE DRIVEN OVER AREAS THAT HAVE BEEN ROUGHENED.
4. AS SURFACE ROUGHENING IS ONLY A TEMPORARY CONTROL, ADDITIONAL TREATMENTS MAY BE NECESSARY TO MAINTAIN THE SOIL SURFACE IN A ROUGHENED CONDITION.

Temporary Seeding

What it is

Temporary seeding is the use of quickly germinating vegetative cover on disturbed areas to stabilize soils and control erosion.

When and Where to use it

- On any disturbed areas that are to remain in an interim state for more than 60 days, but less than one year.

When and Where NOT to use it

- Temporary seeding shall not be used in areas that receive construction traffic; granular material shall be used to stabilize high traffic areas (see Vehicle Tracking Fact Sheet).
- Temporary seeding is not to be used on disturbed areas left in an interim state for more than 1 year. Permanent seeding is then required.

Application Techniques and Maintenance Requirements

Figure TS-1 provides application techniques and maintenance requirements for temporary seeding.

RECOMMENDED ANNUAL GRASSES

SPECIES (COMMON NAME)	GROWTH SEASON	SEEDING DATE	POUNDS OF PURE LIVE SEED (PLS) (PLS/ACRE)	PLANTING DEPTH (INCHES)
1. OATS	COOL	MARCH 16 - APRIL 30	35-50	1-2
2. SPRING WHEAT	COOL	MARCH 16 - APRIL 30	25-35	1-2
3. SPRING BARLEY	COOL	MARCH 16 - APRIL 30	25-35	1-2
4. ANNUAL RYEGRASS	COOL	MARCH 16 - JUNE 30	10-15	1/2
5. MILLET	WARM	MAY 16 - JULY 15	3-15	1/2-3/4
6. SUDANGRASS	WARM	MAY 16 - JULY 15	5-10	1/2-3/4
7. SORGHUM	WARM	MAY 16 - JULY 15	5-10	1/2-3/4
8. WINTER WHEAT	COOL	SEPTEMBER 1 - 30	20-35	1-2
9. WINTER BARLEY	COOL	SEPTEMBER 1 - 30	20-35	1-2
10. WINTER RYE	COOL	SEPTEMBER 1 - 30	20-35	1-2
11. TRITICALE	COOL	SEPTEMBER 1 - 30	25-40	1-2

THIS TABLE WAS TAKEN FROM UDFCD FOR RECOMMENDED ANNUAL GRASSES FOR THE DENVER METROPOLITAN AREA. THIS TABLE MAY BE USED UNLESS A SITE-SPECIFIC SEED MIX IS REQUESTED AND APPROVED.

TABLE TS-1

TEMPORARY SEEDING NOTES

INSTALLATION REQUIREMENTS

1. DISTURBED AREAS ARE TO BE SEEDED WITHIN 21 DAYS AFTER CONSTRUCTION ACTIVITY OR GRADING ENDS IF SEASON ALLOWS.

2. IF NECESSARY, SOIL IS TO BE CONDITIONED FOR PLANT GROWTH BY APPLYING TOPSOIL, FERTILIZER, OR LIME.

3. SOIL IS TO BE TILLED IMMEDIATELY PRIOR TO APPLYING SEEDS. COMPACT SOILS ESPECIALLY NEED TO BE LOOSENED.

4. SEEDBED DEPTH IS TO BE 4 INCHES FOR SLOPES FLATTER THAN 2:1, AND 1 INCH FOR SLOPES STEEPER THAN 2:1.

5. ANNUAL GRASSES LISTED IN TABLE TS-1 ARE TO BE USED FOR TEMPORARY SEEDING. SEED MIXES ARE NOT TO CONTAIN ANY NOXIOUS WEED SEEDS INCLUDING RUSSIAN OR CANADIAN THISTLE, KNAPWEED, PURPLE LOOSESTRIFE, EUROPEAN BINDWEED, JOHNSON GRASS, AND LEAFY SPURGE.

6. TABLE TS-1 ALSO PROVIDES REQUIREMENTS FOR SEEDING RATES, SEEDING DATES, AND PLANTING DEPTHS FOR THE APPROVED TYPES OF ANNUAL GRASSES.

7. SEEDING IS TO BE APPLIED USING MECHANICAL TYPE DRILLS EXCEPT WHERE SLOPES ARE STEEP OR ACCESS IS LIMITED THEN HYDRAULIC SEEDING MAY BE USED.

8. ALL SEEDED AREAS ARE TO BE MULCHED (SEE FACTSHEET ON MULCHING).

9. IF HYDRAULIC SEEDING IS USED THEN HYDRAULIC MULCHING SHALL BE DONE SEPARATELY TO AVOID SEEDS BECOMING ENCAPSULATED IN THE MULCH.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL SEEDED AREAS TO ENSURE GROWTH.

2. AREAS WHERE GROWTH IS NOT OCCURRING QUICKLY OR THE MULCH HAS BEEN REMOVED SHALL BE RE-SEEDED AS SOON AS POSSIBLE AND RE-MULCHED IF NEEDED.

3. SEEDED AREAS ARE NOT TO BE DRIVEN OVER WITH CONSTRUCTION EQUIPMENT OR VEHICLES.

Vehicle Tracking

What it is

Vehicle tracking refers to the stabilization of construction entrances, roads, parking areas, and staging areas to prevent the tracking of sediment from the construction site.

When and Where to use it

- All points where vehicles exit the construction site onto a public road.
- Construction entrance/exit should be located at permanent access locations if at all possible.
- Construction roads and parking areas.
- Loading and unloading areas.
- Storage and staging areas.
- Where trailers are parked.
- Any construction area that receives high vehicular traffic.

When and Where NOT to use it

- The vehicle tracking area should not be located in areas that are wet or where soils erode easily.

This picture shows an unstabilized entrance where dirt is being tracked onto a public road.

Construction Details and Maintenance Requirements

Figure VT-1 and VT-2 provide construction details and maintenance requirements for vehicle tracking.

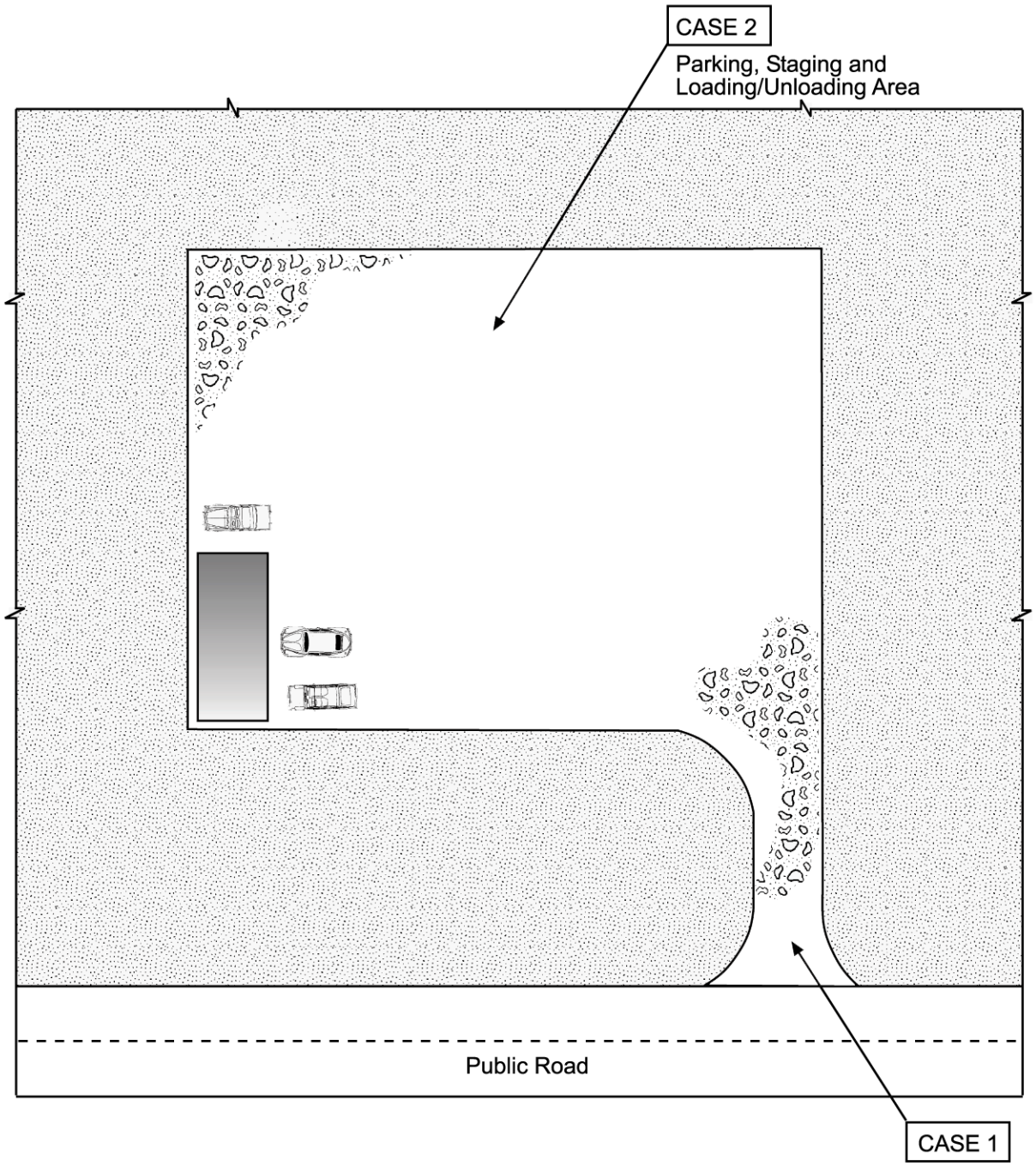
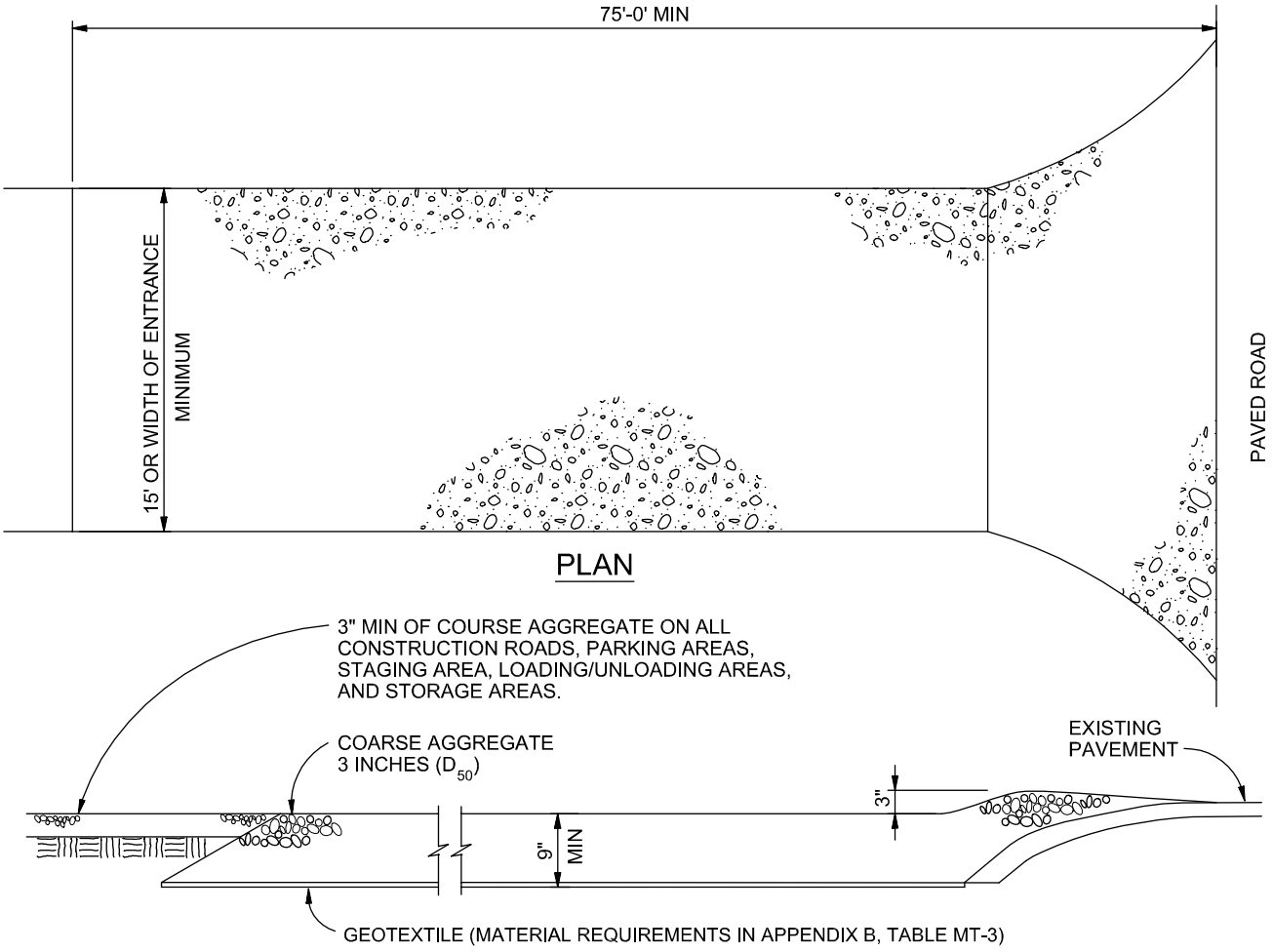


Table VT-1

	Case 1	Case 2
Gravel Thickness	9”	3”
Filter Fabric	YES	NO

City of Colorado Springs
Storm Water Quality

Figure VT-1
Vehicle Tracking
Application Examples



VEHICLE TRACKING

NTS

VEHICLE TRACKING NOTES

INSTALLATION REQUIREMENTS

1. ALL ENTRANCES TO THE CONSTRUCTION SITE ARE TO BE STABILIZED PRIOR TO CONSTRUCTION BEGINNING.

2. CONSTRUCTION ENTRANCES ARE TO BE BUILT WITH AN APRON TO ALLOW FOR TURNING TRAFFIC, BUT SHOULD NOT BE BUILT OVER EXISTING PAVEMENT EXCEPT FOR A SLIGHT OVERLAP.

3. AREAS TO BE STABILIZED ARE TO BE PROPERLY GRADED AND COMPACTED PRIOR TO LAYING DOWN GEOTEXTILE AND STONE.

4. CONSTRUCTION ROADS, PARKING AREAS, LOADING/UNLOADING ZONES, STORAGE AREAS, AND STAGING AREAS ARE TO BE STABILIZED.

5. CONSTRUCTION ROADS ARE TO BE BUILT TO CONFORM TO SITE GRADES, BUT SHOULD NOT HAVE SIDE SLOPES OR ROAD GRADES THAT ARE EXCESSIVELY STEEP.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL STABILIZED AREAS, ESPECIALLY AFTER STORM EVENTS.

2. STONES ARE TO BE REAPPLIED PERIODICALLY AND WHEN REPAIR IS NECESSARY.

3. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED DAILY BY SHOVELING OR SWEEPING. SEDIMENT IS NOT TO BE WASHED DOWN STORM SEWER DRAINS.

4. STORM SEWER INLET PROTECTION IS TO BE IN PLACE, INSPECTED, AND CLEANED IF NECESSARY.

5. OTHER ASSOCIATED SEDIMENT CONTROL MEASURES ARE TO BE INSPECTED TO ENSURE GOOD WORKING CONDITION.

Sediment Basin (SB) SC-7

Description

A sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. Sediment basins are designed to capture site runoff and slowly release it to allow time for settling of sediment prior to discharge. Sediment basins are often constructed in locations that will later be modified to serve as post-construction stormwater basins.

Photograph SB-1. Sediment basin at the toe of a slope. Photo courtesy of WWE.

Appropriate Uses

Most large construction sites (typically greater than 2 acres) will require one or more sediment basins for effective management of construction site runoff. On linear construction projects, sediment basins may be impractical; instead, sediment traps or other combinations of BMPs may be more appropriate.

Sediment basins should not be used as stand-alone sediment controls. Erosion and other sediment controls should also be implemented upstream.

When feasible, the sediment basin should be installed in the same location where a permanent post-construction detention pond will be located.

Design and Installation

The design procedure for a sediment basin includes these steps:

- **Basin Storage Volume**: Provide a storage volume of at least 3,600 cubic feet per acre of drainage area. To the extent practical, undisturbed and/or off-site areas should be diverted around sediment basins to prevent "clean" runoff from mixing with runoff from disturbed areas. For undisturbed areas (both on-site and off-site) that cannot be diverted around the sediment basin, provide a minimum of 500 ft^3/acre of storage for undeveloped (but stable) off-site areas in addition to the 3,600 ft^3/acre for disturbed areas. For stable, developed areas that cannot be diverted around the sediment basin, storage volume requirements are summarized in Table SB-1.

- **Basin Geometry:** Design basin with a minimum length-to-width ratio of 2:1 (L:W). If this cannot be achieved because of site space constraints, baffling may be required to extend the effective distance between the inflow point(s) and the outlet to minimize short-circuiting.

- **Dam Embankment**: It is recommended that embankment slopes be 4:1 (H:V) or flatter and no steeper than 3:1 (H:V) in any location.

Sediment Basins	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

- **Inflow Structure**: For concentrated flow entering the basin, provide energy dissipation at the point of inflow.

Table SB-1. Additional Volume Requirements for Undisturbed and Developed Tributary Areas Draining through Sediment Basins

Imperviousness (%)	Additional Storage Volume (ft^3) Per Acre of Tributary Area
Undeveloped	500
10	800
20	1230
30	1600
40	2030
50	2470
60	2980
70	3560
80	4360
90	5300
100	6460

- **Outlet Works**: The outlet pipe shall extend through the embankment at a minimum slope of 0.5 percent. Outlet works can be designed using one of the following approaches:

  - **Riser Pipe (Simplified Detail):** Detail SB-1 provides a simplified design for basins treating no more than 15 acres.

  - **Orifice Plate or Riser Pipe**: Follow the design criteria for Full Spectrum Detention outlets in the EDB Fact Sheet provided in Chapter 4 of this manual for sizing of outlet perforations with an emptying time of approximately 72 hours. In lieu of the trash rack, pack uniformly sized 1½ - to 2-inch gravel in front of the plate or surrounding the riser pipe. This gravel will need to be cleaned out frequently during the construction period as sediment accumulates within it. The gravel pack will need to be removed and disposed of following construction to reclaim the basin for use as a permanent detention facility. If the basin will be used as a permanent extended detention basin for the site, a trash rack will need to be installed once contributing drainage areas have been stabilized and the gravel pack and accumulated sediment have been removed.

  - **Floating Skimmer**: If a floating skimmer is used, install it using manufacturer's recommendations. Illustration SB-1 provides an illustration of a Faircloth Skimmer Floating Outlet™, one of the more commonly used floating skimmer outlets. A skimmer should be designed to release the design volume in no less than 48 hours. The use of a floating skimmer outlet can increase the sediment capture efficiency of a basin significantly. A floating outlet continually decants cleanest water off the surface of the pond and releases cleaner water than would discharge from a perforated riser pipe or plate.

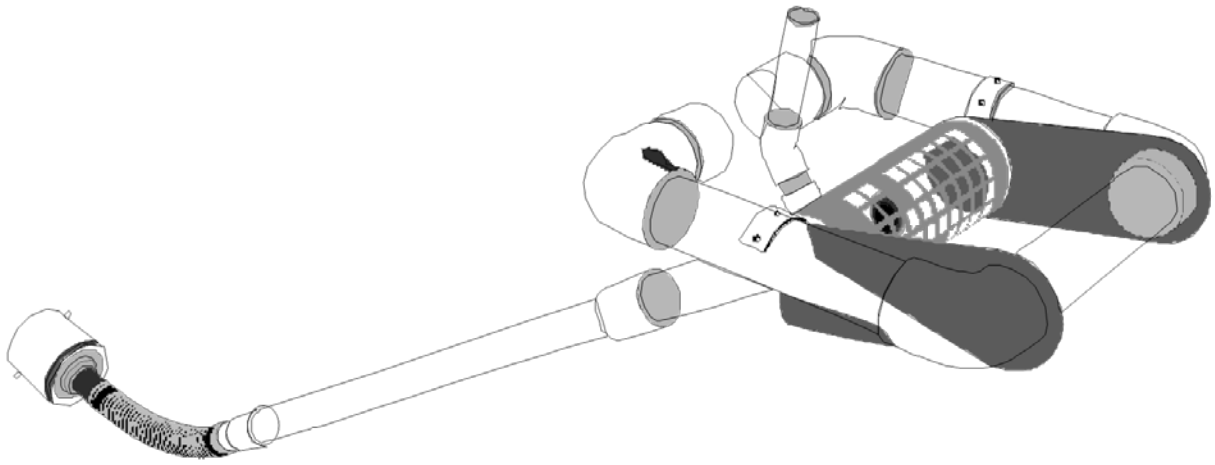


Illustration SB-1. Outlet structure for a temporary sediment basin - Faircloth Skimmer Floating Outlet. Illustration courtesy of J. W. Faircloth & Sons, Inc., FairclothSkimmer.com.

- **Outlet Protection and Spillway:** Consider all flow paths for runoff leaving the basin, including protection at the typical point of discharge as well as overtopping.
  - **Outlet Protection:** Outlet protection should be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway into which discharge occurs. This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.
  - **Emergency Spillway:** Provide a stabilized emergency overflow spillway for rainstorms that exceed the capacity of the sediment basin volume and its outlet. Protect basin embankments from erosion and overtopping. If the sediment basin will be converted to a permanent detention basin, design and construct the emergency spillway(s) as required for the permanent facility. If the sediment basin will not become a permanent detention basin, it may be possible to substitute a heavy polyvinyl membrane or properly bedded rock cover to line the spillway and downstream embankment, depending on the height, slope, and width of the embankments.

Maintenance and Removal

Maintenance activities include the following:

- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- Do not remove a sediment basin until the upstream area has been stabilized with vegetation.

Final disposition of the sediment basin depends on whether the basin will be converted to a permanent post-construction stormwater basin or whether the basin area will be returned to grade. For basins being converted to permanent detention basins, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. If the sediment basin is not to be used as a permanent detention facility, fill the excavated area with soil and stabilize with vegetation.

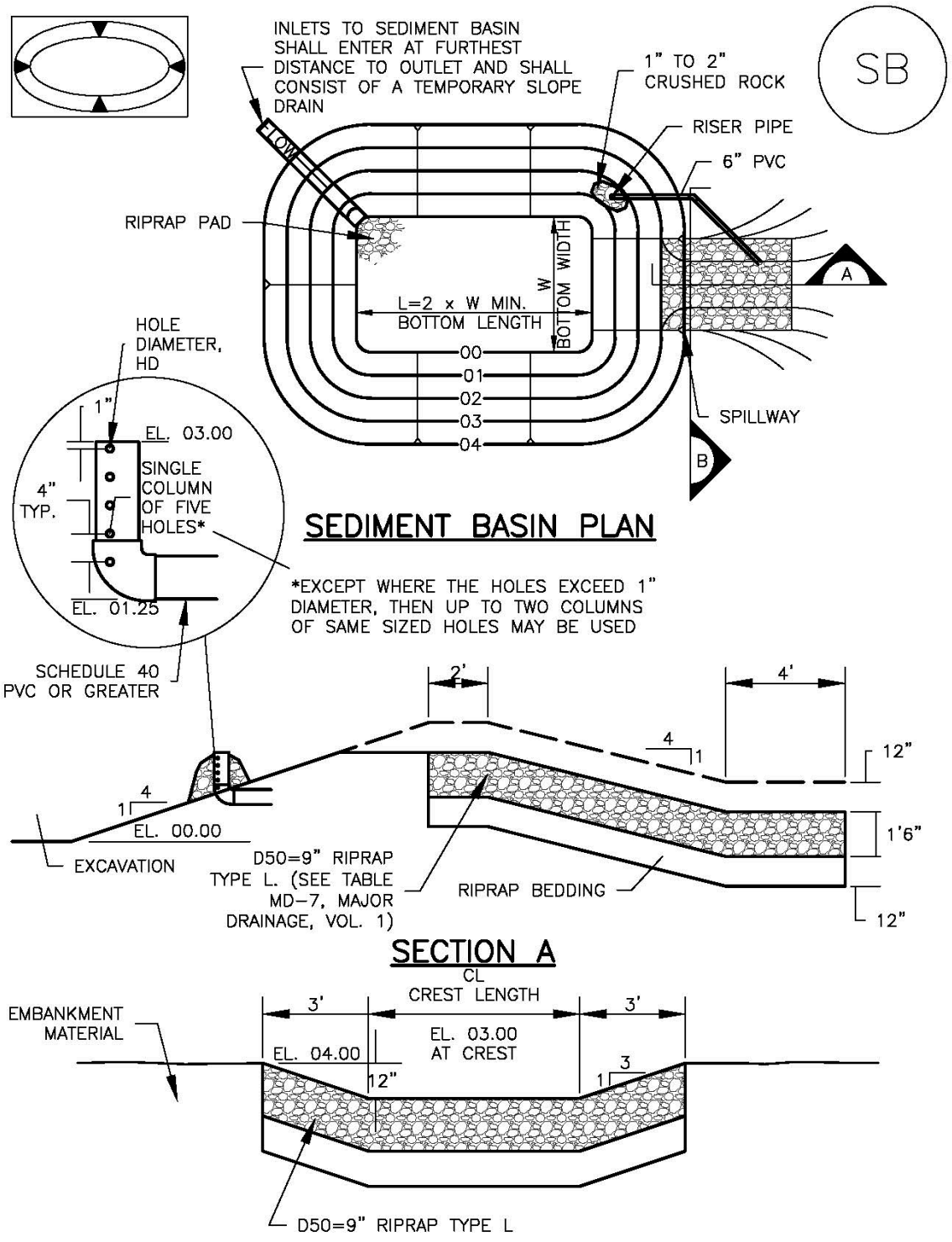

SB
INLETS TO SEDIMENT BASIN SHALL ENTER AT FURTHEST DISTANCE TO OUTLET AND SHALL CONSIST OF A TEMPORARY SLOPE DRAIN
FLOW
1" TO 2" CRUSHED ROCK
RISER PIPE
6" PVC
RIPRAP PAD
W BOTTOM WIDTH
L=2 x W MIN. BOTTOM LENGTH
00
01
02
03
04
A
B
SPILLWAY
HOLE DIAMETER, HD
1"
EL. 03.00
4" TYP.
SINGLE COLUMN OF FIVE HOLES*
EL. 01.25
SCHEDULE 40 PVC OR GREATER
SEDIMENT BASIN PLAN
*EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED
2'
4'
4
1
12"
4
1
EL. 00.00
EXCAVATION
D50=9" RIPRAP TYPE L. (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1)
RIPRAP BEDDING
1'6"
12"
SECTION A
CL
CREST LENGTH
3'
3'
EMBANKMENT MATERIAL
EL. 04.00
EL. 03.00 AT CREST
12"
3
1
D50=9" RIPRAP TYPE L

TABLE SB–1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/16
3	28	5	½
4	33 ½	6	9/16
5	38 ½	8	21/32
6	43	9	21/32
7	47 ¼	11	25/32
8	51	12	27/32
9	55	13	⅞
10	58 ¼	15	15/16
11	61	16	31/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 ⅛
15	73 ¼	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF SEDIMENT BASIN.
   - –TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   - –FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   - –FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).

5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.

6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Appendix E

Kumar & Associates, Inc.
Geotechnical and Materials Engineers
and Environmental Scientists

ACEC
MEMBER

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Office Locations: Denver (HQ), Colorado Springs, Fort Collins, Glenwood Springs, Parker, and Summit County, Colorado

September 5, 2017

Wright Water Engineers
Attn: Mr. Hayes Lenhart, P.E.
2490 West 26th Avenue, Suite 100-A
Denver, Colorado 80211

Subject: Proposed Forest Lakes Water Treatment Plant, Near SWC of Forest Lakes Drive and Long Valley Drive, El Paso County, Colorado

Project No. 042-106.1

Dear Mr. Lenhart:

As requested, this letter provides our opinion regarding the suitability of our previously prepared geotechnical engineering report for the design of the proposed water treatment plant in El Paso, Colorado. We previously prepared a geotechnical report for the plant development, Project No. 042-106, dated February 20, 2004, and supplement letter dated August 20, 2004.

We understand the proposed construction will be similar to what was described in our 2004 report, although it appears the treatment building footprint has been rotated and changed in size from 75'x85' to about 110'x40'. Also, a detached backwash reclaim basin with approximate plan dimensions of 45'x35' will be added immediately northeast of the treatment plant building. We also understand the site hasn't been significantly altered since the original construction. A well control building and associated infrastructure has been built south of the proposed water treatment plant since our 2004 study.

Based on our understanding of the proposed construction, it is our opinion the recommendations contained in our 2004 report remain applicable for the proposed construction. The assumption has been made that the subsurface conditions in the area of proposed construction are consistent to those reported in 2004. At the time of construction, we recommend a representative of Kumar & Associates observe all foundation excavations prior to fill and concrete placement to further confirm the recommendations provided. Since we did not conduct additional subsurface exploration, we will be assuming the conditions observed in the excavation will represent those within the depth of influence of the foundation. It is possible the data obtained by a subsurface exploration could change the recommendations contained in the 2004 report, however, the previously reported subsurface conditions did appear fairly uniform, and the risk of differing conditions seems low.

If there are any questions or we may be of further assistance, do not hesitate to contact our office.
Sincerely,

KUMAR & ASSOCIATES, INC.
Duane P. Craft, P.E.

D. P. Craft
9/5/17

DPC:bj
Rev. by: AFK

Kumar & Associates, Inc.
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GEOTECHNICAL ENGINEERING STUDY
PROPOSED FOREST LAKES WATER TREATMENT PLANT
FOREST LAKES DEVELOPMENT
EL PASO COUNTY, COLORADO

Prepared by:
Bruce E. Berends, P.E.

Reviewed by:

Duane P. Craft, P.E.

Prepared for:

FOREST LAKES METROPOLITAN DISTRICT
2 NORTH CASCADE AVENUE, SUITE 1280
COLORADO SPRINGS, COLORADO 80903

ATTN: MS. ANN NICHOLS

Project No. 042-106

February 20, 2004

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SUMMARY

1. The subsurface conditions at the sites of the proposed treatment plant building, raw water pump station and along the raw water line alignment can generally be characterized by silty sand and clayey sand overburden soils underlain by sandstone bedrock. The thickness of the overburden soils at the treatment plant site range from approximately 11 to 20 feet, at the future building site is approximately 19 feet, at the approximate midpoint of the raw water line is approximately 13.5 feet, and at the raw water pump station site is approximately 2 feet.

2. When measurements were made up to ten days after the borings were drilled, ground water was encountered at a depth of approximately 25 feet in Boring 4 at the treatment plant, approximately 30 feet in Boring 5 at the site of possible future construction, and approximately 11 feet in Boring 7 at the pump station site. Ground water was not encountered in the other four borings.

3. We recommend the proposed treatment plant building and raw water pump station be supported on spread footings or mat foundations bearing on the undisturbed native soils, sandstone bedrock or new structural fill. Spread footings and mat foundations may be designed for an allowable bearing pressure of 3,000 psf.

PURPOSE AND SCOPE OF STUDY

This report presents the results of a geotechnical engineering study for the proposed Forest Lakes Water Treatment Plant to be located in the Forest Lakes Development south and west of the intersection of the proposed Forest Lakes and Long Valley Drives. The project site is shown on Figure 1. The study was conducted in accordance with the scope of work and our proposal dated January 12, 2004, for the purpose of developing foundation recommendations for the proposed structures.

This report has been prepared to summarize the data obtained during this study, and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction of the proposed facilities are included in the report.

PROPOSED CONSTRUCTION

We understand the treatment plant building will be a single-story structure with plan dimensions of approximately 75 x 85 feet. A clearwell inside of the building will extend to

approximately 17 feet below the building slab level. Foundation loads for the structure are assumed to be light, typical for a single story building. The information provided suggests grading for the building will require cuts ranging from approximately 6 to 16 feet.

The raw water pump station will be a buried concrete structure which will extend to approximately 25.5 feet below the ground level at the structure. The grading plans indicate grade changes at the pump station will be negligible.

The proposed 8-inch raw water line will be approximately 1,350 feet long and will extend from the proposed raw water pump station east to the proposed treatment plant building. We understand trench depths for the raw water line will be approximately 7 feet below the final grade which, based on the grading plans, ranges from near existing grade to approximately 15 feet below the existing grades.

If the proposed construction varies significantly from that described above or depicted in this report, we should be notified to reevaluate the recommendations provided herein.

SITE CONDITIONS

At the time of our field studies, the area of the proposed construction was vacant and vegetated with native grasses and weeds. The ground surface at the treatment plant site is moderately sloping down to the east; there is approximately 11 feet of relief within the proposed treatment plant footprint. The ground surface at the raw water pump station is gently sloping down to the south toward Bristlecone Lake. There is approximately 2 feet of relief within the pump station footprint. The ground surface along the proposed alignment of the 8-inch raw water line has strongly sloping to moderately steep slopes down to the southwest, south and southeast. From the proposed raw water pump station site, the existing grade along the proposed raw water line alignment rises approximately 44 feet to the approximate midpoint of the water line and then falls approximately 38 feet to the proposed treatment plant site. Bristlecone Lake is located approximately 170 feet southwest of the treatment plant site and 50 feet south of the pump station site.

SUBSURFACE CONDITIONS

Information on subsurface conditions at the site was obtained by drilling seven exploratory borings at the approximate locations shown on Figure 1. Borings 1 through 4 were drilled at the proposed treatment plant building site, Boring 5 was drilled at a potential future building site south of the treatment plant, Boring 6 was drilled at the approximate midpoint of the raw water line, and Boring 7 was drilled at the proposed site of the raw water pump station. Logs of the borings are presented on Figure 2, which is followed by the legend and notes for the logs on Figure 3. The results of laboratory testing performed on selected soil samples of the subsoils are presented on Figures 2 and 4 though 7, and are summarized on Table I.

The subsurface conditions at the sites of the proposed treatment plant building, raw water pump station and along the raw water line alignment can generally be characterized by silty sand and clayey sand overburden soils underlain by sandstone bedrock. The thickness of the overburden soils at the treatment plant site range from approximately 11 to 20 feet, at the future building site is approximately 19 feet, at the approximate midpoint of the raw water line is approximately 13.5 feet, and at the raw water pump station site is approximately 2 feet. The sampler penetration blow counts indicate the silty sands are loose to very dense, that the clayey sands are medium to hard in consistency, and that the sandstone bedrock is medium hard to very hard in consistency. Results of a swell-consolidation test presented on Figure 7 indicate the tested sample of clayey sand had a low swell potential when wetted under a 1 ksf surcharge.

The ground water level was measured at a depth of approximately 25 feet in Boring 4 at the treatment plant site, 30 feet in Boring 5 at the proposed future building site and 11 feet in Boring 7 at the raw water pump station site. Ground water was not observed in Boring 7 until a layer of cleaner sandstone was penetrated at a depth of approximately 29 feet. The water level rose in the boring after this layer was penetrated. Ground water was not encountered in the other four borings drilled on the site.

FOUNDATION RECOMMENDATIONS

Considering the subsurface conditions encountered in the exploratory borings and the nature of the proposed construction, we recommend the treatment plant and raw water pump station structures be supported on spread footings or mat foundations bearing on the

undisturbed native soil, sandstone bedrock or new structural fill. The design and construction criteria presented below should be observed for a spread footing foundation system. The construction details should be considered when preparing project documents.

1. Footings or mat foundations placed on the undisturbed native soils, sandstone or new structural fill may be designed for an allowable soil bearing pressure of 3,000 psf.

2. Spread footings placed on the native granular soils or structural fill should have a minimum width of 16 inches for continuous footings and 24 inches for isolated pads. For foundations bearing entirely on sandstone, the minimum foundation width should be 12 inches for both continuous footings and isolated pads.

3. Exterior foundations and foundations beneath unheated areas should be provided with adequate soil cover above their bearing elevation for frost protection. Placement of foundations at least 30 inches below the exterior grade is typically used in this area.

4. The lateral resistance of a spread footing placed on undisturbed native soils, structural fill or sandstone will be a combination of the sliding resistance of the footing on the foundation materials and passive earth pressure against the side of the footing. Resistance to sliding at the bottoms of the footings may be calculated based on an allowable coefficient of friction of 0.3. Passive pressure against the sides of the footings may be calculated using and allowable equivalent fluid unit weight of 190 psf. ...

   Compacted fill placed against the sides of the footings to resist lateral loads should be a nonexpansive, granular material compacted to least 95% of the maximum standard Proctor density at a moisture content near optimum.

5. Continuous foundation walls should be reinforced top and bottom to span an unsupported length of at least 10 feet.

6. Areas of loose or disturbed soil encountered within the foundation excavation should be removed and the footings extended down to adequate native bearing material. As an alternate, the loose or disturbed soil may be removed and replaced with nonexpansive fill material compacted to at least 100% of the maximum standard Proctor density near optimum moisture content. New fill should extend down from the edges of the footings at a minimum 1 horizontal to 1 vertical projection.

7. Granular foundation soils should be densified with a smooth vibratory compactor prior to placement of concrete.

8. A representative of the geotechnical engineer should observe all footing excavations prior to concrete placement.

FLOOR SLABS

The native on-site soils, exclusive of topsoil, and sandstone bedrock are suitable to support lightly to moderately loaded slab-on-grade construction. To reduce the effects of some differential movement, floor slabs should be separated from all bearing walls and columns with expansion joints which allow unrestrained vertical movement. Floor slab control joints should be used to reduce damage due to shrinkage cracking. The joint spacing and any requirements for slab reinforcement should be established by the designer based on experience and the intended slab use.

If moisture-sensitive floor coverings will be used in the treatment plant building, mitigation of moisture penetration into the slabs such as by use of a vapor barrier may be required. If an impervious vapor barrier membrane is used, special precautions will be required to prevent differential curing problems which could cause the slabs to warp. A minimum 3-inch sand layer between the concrete and the vapor barrier is sometimes used for this purpose.

Structural fill placed for support of floor slabs should be nonexpansive, granular soil having a maximum site of 4 inches, containing a maximum of 40% passing a No. 200 sieve, and having a maximum liquid limit of 30 and a maximum plasticity index of 10. It appears the

portions of the on-site soils consisting of silty sand may be suitable for use as nonexpansive, granular fill. Other on-site soils not meeting these criteria including the clayey sand, may be suitable if laboratory testing performed at the time of construction indicates the soils are nonexpansive when placed in a compacted condition. The sandstone bedrock may be used as structural fill if it is broken down a to soil size material meeting the criteria recommended above.

EARTH RETAINING STRUCTURES

Earth retaining structures should be designed for the lateral earth pressure generated by the backfill. The lateral earth pressure acting on a wall is a function of the degree of rigidity of the retaining structure and the type of materials used as backfill. Rigid earth retaining structures which are restrained from lateral deflection should be designed for the at-rest earth pressure condition. Cantilevered retaining structures capable of deflecting under the lateral loads will allow mobilization of the shear strength of the backfill. These walls may be designed for the reduced lateral earth pressure represented by the active earth pressure condition. Walls with rigidities between the rigid condition (at rest) and the flexible condition (active) may be designed for an intermediate earth pressure.

We recommend earth retaining structures be designed for lateral earth pressures presented in the following table:

MATERIAL	EQUIVALENT FLUID WEIGHT (pcf)					
	ACTIVE CONDITION		INTERMEDIATE CONDITION		AT REST CONDITION	
	γ_m	γ_b	γ_m	γ_b	γ_m	γ_b
On-site silty sand	45	22	50	25	65	32
Imported free-draining sand	40	20	45	22	60	30
γ_m = moist unit weight γ_b = buoyant unit weight						

Imported free-draining sand should have a maximum of 10% passing the No. 200 sieve and a maximum plasticity index of 6. The buoyant equivalent fluid weights, plus the hydrostatic

pressure, should be used below the ground-water level. We recommend the ground-water levels be assumed to be at elevation 6,881 feet at the treatment plant and 6,891 feet at the raw water pump station. All earth retaining structures should be designed for appropriate surcharge pressures such as those resulting from traffic, construction materials and equipment. An upward sloping backfill surface will also increase the lateral earth pressure imposed on an earth retaining structure.

Retaining structure backfill should be placed in uniform lifts and compacted to between 95% and 98% of the maximum standard Proctor density near the optimum moisture content. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the retaining structures. Some settlement of deep backfills will occur even if the material is placed correctly.

WATER SOLUBLE SULFATES

The concentration of water soluble sulfates measured in samples obtained from the exploratory borings ranges from less than 0.02% to approximately 0.36%. These concentrations of water soluble sulfates represent a negligible to severe degree of sulfate attack on concrete exposed to these materials. The degree of attack is based on a range of negligible, positive, severe and very severe as presented in the U.S. Bureau of Reclamation Concrete Manual. Based on this information, we recommend all concrete exposed to the on-site materials contain ASTM C 150 Type V cement. Concrete should have a minimum cement content of 564 pounds (6 sacks) per cubic yard, have a maximum water-cement ratio (by weight) of 0.45, and have air entrainment.

The above recommendation conforms with the general guidance of the American Concrete Institute (ACI) and the Portland Cement Association (PCA). However, Type V cement may have limited local availability. When this is the case, PCA guidance suggests that project specifications should allow for equivalent alternatives provided that the equivalence can be demonstrated by the supplier. Such alternatives might include use of blended cements (cement and pozzolon) with demonstrated sulfate resistance or Type II cement which meets or nearly meets Type V criteria (containing 5 to 6 percent tricalcium aluminate), combined with an appropriate cement content and water-cement ratio.

SURFACE DRAINAGE

Proper surface drainage is very important for acceptable performance of the facility during construction and after the construction has been completed. Drainage recommendations provided by local, state and national entities should be followed based on the intended use of the facility. The following recommendations should be used as guidelines and changes should be made only after consultation with the geotechnical engineer.

1. Excessive wetting or drying of the foundation subgrade should be avoided during construction.

2. Exterior foundation backfill should be adjusted to near optimum moisture content and compacted to at least 95% of the maximum standard Proctor density in pavement areas and to at least 90% of the maximum standard Proctor density in landscape areas.

3. Care should be taken when compacting around the foundation walls and underground structures to avoid damage to the structure. Hand compaction procedures, if necessary, should be used to prevent lateral pressures from exceeding the design values.

4. The ground surface surrounding the exterior of the building should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 6 inches in the first 10 feet in unpaved areas. Site drainage beyond the 10-foot zone should be designed to promote runoff and reduce infiltration. A minimum slope of 3 inches in the first 10 feet is recommended in the paved areas. These slopes may be changed as required for handicap access points in accordance with the Americans with Disabilities Act.

EXCAVATION CONSIDERATIONS

The on-site granular soils classify as Type C soils in accordance with OSHA regulations. Because of the presence of weakly cemented layers in the sandstone, we recommend the bedrock be considered a Type A soil above the ground-water level and a Type C soil below the ground-water level. Excavations should satisfy all regulatory requirements for safety.

OSHA regulation requires that excavations greater than 20 feet in depth be designed by a geotechnical engineer.

It appears the excavation for the raw water pump station will extend to approximately 15 feet or more below the ground-water level. The conditions encountered suggest the measured ground-water level may be a piezometric surface of a confined aquifer layer located approximately 4 feet below the proposed bottom of the pump station, or an estimated 2 to 3 feet below the base of the excavation. In order to reduce the potential for uplift and disturbance of the excavation caused by unbalanced hydrostatic head, we recommend consideration be given to drilling pressure relief wells into the aquifer prior to completing the excavation. The pressure relief wells should consist of minimum 4-inch-diameter holes drilled into the aquifer layer on a 15-foot grid. Alternatively, the wells may consist of pits excavated into the aquifer at a minimum of four locations around the excavation perimeter. The wells should be drilled or excavated when the excavation is no lower than elevation 6,874 feet. We anticipate the excavation can be dewatered during construction using perimeter trenches combined with sumps. The trenches should be sloped to the sumps where water can be pumped from the excavation.

The native bedrock at the base of the excavation may soften due to construction traffic and the presence of water. Disturbed material beneath floor slabs may require excavation and replacement. In order to reduce this problem, we recommend the contractor consider a lean concrete "mud mat." In lieu of the "mud mat," a thick layer of gravel may provide a stable working platform.

DESIGN AND CONSTRUCTION SUPPORT SERVICES

Kumar & Associates, Inc., should be retained to review the project plans and specifications for conformance with the recommendations provided in our report. We are also available to assist the design team in preparing specifications for geotechnical aspects of the project and, if necessary, perform additional studies to accommodate any changes in the proposed construction.

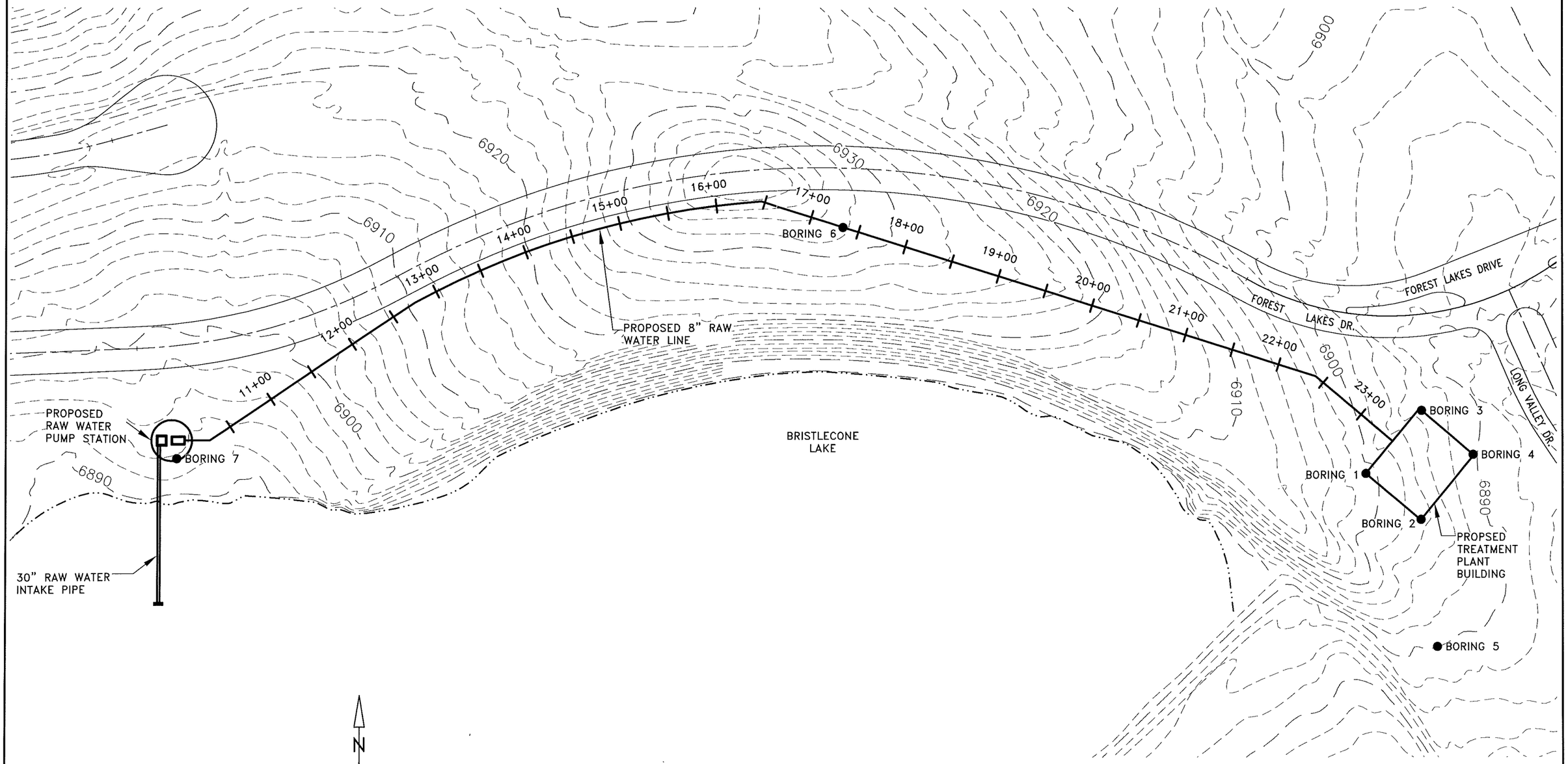
We recommend that Kumar & Associates, Inc., be retained to provide observation and testing services to document that the intent of this report and the requirements of the plans and specifications are being followed during construction, and to identify possible variations in subsurface conditions from those encountered in this study.

LIMITATIONS

This study has been conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings drilled at the locations indicated on Figure 1 and the proposed type of construction. The nature and extent of subsurface variations across the site may not become evident until excavation is performed. If during construction, fill, soil, rock or water conditions appear to be different from those described herein, this office should be advised at once so reevaluation of the recommendations may be made. We recommend on-site observation of excavations by a representative of the geotechnical engineer.

BEB: pw

xc: JDS-Hydro Consultants, Inc., Attn: Mr. John McGinn



042–106	Kumar & Associates		LOCATION OF EXPLORATORY BORINGS	Fig. 1

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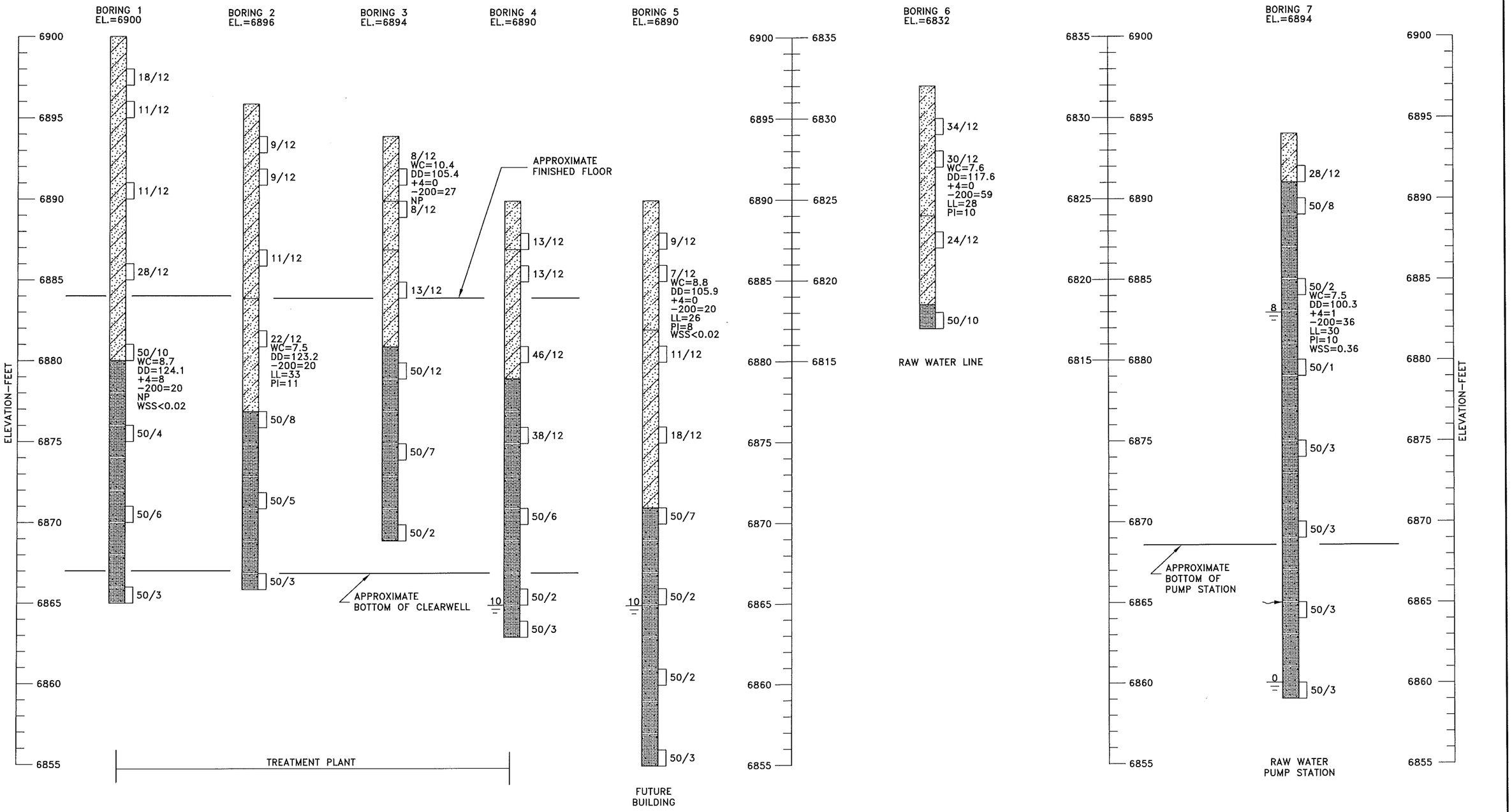


042-106	Kumar & Associates		LOGS OF EXPLORATORY BORINGS	Fig. 2

LEGEND

SILTY SAND (SM), WITH OCCASIONAL COBBLES, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, LIGHT BROWN TO REDDISH BROWN.

CLAYEY SAND (SC), WITH OCCASIONAL LAYERS OF SAND WITH CLAY AND SANDY LEAN CLAY, MEDIUM TO HARD, SLIGHTLY MOIST TO MOIST, LIGHT BROWN TO REDDISH BROWN.

SANDSTONE BEDROCK, CLAYEY, WITH OCCASIONAL CLAYSTONE LAYERS, MEDIUM HARD TO VERY HARD, SLIGHLTY MOIST TO WET, LIGHT BROWN, REDDISH BROWN AND GRAY.

DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLER.

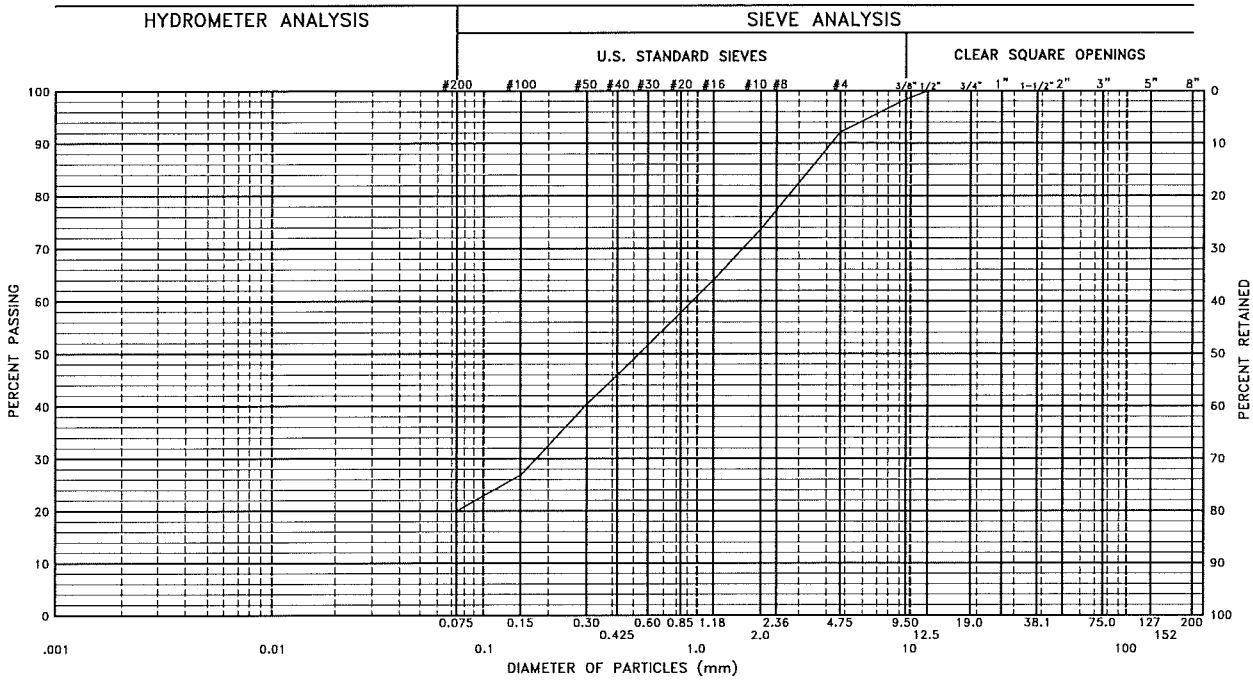
18/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 18 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

$\frac{10}{}$ DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.

DEPTH AT WHICH GROUND-WATER SEEPAGE OBSERVED AT THE TIME OF DRILLING.

LABORATORY TEST RESULTS:
WC = WATER CONTENT (%) (ASTM D 2216);
DD = DRY DENSITY (pcf) (ASTM D 2216);
+4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
-200 = PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140);
LL = LIQUID LIMIT (ASTM D 4318);
PI = PLASTICITY INDEX (ASTM D 4318);
NP = NONPLASTIC (ASTM D 4318);
WSS = WATER SOLUBLE SULFATES (%) (HACH METHOD).

NOTES
1. THE EXPLORATORY BORINGS WERE DRILLED BETWEEN JANUARY 19 AND 24, 2004, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE EXPLORATORY BORINGS WERE LOCATED BY OTHERS.
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE OBTAINED BY INTERPOLATION BETWEEN CONTOURS ON THE PLAN PROVIDED AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
4. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
5. GROUND WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

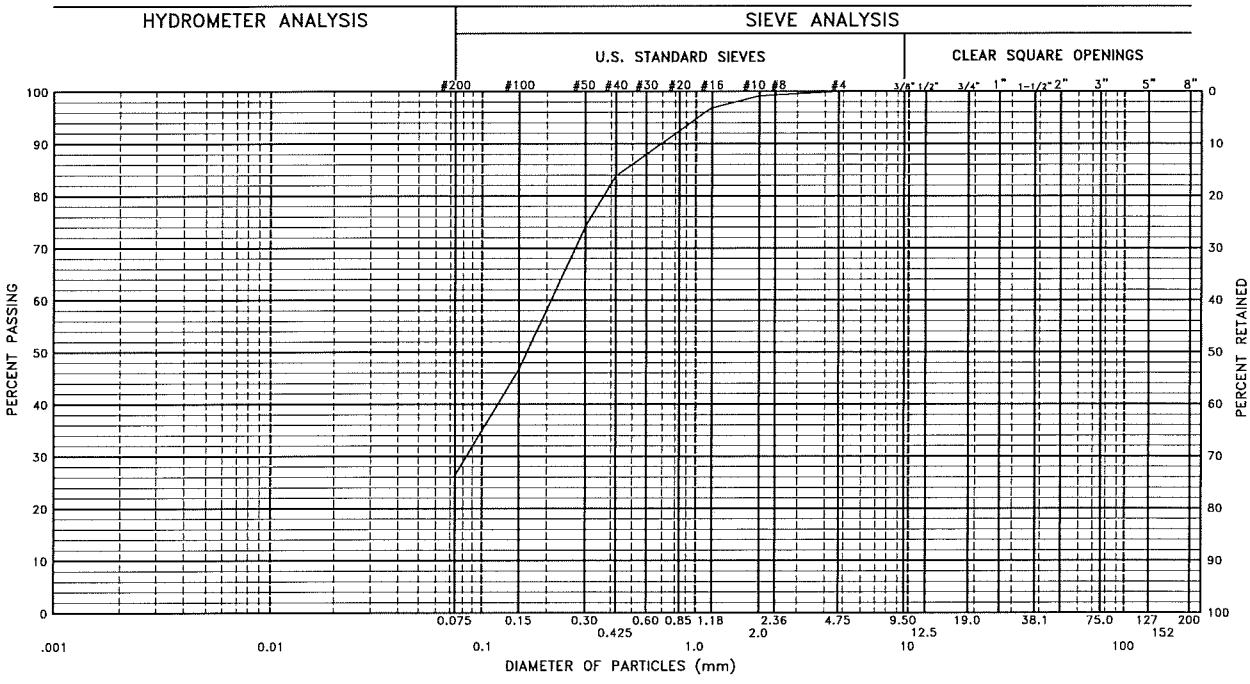


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 8 %
SAND: 72 %
SILT AND CLAY: 20 %

LIQUID LIMIT:
PLASTICITY INDEX: NP

SAMPLE OF: Silty sand
FROM: Boring 1 @ 19 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 0 %
SAND: 73 %
SILT AND CLAY: 27 %

LIQUID LIMIT:
PLASTICITY INDEX: NP

SAMPLE OF: Silty sand
FROM: Boring 3 @ 2 feet

042-106	Kumar & Associates	GRADATION TEST RESULTS	Fig. 4

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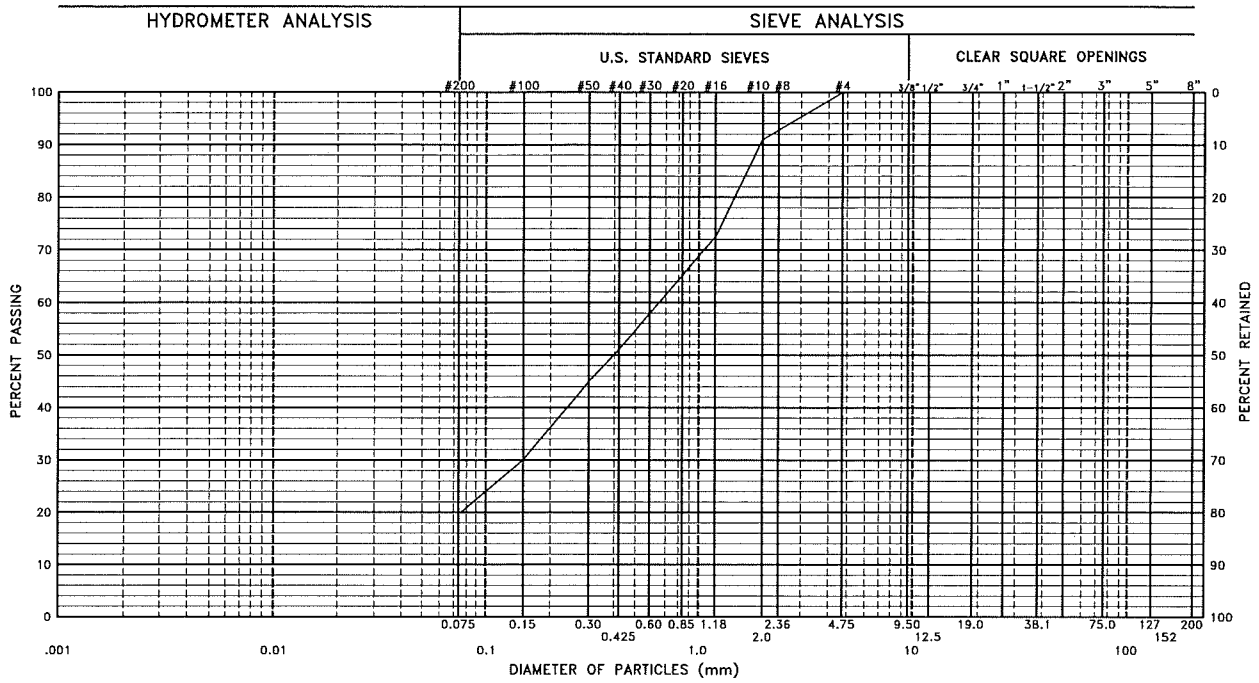
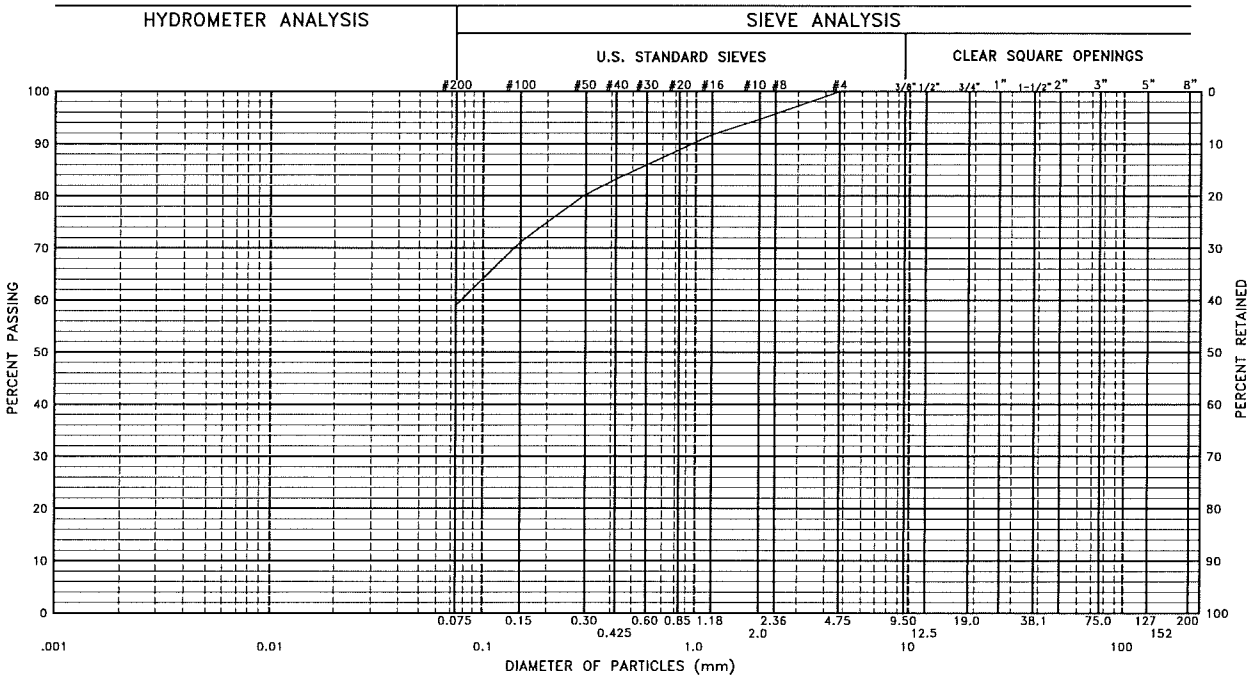


SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 0 %
SAND: 80 %
SILT AND CLAY: 20 %

LIQUID LIMIT: 26
PLASTICITY INDEX: 8

SAMPLE OF: Clayey sand
FROM: Boring 5 @ 4 feet



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 0 %
SAND: 41 %
SILT AND CLAY: 59 %

LIQUID LIMIT: 28
PLASTICITY INDEX: 10

SAMPLE OF: Sandy lean clay
FROM: Boring 6 @ 4 feet

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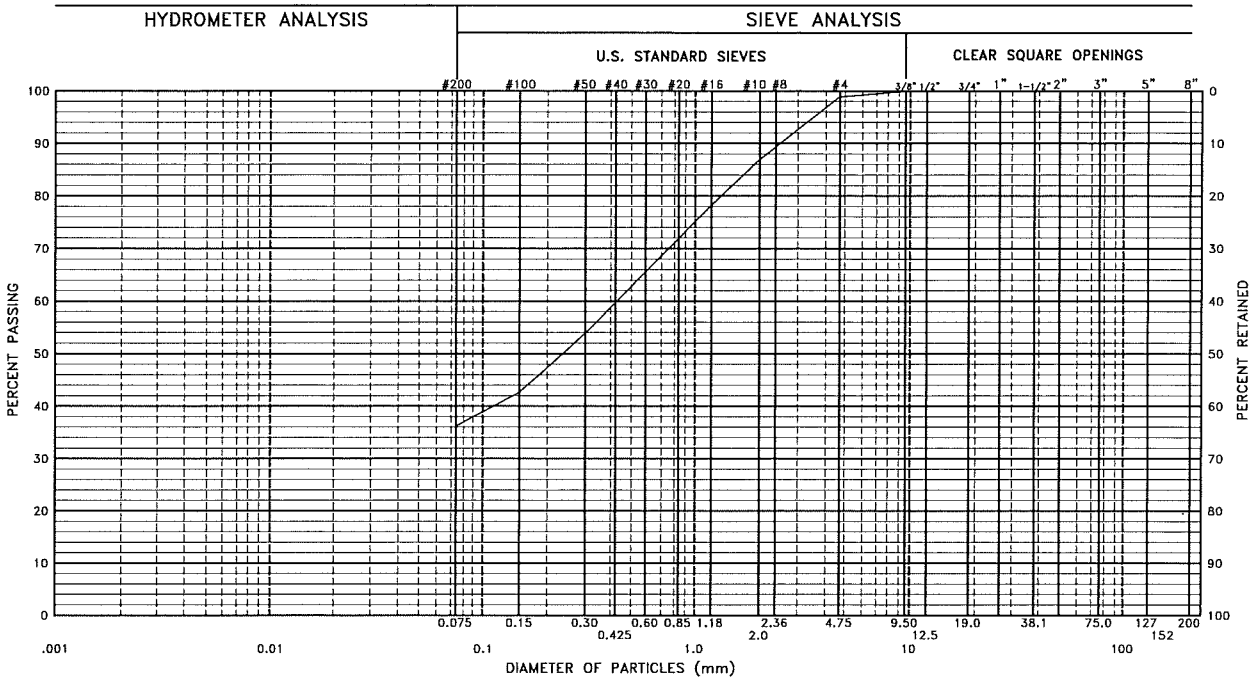
042-106	Kumar & Associates	GRADATION TEST RESULTS	Fig. 5



SILT AND CLAY	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL: 1 %
SAND: 63 %
SILT AND CLAY: 36 %

LIQUID LIMIT: 30
PLASTICITY INDEX: 10

SAMPLE OF: Sandstone
FROM: Boring 7 @ 9 feet

042-106	Kumar & Associates	GRADATION TEST RESULTS	Fig. 6

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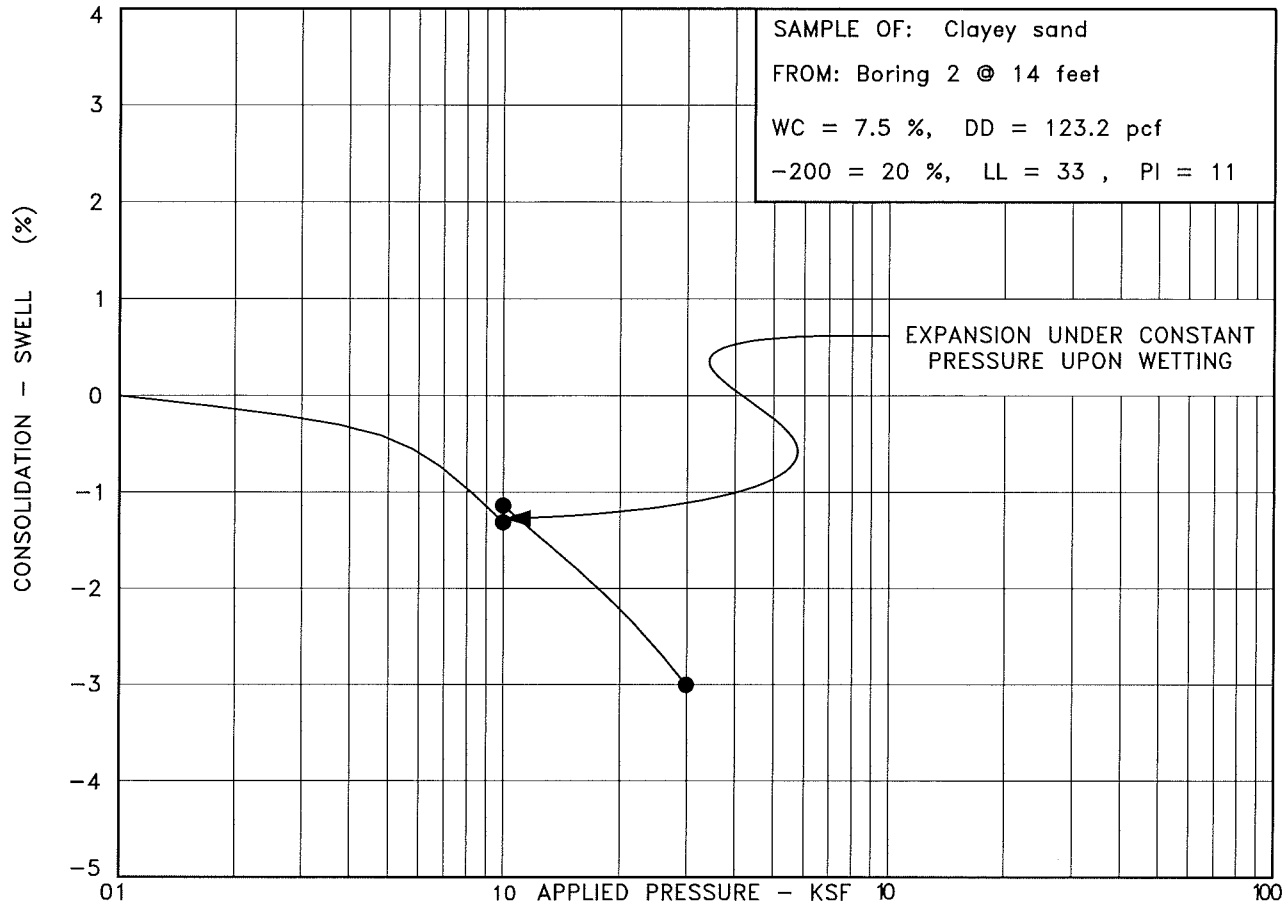

042-106	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 7

Feb 03, 04Y - 14:49pm
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Kumar & Associates, Inc.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

Project No.: 042-106
Project Name: Forest Lakes Water Treatement Plant
Date Sampled: 1/19/04 and 1/21/04
Date Received: 1/22/04

SAMPLE LOCATION		DATE TESTED	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		WATER SOLUBLE SULFATES (%)	SOIL OR BEDROCK TYPE
BORING	DEPTH (ft)				GRAVEL (%)	SAND (%)		LIQUID LIMIT	PLASTICITY INDEX		
1	19	1/26/2004	8.7	124.1	8	72	20		NP	<0.02	Silty sand (SM)
2	14	1/26/2004	7.5	123.2			20	33	11		Clayey Sand (SC)
3	2	1/26/2004	10.4	105.4	0	73	27		NP		Silty sand (SM)
5	4	1/26/2004	8.8	105.9	0	80	20	26	8	<0.02	Clayey sand (SC)
6	4	1/26/2004	7.6	117.6	0	41	59	28	10		Sandy lean clay (CL)
7	9	1/26/2004	7.5	100.3	1	63	36	30	10	0.36	Sandstone

Appendix F

Appendix G

TEMPORARY ACCESS LICENSE AGREEMENT

THIS GRANT OF TEMPORARY ACCESS LICENSE AGREEMENT (hereinafter "**Agreement**") is made and executed this 2nd day of November, 2017 by the Forest Lakes Residential Development, LLC, a Colorado limited liability company (hereinafter referred to as **"Grantor"**) and the Forest Lakes Metropolitan District, a quasi-municipal corporation and political subdivision of the State of Colorado, whose address is 2 N. Cascade, Ste 1280, Colorado Springs, CO 80903 (hereinafter referred to as **"Grantee"** or **"District"**) to include the District's contractors.

The Grantor does hereby grant a license for temporary, non-exclusive access to the District and its contractors to use portions of the property generally known as Filing #2 identified on Exhibit A attached hereto (**"Property"**), which property is adjacent to the District's approximate 3.5 acre Surface Water Treatment Plant site identified on Exhibit B attached hereto (**"Grantee Property"**), for the purpose of accessing, grading, stormwater drainage and construction of improvements related to the Surface Water Treatment Plant (all such access and construction and related activity hereinafter referred to as the **"Work"**).

Purpose

The access granted herein to the Property is a non-exclusive, temporary access for the limited purposes of access reasonably necessary to conduct and complete the Work, as described above.

DURATION OF AGREEMENT

The non-exclusive temporary access granted herein shall commence from the date of the grant; however, said temporary access shall terminate at any time upon mutual agreement of the parties or by August 31, 2019, whichever occurs sooner. If the District needs additional time to perform the Work, it shall request, in writing, an extension of time from the Grantor.

COVENANTS

In consideration of the promises, mutual covenants and agreements contained herein, the Parties agree as follows:

1. Ingress, Egress and Work. District shall have and may exercise the right of reasonable ingress and egress in, to, through, over, under and across the Property for access to and from the roads, highways, streets, alleys, trails, or any other point nearest to the Property to perform the Work as defined above. To the maximum practicable extent, District shall use existing gates, roads, and facilities to avoid disruption of the Grantor's operations on the Property.

2. Grantor's Rights Unaffected. The Grantor shall retain the right to make full use of the Property subject to any existing encumbrances provided however, the Grantor shall not unreasonably interfere with Grantee's rights as set forth in this Agreement for the purposes of completing the Work.

3. Surface Restoration to Land. District shall repair any physical damage done to the Property by or resulting from its actions or operations. District shall promptly restore, replace, re-vegetate, or repair the surface of the Property to the original condition as near as may be reasonably possible.

4. Workmanship. District agrees to perform all work in a neat and workmanlike manner so as not to interfere with either the Grantor's use of the Property, and without cost or liability to the Grantor. District shall take all necessary measures to protect the Grantor, the District's employees, and the general public from its activities on the Property.

5. Insurance. District represents and warrants to the Grantor that per Colorado Statue the District maintains insurance through the Colorado Special Districts Property and Liability Pool, and its contractors carry insurance, including workers compensation insurance, general liability and professional insurance and automotive insurance. Prior to its first access to the Property under this Agreement, upon request District will provide the Grantor with the Certificates of Insurance evidencing the insurance coverage described herein and such supplemental certificates as may be appropriate.

6. Entire Agreement. This Agreement represents the entire agreement between the Parties and no additional or different oral representation, promise or agreement shall be binding on any of the Parties hereto with respect to the subject matter of this instrument, unless stated in writing signed by Grantor and the Grantee.

7. Amendments. No modification, amendment, notation, change, or other alteration of this Agreement shall be valid unless mutually agreed to by the Parties in writing and executed as an addendum to this Agreement.

8. Governing Law, Venue, Jurisdiction, and Indemnification. This Agreement shall be governed by and interpreted in accordance with the laws of the State of Colorado. Venue shall exclusively be in the District or County Court in and for El Paso County, Colorado.

The Grantor and Grantee both agree to be solely responsible for the conduct of their own respective officials, employees, agents, assigns, and contractors as a result of performance of this Agreement. Nothing in this section shall be deemed to waive or otherwise limit the defenses available to the District provided by law or applicable metropolitan district acts.

9. Notice: **District shall provide the Grantor with no less than forty-eight (48) hours written notice prior to beginning the Work**. One notification may cover multiple days of the Work. All notices, correspondence, or inquiries from the District to the Grantor under this Agreement shall be directed to:

Thomas M. Blunk, Partner
CP Real Estate Capital
1650 Lake Cook Road, Ste 150
Deerfield, IL 60015
Telephone: (312) 543-1903
Electronic mail: tblunk@cprecapital.com

With an electronic copy sent to:

Jane Dickinson Kress
Forest Lakes Residential Development, LLC
1111 Main Street, Suite 1600
Kansas City, MO 64105
Telephone: (816) 412-1660
Electronic mail: jkress@dfckc.com

RIGHTS OF THIRD PARTIES

This grant of nonexclusive temporary access is not and shall not be deemed to confer upon or grant to any third party any right to claim damages or bring any lawsuit, action or other proceeding against either the Grantee or Grantor because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

THIS AGREEMENT is made and entered into the year and date first above written.

GRANTOR:

Forest Lakes Residential Development, LLC
a Colorado limited liability company

By: _____

THOMAS M. BLUNK
(Printed Name)

AUTHORIZED PERSON
(Title)

11/2/17
(Date)

GRANTEE:

Forest Lakes Metropolitan District
a quasi-municipal corporation and political subdivision of the State of Colorado

By: _____

ANN E. NICHOLS
(Printed Name)

DISTRICT MANAGER
(Title)

NOV. 2, 2017
(Date)

EXHIBIT A

LEGAL DESCRIPTION OF FOREST LAKES RESIDENTIAL DEVELOPMENT, LLC OWNED LAND FOR FILING #2

A PARCEL OF LAND BEING A PORTION OF THE SOUTHWEST QUARTER OF SECTION 26, AND THE SOUTHEAST QUARTER OF SECTION 27 ALL IN TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS: THE SOUTH LINE OF THE SOUTHEAST QUARTER OF SECTION 27, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO AS DEPICTED ON A LAND SURVEY PLAT PREPARED BY W.K. CLARK & ASSOCIATES, INC. DEPOSITED UNDER RECEPTION NO. 94901132, OF THE RECORDS OF EL PASO COUNTY, COLORADO, MONUMENTED AT THE EAST END BY A 1-1/4 INCH OUTSIDE DIAMETER IRON PIPE AT THE SOUTHEAST CORNER OF SAID SECTION 27 AND At THE WEST END BY A MARKED STONE AT THE SOUTH QUARTER CORNER OF SAID SECTION 27, BEING ASSUMED TO BEAR S89°06'01"W, A DISTANCE OF 2627.04 FEET

COMMENCING AT THE SOUTHEAST CORNER OF SECTION 27, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO;

THENCE N01°53'03"W, ON THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 27, A DISTANCE OF 264.04 FEET TO THE POINT OF BEGINNING;

THENCE S89°06'01"W, A DISTANCE OF 346.55 FEET;
THENCE N01°53'03"W, A DISTANCE OF 10.29 FEET TO A POINT ON THE BOUNDARY OF A PARCEL OF LAND DESCRIBED IN A DOCUMENT RECORDED UNDER RECEPTION NO. 204044409 IN THE RECORDS OF EL PASO COUNTY, COLORADO;

THENCE ON THE BOUNDARY OF SAID PARCEL OF LAND DESCRIBED IN A DOCUMENT RECORDED UNDER RECEPTION NO. 204044409 THE FOLLOWING TWENTY SIX (26) COURSES;

1. N59°29'17"E, A DISTANCE OF 51.68 FEET;
2. N06°07'30"W, A DISTANCE OF 110.74 FEET;
3. N46°28'55"W, A DISTANCE OF 104.05 FEET;
4. N16°07'05"E, A DISTANCE OF 40.14 FEET;
5. N05°05'06"W, A DISTANCE OF 62.66 FEET;
6. N50°02'04"W, A DISTANCE OF 43.81 FEET;
7. N23°12'31"W, A DISTANCE OF 187.95 FEET;
8. N36°52'39"W, A DISTANCE OF 120.40 FEET;

9. N53°08'54"W, A DISTANCE OF 451.70 FEET;
10. N62°50'04"W, A DISTANCE OF 227.51 FEET;
11. N38°22'21"W, A DISTANCE OF 177.20 FEET;
12. S81°24'30"W, A DISTANCE OF 119.63 FEET;
13. S17°50'57"W, A DISTANCE OF 164.79 FEET;
14. S35°43'43"E, A DISTANCE OF 148.27 FEET;
15. S01°33'29"E, A DISTANCE OF 94.11 FEET;
16. S28°53'19"E, A DISTANCE OF 239.77 FEET;
17. S62°22'47"E, A DISTANCE OF 132.59 FEET;
18. S51°12'34"E, A DISTANCE OF 99.15 FEET;
19. S02°39'30"W, A DISTANCE OF 58.53 FEET;
20. S54°42'08"W, A DISTANCE OF 388.61 FEET;
21. N82°44'50"W, A DISTANCE OF 100.00 FEET TO A POINT ON CURVE;
22. ON THE ARC OF A CURVE TO THE RIGHT WHOSE CENTER BEARS N82°44"51"W, HAVING A DELTA OF 55°09'05", A RADIUS OF 250.00 FEET AND A DISTANCE OF 240.64 FEET TO A POINT ON CURVE;
23. N49°41'38"W, A DISTANCE OF 353.05 FEET TO A POINT ON CURVE;
24. ON THE ARC OF A CURVE TO THE RIGHT WHOSE CENTER BEARS N85°42'12"E, HAVING A DELTA OF 87°16'48", A RADIUS OF 200.00 FEET AND A DISTANCE OF 304.66 FEET TO A POINT ON CURVE;
25. N20°35'43"W, A DISTANCE OF 533.66 FEET;
26. N20°16'16"W, A DISTANCE OF 293.60 FEET;

THENCE S86°14'05"E, A DISTANCE OF 50.54 FEET TO A POINT ON CURVE;
THENCE ON THE ARC OF A CURVE TO THE RIGHT WHOSE CENTER BEAS S86°14'05"E, HAVING A DELTA OF 15°08'43", A RADIUS OF 330.00 FEET AND A DISTANCE OF 87.23 FEET TO A POINT OF REVERSE CURVE;
THENCE ON THE ARC OF A CURVE TO THE LEFT HAVING A DELTA OF 38°41'14", A RADIUS OF 570.00 FEET AND A DISTANCE OF 384.88 FEET TO A POINT OF COMPOUND CURVE;
THENCE ON THE ARC OF A CURVE TO THE LEFT HAVING A DELTA OF 14°18'06", A RADIUS OF 288.00 FEET AND A DISTANCE OF 71.89 FEET TO A POINT OF TANGENT;
THENCE N34°04'43"W, A DISTANCE OF 59.54 FEET TO A POINT OF CURVE;
THENCE ON THE ARC OF CURVE TO THE RIGHT HAVING A DELTA OF 09°47'29", A RADIUS OF 330.00 FEET AND A DISTANCE OF 56.39 FEET TO A POINT ON CURVE SAID POINT BEING ON THE BOUNDARY OF FOREST LAKES FILING NO. 1 RECORDED UNDER RECEPTION NO. 206712407;

THENCE ON THE BOUNDARY OF SAID FOREST LAKES FILING NO. 1 THE FOLLOWING TWELVE (12) COURSES;

1. N65°42'45"E, A DISTANCE OF 100.00 FEET;
2. N24°17'15"W,A DISTANCE OF 54.88 FEET;
3. N65°01'27"E, A DISTANCE OF 31.38 FEET TO A POINT OF CURVE;
4. ON THE ARC OF A CURVE TO THE RIGHT HAVING A DELTA OF 03°27'06", A RADIUS OF 255.00 FEET AND A DISTANCE OF 15.36 FEET TO A POINT OF

TANGENT;

5. N68°28'33"E, A DISTANCE OF 55.21 FEET TO A POINT OF CURVE;
6. ON THE ARC OF A CURVE TO THE RIGHT HAVING A DELTA OF 51°58'03", A RADIUS OF 140.00 FEET AND A DISTANCE OF 126.98 FEET TO A POINT OF TANGENT;
7. S59°33'25"E, A DISTANCE OF 2055.62 FEET TO A POINT OF CURVE;
8. ON THE ARC OF A CURVE TO THE RIGHT HAVING A DELTA OF 41°06'27", A RADIUS OF 870.00 FEET AND A DISTANCE OF 624.19 FEET TO A POINT ON CURVE;
9. ON THE ARC OF A CURVE TO THE RIGHT WHOSE CENTER BEARS N21°41'05"W, HAVING A DELTA OF 23°59'29", A RADIUS OF 346.00 FEET AND A DISTANCE OF 144.88 FEET TO A POINT OF REVERSE CURVE;
10. ON THE ARC OF A CURVE TO THE LEFT HAVING A DELTA OF 01°56'09", RADIUS OF 470.00 FEET AND A DISTANCE OF 15.88 FEET TO A POINT ON CURVE;
11. N89°39'46"W, A DISTANCE OF 69.06 FEET TO A POINT ON CURVE;
12. ON THE ARC OF A CURVE TO THE LEFT WHOSE CENTER BEARS S17°21'22"W, HAVING A DELTA OF 17°12'55", A RADIUS OF 270.00 FEET AND A DISTANCE OF 81.13 FEET TO A POINT OF TANGENT;

THENCE N89°51'33"W, A DISTANCE OF 176.82 FEET TO A POINT ON THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 27;
THENCE S01°53'03"E, ON THE EAST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 27, A DISTANCE OF 374.85 FEET TO THE POINT OF BEGINNING;

CONTAINING A CALCULATED AREA OF 48.191 ACRES

NO FIELD SURVEY WAS COMPLETED TO PREPARE THIS DESCRIPTION.

EXHIBIT B

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200 (719)785-0790
Colorado Springs, Colorado 80903 (719)785-0799(Fax)

JOB NO. 1175.00-22
MAY 17, 2017

LEGAL DESCRIPTION:

A PARCEL OF LAND BEING A PORTION OF THE SOUTHEAST QUARTER OF SECTION 27, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, EL PASO COUNTY, COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BASIS OF BEARINGS: A PORTION OF THE NORTHEASTERLY BOUNDARY OF FOREST LAKES FILING NO. 2A RECORDED UNDER RECEPTION NO. 216713884 RECORDS OF EL PASO COUNTY, COLORADO, BEING ALSO A PORTION OF THE SOUTHERLY RIGHT OF WAY LINE OF FOREST LAKES DRIVE AS PLATTED IN FOREST LAKES FILING NO. 1 RECORDED UNDER RECEPTION NO. 206712407 BEING MONUMENTED AT BOTH ENDS BY A NO. 5 REBAR AND 1 ½" ALUMINUM SURVEYORS CAP STAMPED "CCES LLC PLS 30118" IS ASSUMED TO BEAR N59°33'251"W, A DISTANCE OF 754.49 FEET

COMMENCING AT THE SOUTHWESTERLY CORNER OF LONG VALLEY DRIVE AS PLATTED IN FOREST LAKES FILING NO. 1 RECORDED UNDER RECEPTION NO. 206712407 RECORDS OF EL PASO COUNTY, COLORADO, SAID POINT BEING A POINT ON CURVE, SAID POINT ALSO BEING THE POINT OF BEGINNING;

THENCE ON THE ARC OF A CURVE TO THE LEFT WHOSE CENTER BEARS N65°42'45"E, HAVING A DELTA OF 09°47'29", A RADIUS OF 330.00 FEET AND A DISTANCE OF 56.39 FEET TO POINT OF TANGENT;
THENCE S34°04'43"E, A DISTANCE OF 59.54 FEET TO A POINT OF CURVE;
THENCE ON THE ARC OF A CURVE TO THE RIGHT HAVING A DELTA OF 14°18'06", A RADIUS OF 288.00 FEET AND A DISTANCE OF 71.89 FEET TO A POINT OF COMPOUND CURVE;
THENCE ON THE ARC OF A CURE TO THE RIGHT HAVING A DELTA OF 38°41'14", A RADIUS OF 570.00 FEET AND A DISTANCE OF 384.88 FEET TO A POINT OF REVERSE CURVE;
THENCE ON THE ARC OF A CURVE TO THE LEFT HAVING A DELTA OF 15°08'43", A RADIUS OF 330.00 FEET AND A DISTANCE OF 87.23 FEET TO A POINT ON CURVE;
THENCE N86°14'05"W, A DISTANCE OF 50.54 FEET TO A POINT ON THE EASTERLY BOUNDARY LINE OF A PARCEL OF LAND DESCRIBED IN A DOCUMENT RECORDED UNDER RECEPTION NO. 204044409;

THENCE ON THE EASTERLY BOUNDARY LINE OF SAID PARCEL OF LAND DESCRIBED IN A DOCUMENT RECORDED UNDER RECEPTION NO. 204044409 THE FOLLOWING (3) THREE COURSES;

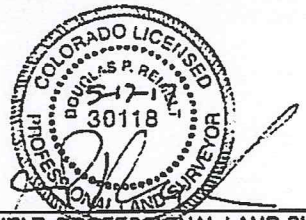
1. N19°16'05"W, A DISTANCE OF 313.29 FEET;
2. N34°00'06"W, A DISTANCE OF 119.27 FEET;
3. N50°48'40"W, A DISTANCE OF 277.20 FEET TO THE SOUTHEASTERLY CORNER OF TRACT E AS PLATTED IN SAID FOREST LAKES FILING NO. 1;

THENCE N29°00'53"E, ON THE EASTERLY BOUNDARY OF SAID TRACT E, A DISTANCE OF 154.19 FEET TO A POINT ON CURVE, SAID POINT BEING ON THE SOUTHERLY RIGHT OF WAY LINE OF SAID FOREST LAKES DRIVE;
THENCE ON SAID SOUTHERLY RIGHT OF WAY LINE ON THE ARC OF A CURVE TO THE LEFT WHOSE CENTER BEARS N29°00'53"E, HAVING A DELTA OF 44°50'44", A RADIUS OF 340.00 FEET AND A DISTANCE OF 266.12 FEET TO A POINT ON THE WESTERLY RIGHT OF WAY LINE OF SAID LONG VALLEY DRIVE;
THENCE S24°17'15"E, ON THE WESTERLY RIGHT OF WAY LINE OF SAID LONG VALLEY DRIVE, A DISTANCE OF 58.00 FEET TO THE POINT OF BEGINNING;

CONTAINING A CALCULATED AREA OF 3.520 ACRES

LEGAL DESCRIPTION STATEMENT:

I, DOUGLAS P. REINELT, A LICENSED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY STATE THAT THE ABOVE LEGAL DESCRIPTION AND ATTACHED EXHIBIT WERE PREPARED UNDER MY RESPONSIBLE CHARGE AND ON THE BASIS OF MY KNOWLEDGE, INFORMATION AND BELIEF, ARE CORRECT.



DOUGLAS P. REINELT, PROFESSIONAL LAND SURVEYOR
COLORADO P.L.S. NO. 30118
FOR AND ON BEHALF OF CLASSIC CONSULTING
ENGINEERS AND SURVEYORS

MAY 17, 2017
DATE

DENVER
2490 W. 26th Avenue Suite 100A
Denver, Colorado 80211
Phone: 303.480.1700
Fax: 303.480.1020

GLENWOOD SPRINGS
818 Colorado Avenue
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DURANGO
1666 N. Main Avenue Suite C
Durango, Colorado 81301
Phone: 970.259.7411
Fax: 970.259.8758

www.wrightwater.com

WWE

Wright Water Engineers, Inc.