Southern Colorado Rail Park

EL PASO COUNTY, COLORADO

PREPARED FOR

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Conceptual Drainage Summary

September 2023

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SOUTHERN COLORADO RAIL PARK
EL PASO COUNTY, COLORADO
CONCEPTUAL DRAINAGE SUMMARY

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Summary of Project

The Southern Colorado Rail Park (SCRP) is being submitted to the El Paso County Community Planning and Development Department for review and approval of a Sketch Plan. The Sketch plan is proposing a rail line bisecting the property with proposed light and heavy Industrial land uses. There are also areas for commercial development, commercial services, preservation, low impact uses, roads, as well as areas for open space and drainage improvements. The purpose of this summary is to provide general information, criteria, and concepts in support of the developed drainage improvements.

Project Location

The Southern Colorado Rail Park consists of approximately 3,108 acres located in El Paso County, Colorado. This site is generally located on the west side of Interstate 25, west of the City of Fountain, and south of Colorado Springs, Colorado. The property is located in those parcels of land in sections 12, 13, 14, 23, 24, 25 and 26 of Township 16 South, Range 66 West of the 6th P.M., of El Paso County, Colorado, and in sections 19 and 30, Township 16 South, Range 65 West of the 6th P.M., of El Paso County, Colorado. The site is bounded on the north, west and south by the Fort Carson Military Base and to the east by several public and private properties. One particular property on the east side is the Ray Nixon Power Plant owned by the City of Colorado Springs. The north end of the property is bordered by the existing public road named Charter Oak Ranch Road. There are no other public access locations or roadways around the balance of the project. Only Fort Carson has existing military roads adjacent to the property.

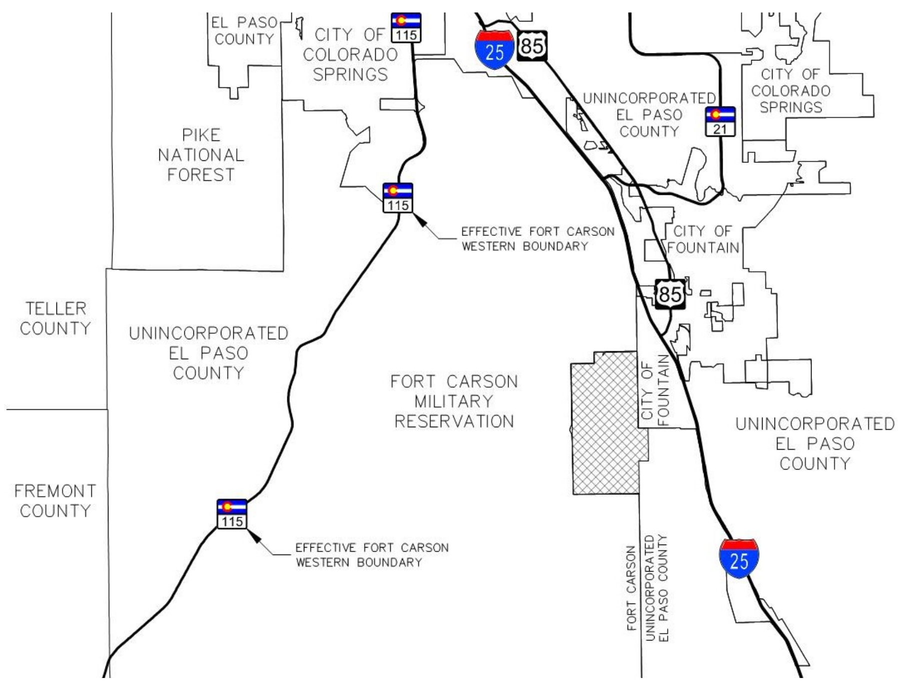

Figure 1. - Vicinity Map

Purpose and Scope

The Sketch Plan submitted to EPC proposes a rail line that bisects the ~3,108 acres generally north to south. The proposed land uses are Light and Heavy Industrial and some Commercial property located along the northern side. The development of this project should follow all criteria provided by the El Paso County code, and criteria within the El Paso County Engineering Criteria Manual, and revisions.

This summary shall shed light on the existing characteristics of the site, its proposed land uses, and provided background on the proposed methodologies for future drainage studies. This report shall also identifying regulatory requirements that will impact future development. The next step in the process shall be to analyze the existing and future drainage conditions of the watershed, quantify surface runoff, define floodplains, identify drainage impacts, develop alternate solutions, and prepare a drainage master plan.

Previous Studies

State which drainage basin

The SCRP is primarily located in the Little Fountain Drainage Basin, while a small portion of the northeast corner of the subject site lies within the Fort Carson Drainage Basin. No drainage basin planning studies have been prepared for the two basins to date. Most of the drainage basin area exists within the Fort Carson Military Base, and the remainder of the property has had limited development.

Little Fountain Creek Drainage Basin (LFCDB) Land Area

Since this basin is "un-studied" there is little background information to rely on to date. However, a general review of the drainage basin area provides the following facts for the land areas inside the LFCDB;

The overall drainage basin area is approximately	35,017 Ac.	100 %
Area of SCRP land	2,897 Ac.	8.27 %
Area of land East of Interstate 25	767 Ac.	2.20 %
Area of land of the Fort Carson Military Base	13,762 Ac.	39.30 %
Area of land west of CO State HWY 115	15,976 Ac.	45.62 %
Area of land near Ray Nixon Power Plant (Area)	1,325 Ac.	3.78 %
Area of land in the City of Fountain	290 Ac.	0.83 %
Area of SCRP land outside the drainage basin (Fort Carson Drainage Basin)	250 Ac.	N/A

Table 1. – LFCDB Land Area Breakdown

The drainage basin's existing drainage facilities have not been studied or cataloged. Therefore, existing drainage structure adequacies or deficiencies are not known at this time. There are no known drainage improvements or drainage structures within the SCRP property. Land areas within the LFCDB are shown on the following page.

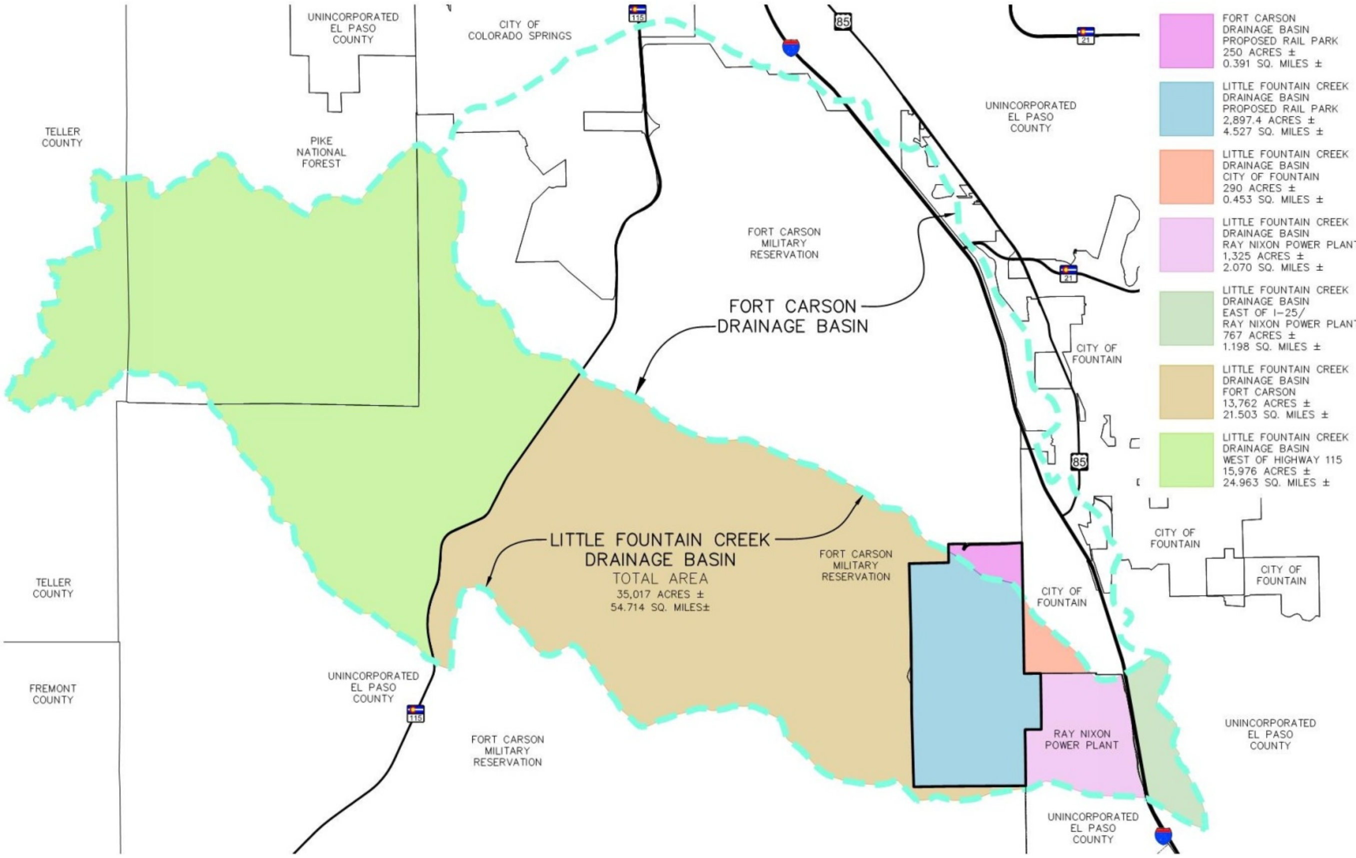

Figure 2. – Land Areas within the LFCDB

Fort Carson Drainage Basin (FCDB) Land Area

Since this basin is also "un-studied" there is little background information to rely on to date. However, a general review of the drainage basin area provides the following facts for the land areas inside the FCDB;

The overall drainage basin area is approximately	24,048 Ac.	100 %
Area of SCRP land	250 Ac.	1.04 %

Table 2 - FCDB Land Area Breakdown

It should be noted that the portion of SCRP land that lies within the FCDB resides beyond 500' feet from any notable natural drainage channel and although the release of developed drainage is important, the impact on the watershed as a whole is not great.

Climate

This area of El Paso County is semi-arid with precipitation averaging approximately 14 to 16 inches per year, with the majority of this precipitation occurring in the form of rainfall. Winters are generally cold and dry. Thunderstorms are common during the summer months. Average temperatures range from about 30°F in the winter to 75°F in the summer.

Onsite Soils and Geology

A Soils and Geology Report was prepared by HDR Engineering Inc. dated June 2023, for the Southern Rail Park Spur, Fountain, Colorado. This report was provided to El Paso County with the Sketch Plan submittal. The report represents research for the proposed rail spur at a desktop level of the existing information for the project area. (Rail spur being the rail line from the Ray Nixon Power Plant to the Fort Carson Military Base boundary through SCRP). The report is similar to this conceptual drainage summary in that will provide more details in the future regarding the soil characteristics, geology, subsurface soil data, etc… on the property.

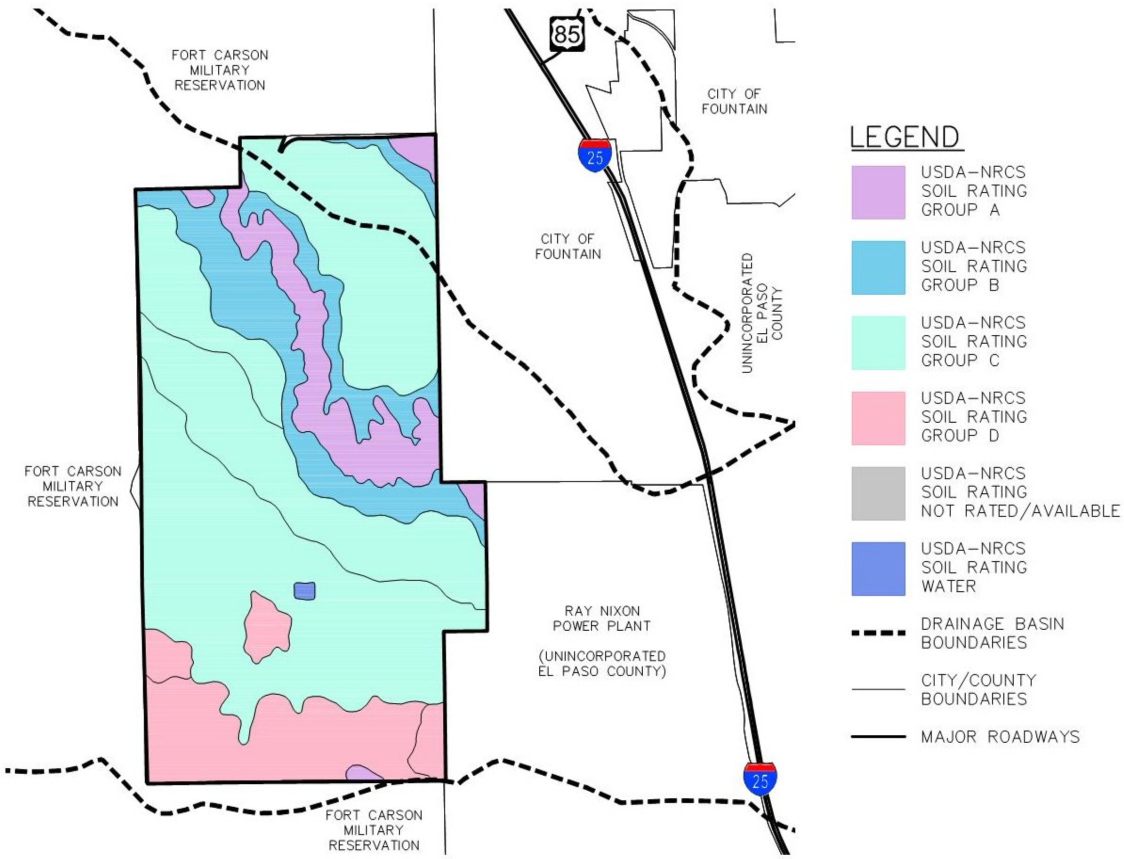

Figure 3. – SCRP Soils Map

Onsite soils were also delineated by M&S Civil Consultants, using the "Web Soil Survey" (WSS), a web-based soil database provided by the U.S. Department of Agriculture (USDA)'s Natural Resources Conservation Service (NRCS). The predominant soil groupings are sandy and clay based loams which possess Hydrologic Soil Group Ratings of A thru D.

The following soils were noted: Heldt Clay Loam, 0-3% slopes, HSG: C, Kim Loam, 1 to 8% slopes HSG B, Schamber-Razor Complex, 8-50% slopes HSG: A, Fort Loam, 1-5% slopes HSG: C, Fort Sandy Loam, 1 to 8% slopes HSG: B, Midway Clay Loam, 1 to 15% slopes, HSG: D, Midway Razor Clay Loams, Dry, 1-18% slopes HSG: D, Manzanola Silty Clay Loam, 0-2% slopes, HSG: C

Existing Stream Gage Data

Existing stream gage data was found within the records of the United States Geological Survey website (USGS – https://waterdata.usgs.gov/nwis. Two data locations were found to be just west of the SCRP property on the Fort Carson Military Base. There is one location on Rock Creek (no longer functioning) and one is on Little Fountain Creek. The site numbers are ID 07105960 for Rock Creek and ID 07105940 for Little Fountain Creek Gages respectively. A map showing the proximity of the two locations to the site is provided below.

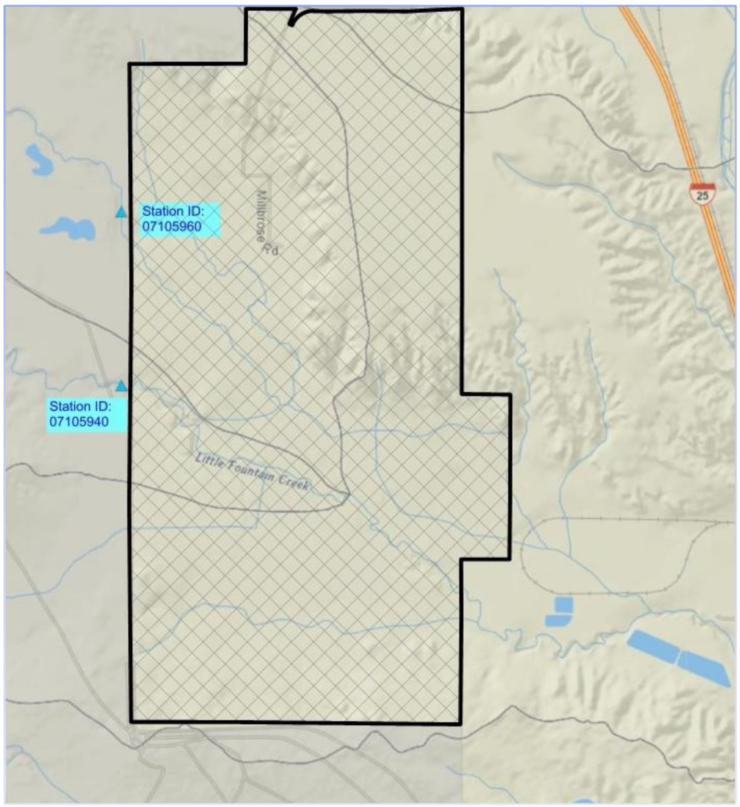

Figure 4. – USGS Gauging Station Locations Relative to Site

Per the downloaded data, the Rock Creek Gage had legacy peak streamflow records between 1979 and 1988. Based upon the graph, provided on the following page, the peak flow measured during that time period occurred in 1986 at a flow rate approximately 176 cfs. The next highest recorded discharge occurred in 1980 at 131 cfs, however additional information provided on the webpage, indicates that the recorded event was affected to an unknown degree by regulation or diversion. The Rock Creek Gage was located at an elevation of 5,600 ft above sea level (NGVD29) and had a contributing drainage area of approximately 16.9 square miles.

Peak streamflow data for the Little Fountain Creek Gages was available between 1978 and 2023. Based upon the graph (also provided on the following page), the peak flow measured at that location occurred in 2013 and totaled approximately 2,810 cfs. The next highest peak discharge recorded during that period, occurred in 1985 and measured 1,110 cfs. The reading in 1985 was also affected to an unknown degree by regulation or diversion. Based upon the available information this Gage is located at an elevation of 5,566 ft above sea level (NAVD88) has a contributing drainage area of 26.8 square miles. The peak flow rate graphs for each Gauging station are provided below.

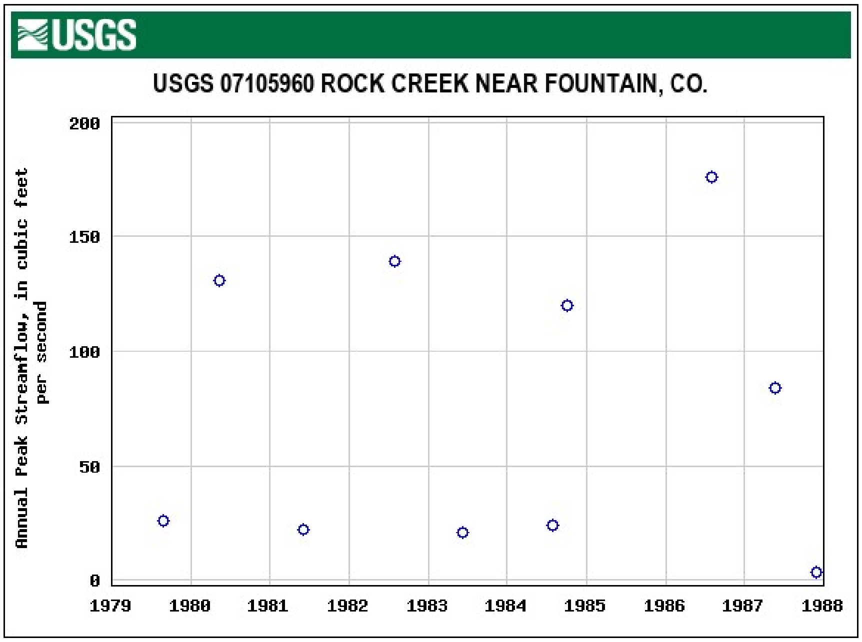

Figure 5. – USGS Rock Creek Near Fountain, CO Peak Streamflow Graph

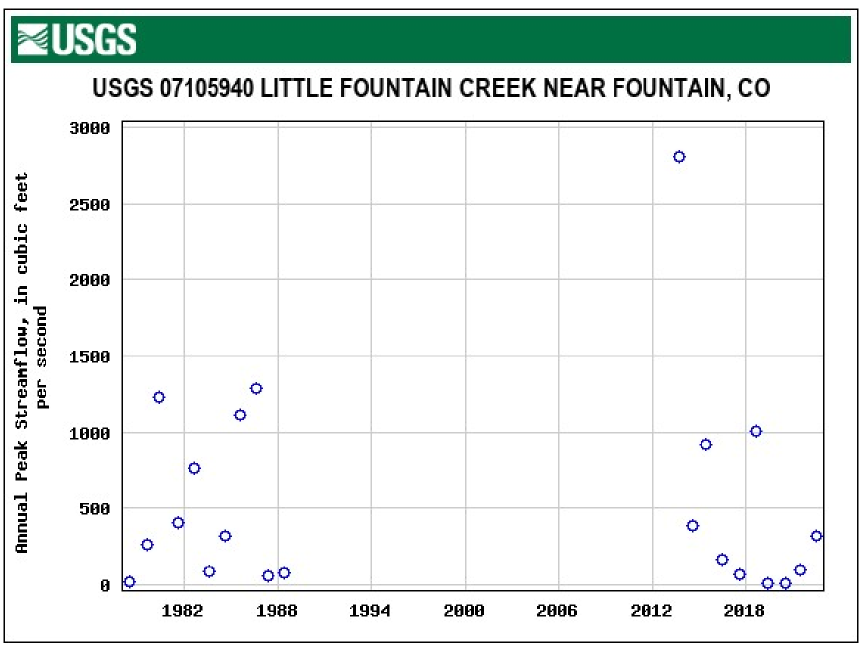

Figure 6. – USGS Little Fountain Creek Near Fountain, CO, Peak Streamflow Graph

At a cursory level, it should be noted 1) that both Gages have limited information upon which to draw from, 2) the peak flow rates of the two Gages appear to differ significantly when compared to one another when evaluating at discharge/per contributing acre and 3) The large peak flow recorded in LFC in 2013 is double that of any other recorded event and should be scrutinized. Given this, additional investigation is required for the up-gradient watershed characteristics, specifically; 1) the understanding of any significant ponding/attenuation which occurs, 2) the quality control of the existing Gages, and 3) need for implementation of additional Gauging stations data located (within the

LFCDB) upstream of State Highway 115. All these factors should be considered when attempting analyze and calibrate the watershed in its entirety.

Floodplain

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0965G and Panel No. 08041C01155G, both revised December 7, 2018, the subject site contains a 100 year floodplain shown as "Zone A" for Little Fountain Creek. "Zone A" being defined as "No Base Flood Elevations Determined". As such, there is no detailed drainage study for Little Fountain Creek. There is no floodplain shown by FEMA for Rock Creek within the project area. It should be noted that approximately 679.39 acres located along the northern portion of the site are contained within map No. 0804110961, at the time of the writing of this summary the imagery for this panel was not available. This may be due to its relative proximity to portion of the base. A copy of the annotated floodplain map is included within the Appendix.

Existing Site Conditions and Current Land Usage

The ~3,108 acre site contains varying topography and land uses. The northeast corner of the property is currently being used as a permitted mining operation, approximately 400 acres. The mining area, currently operated by Schmidt Construction, is for exportation of sand and gravel for construction uses off site. The mining is expected to continue for several years past the writing of this report (September 2023).

Figure 7. – Aerial of SCRP

Show property boundary on exhibit, so able to see mining area in relation to site.

The balance of the site is primarily unused agriculture ground. There is evidence of an old ranch homestead, outbuildings and corrals. In the center of the property there are a few residential properties that are not a part of this study or Sketch Plan. They exist on the lower lying land and are accessed by a private dirt road off of Charter Oak Ranch Road.

The two major drainageways are natural and convey stormwater from the northwest to the southeast. The northern drainageway is known as Rock Creek and the southern is known as Little Fountain Creek. Rock Creek feeds a few old ponds for livestock watering and conveys 16.8 square miles of drainage. Little Fountain Creek is deep and circuitous and conveys 26.8 square miles of drainage downstream. Neither drainageway currently contains any improvements for flood control or erosion protection. The northeast portion of the property, partly being used for mining, lies on top of a plateau. The western and southern property is low lying ground, generally flat along the two drainage ways.

Figure 8. – Looking south across property from atop steep ridgeline

The southwest corner of the property is slightly higher and drains to the east and northeast to Little Fountain Creek. The existing terrain slopes are flat on the top of the plateau and near the drainages. The slopes off of the plateau are steep.

Figure 9. – Photo of Portion of Eroded LF Creek Channel

Figure 10. – Photo of Portion of Eroded Rock Creek Channel

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The undeveloped property is natural range land and is very porous. The plateau is sparsely vegetated with cactus and natural grasses on sandy soil. There are very few trees, if any. The low lying areas contain lush grasses probably from old grazing and livestock feed production on fertile soil. There is thick vegetation and trees along the drainageways.

It should be noted that the site visit was conducted on an abnormal year. The month of May-June 2023 was subject to in excess of 16 inches of rain in El Paso County which is equivalent to the precipitation values for an average year.

Land Cover/Vegetation

The types of vegetation are also diverse across the 54.7 square mile watershed and within the SCRP property. Types of Common land cover within the basin include: Agriculture, Invasive Grassland, Inter-Mountain Basins Wash, Rocky Mountain Gambel Oak-Mixed Montane Shrubland, Rocky Mountain Ponderosa Pine Woodland, Southern Rocky Mountain Pinyon-Juniper Woodland, and Western Great Plains (Colorado GAP Landcover Data). Athough not defined within the HDR Study, emergent wetlands appear to be present in pockets within and along the active channels. These are likely dominated by cattails (Typha latifolia OBL), bulrush (Schoenoplectus lacustris OBL), and sedges (Carex sp. >FACW). In some cases, the wetlands are also mixed with willows (commonly sandbar willow (Salix exigua OBL)), dogwood (Cornus sp. >FACW) and cottonwoods (Populus deltoides FAC).

Historical Features

A draft Feasibility Study has been prepared for the subject property, by HDR Engineering Inc., June 2019. An Environmental Review and Phase I Environmental Site Assessment were completed in 2018. These studies speak to the history and environmental conditions. These studies seem general in nature and more detail should be provided with future studies.

Jurisdictional Wildlife, Wetland & Waterways

A wildlife and Waters of the U.S. Technical Memorandum was prepared by HDR Engineering Inc., May 2023. The memorandum discusses the wildlife, wildlife habitat, Federal and State Listed wildlife species for the property.

Based upon provided memorandum, no wetland delineation was conducted during the site visit of 2018; however a few areas were observed where potential wetlands may exist. Jurisdictional streams were observed onsite, such as Little Fountain Creek and Rock Creek.

To comply with the Clean Water Act Permitting recommends;

- Conduct an official wetland and waters of the U.S. delineation in areas that would be impacted by project construction.
- Coordinate with the USACE, Southern Colorado Branch Office, if impacts to features identified as wetlands.

Per the memorandum, according to the Information for Planning and Consultation (IPaC) system there are up to eight USFWS federally threatened or endangered species and one candidate species with the potential to occur within the project vicinity. However based upon HDR's summary table, the presence of these species is unlikely to occur as no suitable habitat is present with the exception of the Monarch butterfly, who migration habitat may occur with the in project area. Thus to comply with the Endangered Species Act and Migratory Bird Treaty Act and the Bald and Golden Eagle protection act HDR recommends;

- To the extent practical, vegetation removal should occur outside the nesting season for migratory birds
- A survey of the project area for nesting migratory birds should be performed; if active nests are located appropriate buffers should be provided.
- A raptor survey should be conducted prior to the start of construction; if active nests are located the CPW should be notified in order to be in compliance.
- Prior to any ground disturbance near active and inactive prairie dogs colonies in the project are a qualified biologist should conduct a survey to determine if Western burrowing owls are present in any of the colonies and if located follow recommend protocol.

A copy of this memorandum is within the project files stored in the records of El Paso County for this project.

Environmental Resources and Permitting

Section 404 of the Clean Water Act (CWA) establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Where future channel improvements or proposed improvement projects are found to affecting a delineated wetland, a waterway or riparian ecosystem; permitting shall be required in accordance with USACE regulations. All other state and local construction permits related to activities within drainage corridors should also apply.

Figure 11. – Photo of Highly Vegetated Portion of Property

Proposed Development

The proposed development as depicted on the Sketch Plan consists of Heavy Industrial, Light Industrial Commercial, Commercial Services, Preservation/Low Impact Uses, Drainage Flood Control & Open Space, 100 year Floodplain, Rail Easements, and Roadway/ROW. These types of developments produce intense storm water runoff properties. Depending on the layout, location and size of each land use development, the local drainage analysis shall conform to the El Paso County drainage criteria. Portions of the property are likely not developable given the steep nature of the topography. The current mining operation will be developed upon completion of the lease. A summary table of the Proposed Land use is provided on the following page. A copy of the current sketch plan is provided in the appendix.

Ensure building SF by land type is the same between TIS & Drainage Report

Land Use	Acres	% Land Use	SF of Use
Commercial	10.9	0.4	76,666
Commercial Services	130.9	4.2	682,150
Light Industrial	859.0	27.6	2,982,989
Heavy Industrial	1429.8	46.0	1,926,676
Preservation / Low Impact Use	100.6	3.2	-
Drainage, 100 yr Floodplain, Open Space	234.1	7.5	-
Rail Easement	37.0	1.2	-
ROW	119.0	3.8	-
No-build Steep Slopes	175.0	5.6	
Misc.	12.6	0.4	-
Total	3108.9	100%	5,668,481

Table 3 –Proposed Land Use/Area Summary

Drainage Criteria

Hydrology calculations should be performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. This shall include the amendment with Chapter 6 of the 2014 version (revised 2021) of the City of Colorado Springs Drainage Criteria Manual (COSDCM) as adopted by the El Paso County (EPC) Board of County Commissioners (BOCC) by Resolution 15-042. Chapter 6 addresses the hydrologic calculation methods and includes an updated hydrograph to be used with storm drainage runoff. EPC BOCC adopted by the same resolution, Section 3.2.1 of Chapter 13 of the COSDCM referencing Full Spectrum Detention.

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

Hydrology

The development of accurate and representative onsite and contributing watershed hydrology is critical for correctly selecting and sizing stormwater infrastructure that adequately address runoff from the multiple storm events.

Various hydrologic analyses shall be required to determine peak discharge and volumetric runoff for the existing and future development conditions. There are numerous methods that can be applied, but only a few have selected for this project. The method chosen should depend on the purpose of the analysis and the size of the studied drainage basin. The Rational Method is a relatively simple approach used for smaller watersheds where only peak flows are required and a hydrograph is not required. For more complex analysis which requires the study of larger drainage basins and routing requirements, the HEC-HMS model is better suited. Alternative methods such as EPA SWMM should also be considered.

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The large scale hydrologic analysis for the Little Fountain Creek Drainage Basin and the Southern Colorado Rail Park should provide an estimate of the drainage basin's runoff and peak flow response to the 2-, 5-, 10-, 25-, 50- and 100-year recurrence interval rainfall events for both the existing and developed conditions. The results of the hydrologic analysis shall be fed into the hydraulic analysis to further evaluate the drainageways and determine existing flow rates at key design points. The existing flow rates establish a base line for the release of developed runoff. Smaller scale drainage analysis for developments within the Southern rail park should likely involve the Rational Method. This method evaluates only the "minor" and "major" storm events based upon the 5-year and 100-year recurrent interval, respectively.

Planned Data Sources to be Utilized in Hydrologic Analysis

In order to develop onsite hydrology for site and ascertain the impacts from the contributing watershed the planned drainage study should be generated using the best available information provided by El Paso County and acquired from public sources.

Sources of information and their use include the data listed on the following page.

Data Obtained or Forthcoming	Data Source
Aerial Imagery	El Paso County (2016)
LiDAR Data	El Paso County/State of Colorado (2018)
Future Land Use	N.E,S. Inc - Sketch Plan
Future Land Use	El Paso County (2021)
Zoning	El Paso County (2021)
Soils Data	USDA, NRCS, SSURGO (2023)
Rainfall	NOAA Atlas 14 (2013)
Major Watershed Boundaries	El Paso County (2005)
Gage Data	USGS (2002-2023)
GIS Data	El Paso County (2023)
Site Visits	M&S Civil Consultants/HDR
Site Boundary/Add'l. Topographic Data	M&S Civil Consultants (2022-23)

Table 4 – Data and Data Source

Design Rainfall

Rainfall depths must be determined based on the duration and return period of the design storm and the size of the drainage basin being evaluated. Per the City of Colorado Springs Drainage Criteria Manual Depths should be taken directly from the NOAA Atlas 14 website. https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=co)

The depths reported in the NOAA Atlas represent probable total depths for each duration and return period at a point on the ground. These depths can be applied to the design storms or converted to intensities (inches/hour) for the Rational Method as described below. However, as the basin area increases, it is unlikely that the reported point rainfalls will occur uniformly over the entire basin. To account for this characteristic of rain storms an adjustment factor, Depth Area Reduction Factors (DARFs) should be applied.

As previously stated, the selection of the design rainfall should vary depending upon the analysis being provided. As such two locations were chosen to provide cursory rainfall data for the project. The first being near the center of the site, the second located near the centroid of the basin. The 1 hr, 6 hr, and 24 hr values have been presented for the 1-, 2-, 5-, 10-, 25-, 50- and 100-year intervals for potential evaluation.

NOAA Atlas 14, Volume 8, Version 2 – Unadjusted Depths								
Location	PDS based point precipitation frequency estimates with 90 % confidence inverals (in inches)							
	Duration	Average recurrence interval years						
		1	2	5	10	25	50	100
Centroid of SCRP*	60 mins	0.856	1.000	1.29	1.56	2.00	2.38	2.80
Centroid of LFCDB**		0.848	0.997	1.28	1.54	1.95	2.3	2.69
Centroid of SCRP*	6-hr	1.30	1.47	1.84	2.24	2.91	3.54	4.25
Centroid of LFCDB**		1.29	1.46	1.83	2.21	2.85	3.44	4.10
Centroid of SCRP*	24-hr	1.63	1.89	2.39	2.88	3.66	4.36	5.12
Centroid of LFCDB**		1.70	1.96	2.47	2.97	3.78	4.5	5.3

* Latitude 38.6436, Longitude -104.7298, Elevation 5570

** Latitude 38.6795, Longitude -104.8326, Elevation 6203

Table 5 – NOAA Atlas 14 - Unadjusted Point Precipitation

The locations and values to be utilized in the future analysis should be discussed with the El Paso County Planning and Community Development staff prior to implementation. It should be noted that it does not appear as if either of the aforementioned Gauging stations were utilized by NOAA in the development of Point Precipitation Frequency Estimates.

Design Storms

Design storms are used as input into rainfall/runoff models to provide a representation of the typical temporal distribution of rainfall events when the creation of routing of runoff hydrographs is required. Commonly a Type II storm distribution was utilized in preparation of many of the existing Drainage Basin Planning Studies, around the El Paso County/Colorado Springs Area. However, the development of synthetic rainfall event with a 6-hour duration temporal distribution maybe more appropriate when coupled with NOAA Atlas 14 point precipitation values. This synthetic rainfall event may be front loaded, meaning the majority of rainfall occurs within the first 2 hours of the storm.

Depth area reduction factors (DARFs) shall be used to adjust the point-precipitation values from the NOAA Atlas 14 dataset to represent average precipitation over larger areas in the Little Fountain Creek Drainage Basin. As drainage area increases, the basin-average precipitation for a storm event decreases. DARFs should be incorporated into the sub-basin level analysis from values presented in the DCM. The minimum DARF (maximum point rainfall reduction) for the 54-square mile Little Fountain Creek Drainage Basin should end up being around ~92 percent for a 6-hour storm. Additional coordination with El Paso Planning and Development should occur regarding the selection of the utilized rainfall and storm distributions.

Little Fountain Creek Drainage Basin - Description

The Little Fountain Creek Drainage Basin is located along the western portion of El Paso County and flows generally from the northwest to the southeast. The LFCDB contains two perennial streams and has a drainage area of approximately 54.7 square miles at its confluence with Fountain Creek. The headwaters of the LFCDB and areas west of Colorado State Highway 115 are dominated by pine forests associated with steep mountain terrain. While the remainder of the basin is dominated by high range grasslands located upon undeveloped tracts of land. Very limited development occurs within the majority of the watershed, primarily limited to the Interstate-25 and State Highway 115, a few intermittent rural roadways, the mine, and limited portions of Fort Carson, and the Ray Nixon power plant. A watershed basin map is shown below.

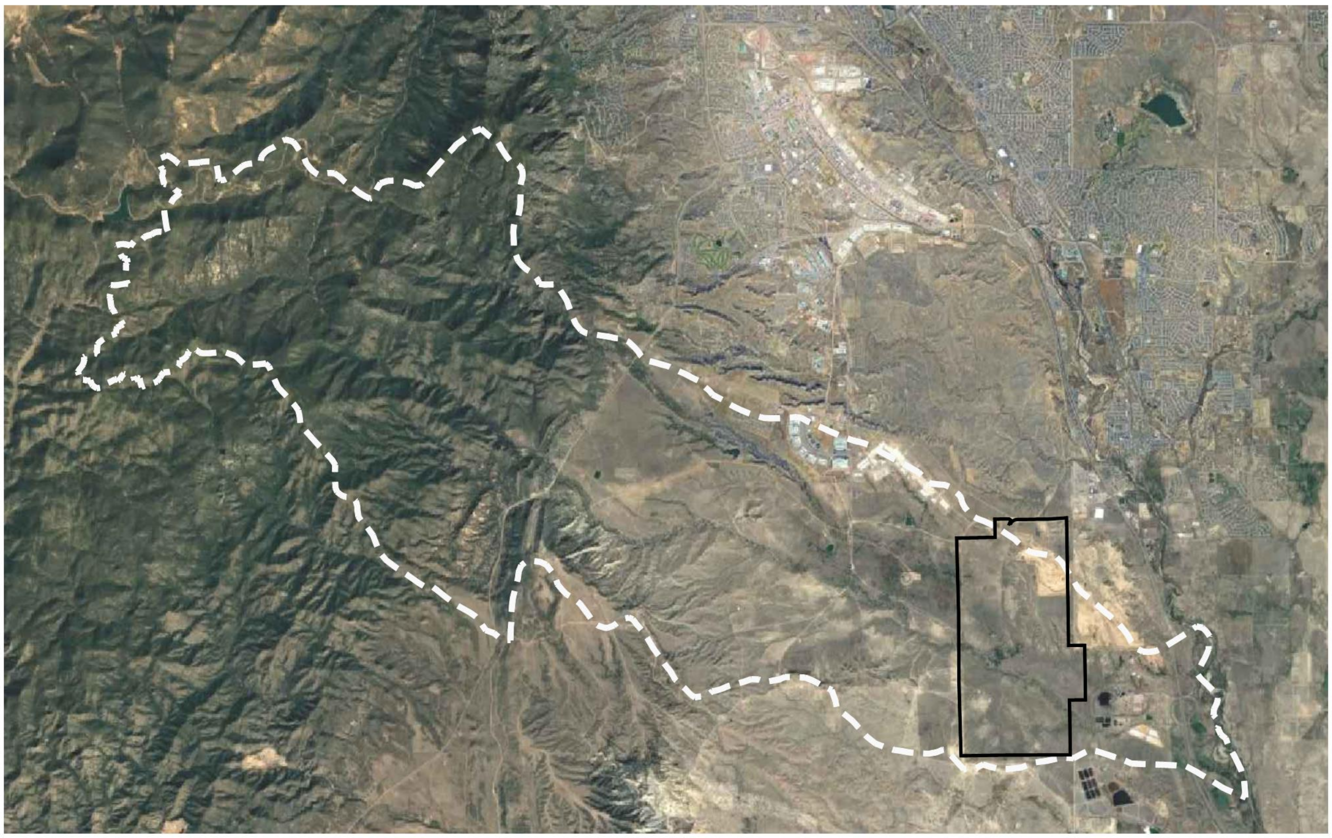


Figure 12. – Aerial of LFC Drainage Basin relative to SCRP

Topography of the Little Fountain Creek Drainage Basin

The topography of the Little Fountain Creek Drainage Basin is also diverse. Figure 13 on the following page which presents banded 7.5 minute series maps from the USGS across the local drainage basins reflects this. One take away from the figure is the notable vertical differential across the watershed represented by changes in density of the illustrated contours as the lands transition from mountain hillsides above Hwy115 to relatively flat high prairie lands adjacent to the subject site. The maps also indicated the presences of several small tributaries. A large scale exhibit of the image below has been provided in the appendix.

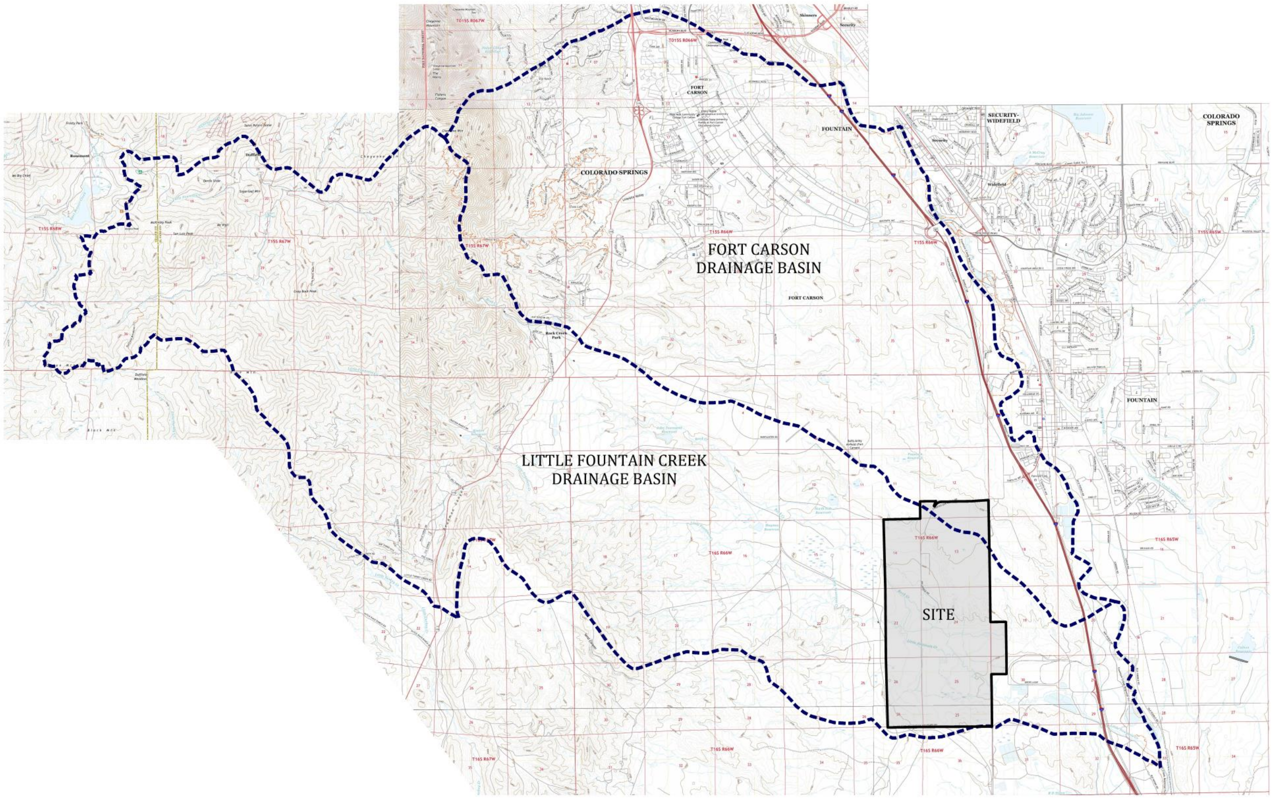


Figure 13. – LFC and FCB Drainage Basins relative to site, using USGS 7.5 min series mapping underlay.

Existing and Proposed Conditions Drainage Subbasin Delineation

Drainage basins should be delineated based on available detailed topographic data (LiDAR), aerial imagery, field reconnaissance and survey data. Common delineation occurs at major roadway crossings, embankments, at locations where significant changes in slopes and land use occur or at any other feature that functions to alter the drainage patterns or terminate at a point of interest. Sub-basin areas are generally limited to 130 acres in size. The LFC Drainage basin should likely be divided into two major subbasins that align with flows that contribute to Rock and Little Fountain Creek.

Large Scale Hydrologic Modeling

A hydrology model for the LFCDB should be developed using the US Army Corps of Engineers (USACE) Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) (latest non-beta version) to simulate the rainfall-runoff process and generate flood hydrographs for the selected storm events.

NRCS Curve Numbers

NRCS curve numbers range from 0 to 100 (the recommended lower limit is 40) and can be used to calculate the volume of runoff from a storm event based on land use characteristics. A curve number of 0 would represent zero runoff (100%

losses), and a curve number of 100 would represent zero losses (100% runoff). The selection of a curve number value depends on the type of soil, identified by the NRCS hydrologic soil group (HSG), the land cover or treatment, and the antecedent runoff condition (ARC). For non-irrigated undeveloped lands ARC I (lower runoff) applies when modeled with short duration thunderstorms. Post development conditions should be modeled utilizing ARCII (higher runoff) curve numbers.

The selection of a curve number value depends on the type of soil, identified by the NRCS hydrologic soil group (HSG), the land cover or treatment, and the antecedent runoff condition (ARC). An area-weighted composite curve number for each sub-basin shall be calculated when multiple land uses were encountered within a basin. The table below provides some common land uses, imperviousness, and CN values for various soil types.

Land Use Index					
NRCS CN ARC I					
		Pre Development CN			
Land Use Classification	% Impervious	HSG A	HSG B	HSG C	HSG D
Woods	0-2	--	39	53	61
Grassland (Rangeland)	2-5	--	48	61	69
Mining	30-50	61	75	83	87
Farmsteads	2-10	38	54	66	72
Sagebrush with grass understory	0-2	--	46	63	70
100 yr Floodplain	0-100	98	98	98	98
No-build Steep Slopes	0-10	42	58	70	75

Table 6 – NRCS CN ARC I Land Use

NRCS CN ARC II					
		Post Development CN			
Land Use Classification	% Impervious	HSG A	HSG B	HSG C	HSG D
Preservation/Low Impact Use	0-5	--	48	74	80
Commercial, Commercial Services	80-90	--	92	94	95
Light Industrial	70-80	--	88	91	93
Heavy Industrial	80-90	--	92	94	95
Rail Easement	75-85	--	89	92	94
Roads/Impervious surfaces	100	--	98	98	98
Rights of Way	85	--	83	89	93

Table 7 – NRCS CN ARC II Land Use

Initial Abstraction

In accordance with the City of Colorado Springs Drainage Criteria Manual, Initial Abstraction (IA) should be calculated for each sub-basin using equation 6-12, $Ia = 0.1 \{(100/CN)-10]$. The calculated values are to be input into the various HEC-HMS models.

Times of Concentration Calculations and Lag Times

Topographic contour data collected from the LiDAR mapping and onsite surveys should be utilized to determine overland flow paths and reach slopes and geometry. Times of concentration calculation are to be analyzed in accordance with guidance provided in Chapter 6, Section 3.2 of the Colorado Springs Drainage Criteria Manual. Overland sheet flow should be limited to a maximum of 100 feet for urban development, while sheet flow for rural development should be limited to 300 feet. Equation 6-13 from the DCM, T(lag) = 0.6 *Tc, shall be utilized to convert times of concentration to lag time.

Reach Routing

The Muskingum-Cunge method should be utilized for channel routing for the defined reaches within the LFC watershed. The channel cross section can be defined by eight points. Manning's channel roughness coefficient (Manning's n) values for earthen channels should be assigned based on published values within the EPC DCM. Where storm sewer conduits are represented as either circular or rectangular cross sections they shall be assigned Manning's n value of 0.013. Labeling of the channel reaches within the HMS model should be designated by the primary watershed upon which it is located with a secondary number or letter that designates its place within that reach. This data should be provided on various model schematics and proposed conditions maps as needed.

Hydrologic Soil Groups within the Little Fountain Creek Drainage Basin

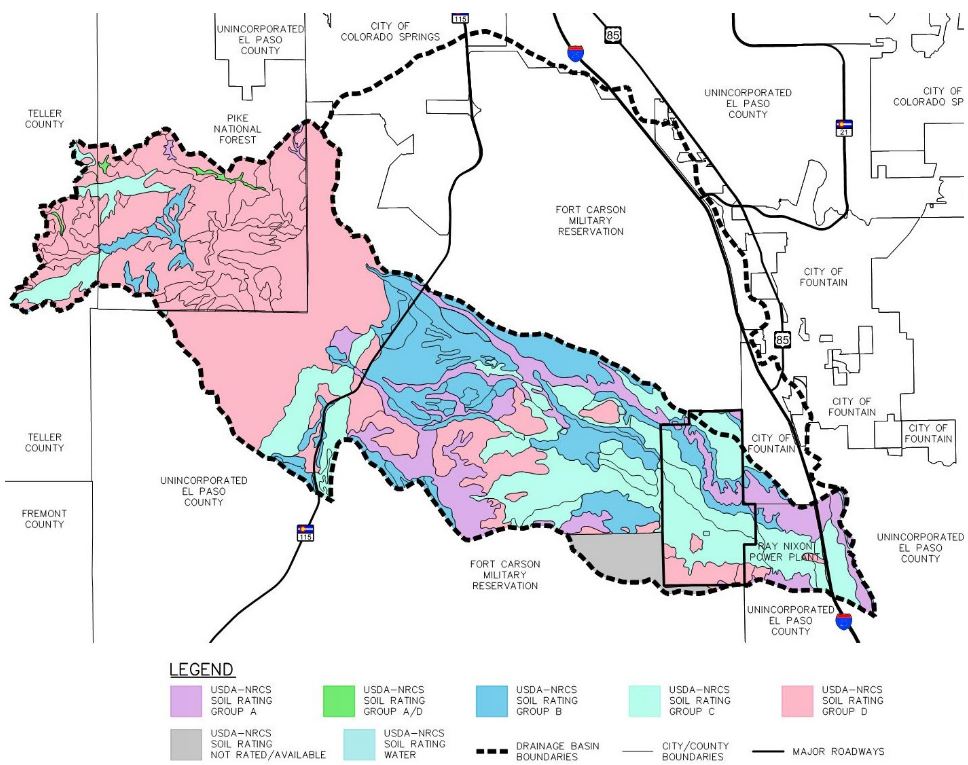


Figure 14. – LFCDB and SCRP Soils Map

Soils were also delineated for the Little Fountain Creek Drainage Basin by M&S Civil Consultants, using the "Web Soil

Survey" (WSS), a web-based database provided by the U.S. Department of Agriculture (USDA)'s Natural Resources Conservation Service (NRCS). The predominant soil groupings are sandy and clay based loams which possess Hydrologic Soil Group Ratings of A thru D and include some combined soil types as well as areas that were not studied or available.

Special Considerations Regarding Soils within the Pike National Forest

The upper portion of the LFCDB lies within the Pike National Forest. Large portions of the Fountain Creek watershed extend into the foothills of the Rocky Mountains and also include the northern and eastern faces of Pikes Peak. Soils in these areas were mapped as part of a soil survey completed for the Pike National Forest in 1992. Due to the level at which the study was conducted, soil mapping for some portions of the foothills does not have adequate resolution to accurately characterize rock outcroppings, depth to bedrock and potential for infiltration and runoff.

Many of the soils in the Pike National Forest were assigned to Group D likely due to the inclusion of scattered rock outcroppings and a perceived depth to bedrock. However, these soils are derived from decomposed Pikes Peak granite that is highly fractured and deeply weathered below the soil profile. These soils have exhibit high infiltration rates with no free water occurring within the soil profile. As such, the City of Colorado Springs has provided additional guidance regarding soils in this area.

For the purposes of establishing hydrology involving these areas, the HSG for soil mapping units in the Pike National Forest should be assigned as shown;

HSG for Soils in the Pike National Forest		
Map Symbol	Major Soil Component	Assigned HSG
42,43,44,45,46,47	Sphinx	B
5,6,7	Catamount	B
21	Ivywild	B
33,34,35,36	Rock outcrop	D
24,25,26	Legault	B
48,49	Tecolote	B
9	Cirque land	D
2	Aquolls	D
10	Condie	B
29,31	Pendant	D

Note: Minor soil map units not listed above shall retain the published HSG

Table 8. – Reassigned HSG for Soils in Pike National Forest

Modeling of Existing Detention Ponds

There are few stock ponds throughout the LFCDB that appear to always remain partially full and do not have any apparent outlet structures. These ponds should be evaluated, but are anticipated to provide minimal flood attenuation and should not be modeled.

Proposed Flood Control Structures – Catchment of Debris & Sediment

At the west side of the project, a flood control structure is proposed on each drainageway entering the property. The purpose of the flood control structures is to maintain the witnessed maximum flow as provided by the USGS data. The Flood Control structures will function to provide an area to catch debris and sediment from the upstream undeveloped Fort Carson Military land. Additionally, the debris and sediment may originate from the far upper reaches of the basin from Pike National Forest. These ponds would need to be modeled to understand the effects of attenuation.

If deemed necessary, an additional regional flood control structure and online detention pond should be proposed along the east side of the project to control the total amount of runoff exiting the proposed project. This scenario is less likely under the assumption that developments, that discharge, to Little Fountain Creek shall be supported by several upstream local stormwater quality and detention ponds. If the eastern pond is required, the pond should be modeled to show the effects of attenuation.

Additional Model Considerations Regarding Conveyance of Runoff from Major Drainageway Basins

It should be noted that unlike regional detention, sub-regional and onsite detention facilities shall not be recognized in the determination of flow rates for downstream major drainageways.

Although the benefits provided by constructed, publicly operated and maintained regional detention facilities may be recognized if approved by El Paso County Planning and Development, a fully developed "emergency conditions" scenario must be analyzed that does not consider the benefits of upstream regional detention facilities. Conveyance facilities and channel improvements should be designed considering the benefits of upstream regional detention when approved by El Paso County Planning and Development. In addition, it must be shown that the "emergency conditions" runoff can be safely conveyed, using additional capacity provided by freeboard or buffer areas, without impacting proposed structures or buildings. Consideration of this additional scenario is warranted because of the potential threat to public health, safety, and welfare associated with flooding along major drainageways.

Hydrologic Model Results

The existing conditions and future conditions model should be executed for the 2-, 5-, 10-, 25-, 50- and 100-year recurrence intervals. Based upon the analysis, both existing conditions and developed conditions models should be checked for reasonableness. This should be done by the utilization of a series of regression equations or by comparisons to other large drainage basin planning studies, which possess similar drainage characteristics to that of the analyzed watershed. Unfortunately there is not a Gauging station present at the confluence of Little Fountain Creek and Fountain Creek from which a direct comparison can be made for the existing condition. The Hydrologic Modeling Results shall need to be reviewed and approved by Federal Emergency Management Agency in the process of mapping or the remapping of regulatory floodplains.

Hydraulic Analysis

The purpose of the hydraulics analysis should be to gain an understanding of the open channel flow characteristics within the existing watershed. These analyses should be completed utilizing the peak flows, provided by the hydrologic modeling for the 2-, 5-, 10-, 25-, 50-, and 100-year storm events. The hydraulic analyses should likely be completed using the USACE Hydrologic Engineering Center-River Analysis System (HEC-RAS) (Latest Non-Beta Version). Objectives of this analysis should be to identify areas of potential infrastructure deficiency and delineate approximate floodplain boundaries for both the existing and future hydrologic conditions.

Modeling of Reaches

HEC-RAS can be utilized to perform one-dimensional, steady flow hydraulic calculations. The stream centerline provided generally follows the channel thalweg to define the reach network. The banks lines differentiate the change in Manning's n value that typically occurs at the extent of the low flow channel. The flowpath lines identify the centroid of the flow in the left overbank, main channel, and right overbank in order to determine the respective reach lengths.

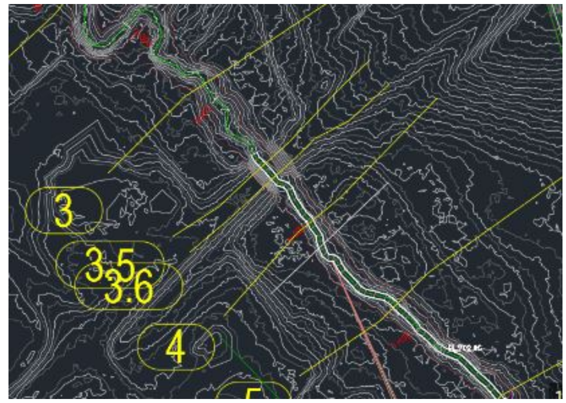


Figure 15. HEC-RAS model representation

The cross-section lines define the channel dimension to acquire topography information along the reach. Cross section topography data can be obtained from an obtained from processed LiDAR data.

Selection of Manning's n Values - Channels

Manning's n values are crucial in specifying channel roughness in the hydraulic model. The values chosen for the next phase of this study should incorporate several different sources. Aerial photography can be used as a starting point, followed by initial assessments verified using in-stream photographs. The USGS water supply paper 2339 should be utilized. "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains. https://pubs.usgs.gov/wsp/2339/report.pdf and the United States Department of Agriculture, "Flow Resistance Coefficient Selection in Natural Channels: A Spreadsheet Tool. www.fs.usda.gov.biology/nsaec/assets/yochum2017flowresitancespreadsheettoolts-103-2.pdf.

Hydraulic Structure Inventory

The size, type and general hydraulic conditions of any existing and future offsite bridges, culvers detention basins, etc. should be inventoried. A table summarizing the facilities should to be provided. The required inputs for bridge modeling, should it be warranted, include data for the deck/roadway, pier, and sloping abutments. The required inputs for culvert modeling include data for the deck/roadway, culvert shape, culvert size, and culvert material. This data should be obtained from the hydraulic structure inventory, topography, and aerial photography.

Entrance loss coefficients shall be assigned to estimate the amount of energy lost as the flow enters a culvert and should be used in determining the upstream headwater elevation for outlet control computations. Entrance loss and exit loss coefficients for different types of culverts shall be based upon those recommended in the HEC-RAS manual.

It is anticipated that some of the up-gradient crossings (such as at HWY 115) over the years of service, have become obstructed with sedimentation, vegetation growth, and the accumulation of debris. Cleaning and maintenance of these culverts is imperative to restore and maintain flood flow capacities. The existing conditions models, should likely take this into effect to determine deficiencies, while other scenarios maybe considered when evaluating future development conditions. The inclusion of any stock ponds or detentions ponds to model attenuation should be considered on a case-by-case basis.

Hydraulic Model Results

Upon completion of the HEC-RAS model, cursory floodplains for the existing and future 100-year floods can be delineated for all of the notable watercourses that travel through the subject site. In addition flood profiles for the existing and future 10 and 100-year floods can be provided thru the subject site. These floodplains and flood profiles should be utilized to determine any deficiencies that exist along the major drainageways and also identify any areas of potential flooding that can be mitigated through site and drainage planning.

Coordination with Federal and Local Floodplain Agencies

As part of the Nation Flood insurance program, the existing conditions floodplains shall set the hydraulic constraints for proposed developments by establishing regulatory Base Flood Elevations, Floodways and Floodplains. This effort shall require coordination with the Federal Emergency Management Agency (FEMA) and the El Paso County Floodplain Administrator. It should be noted that FEMA does not recognize future conditions as part of the NFIP map development process. Conditional Letter of Map revisions (CLOMRs) must be filed with FEMA to allow channel construction. Upon completion of construction Letter of Map Revisions (LOMRs) are required to be processed which should function to realign the regulatory floodplain. Coordination with USACE, in selecting proposed channel improvements shall be required.

Figure 16. FEMA Floodplain Example

Proposed Traffic Infrastructure & Utility Improvements

The Sketch Plan for the project depicts a major roadway network. The road classifications vary in size depending on the projected traffic volumes. The roadway corridors shall also be utilized for utilities and drainage.

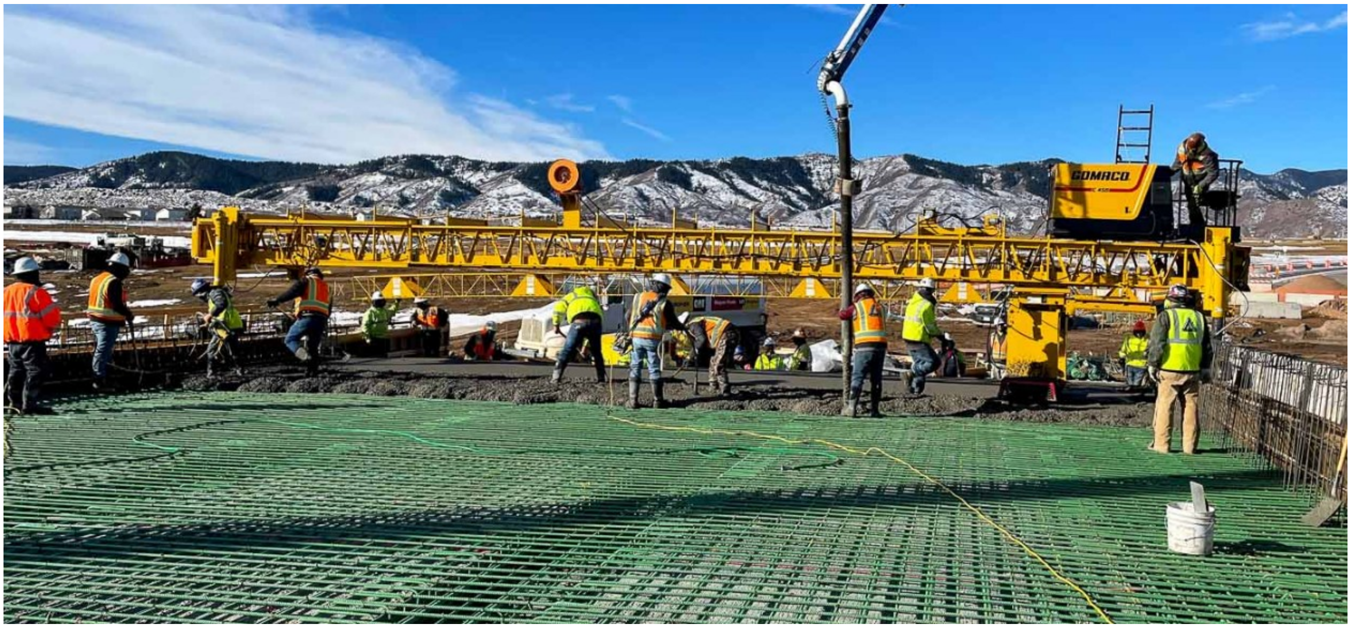
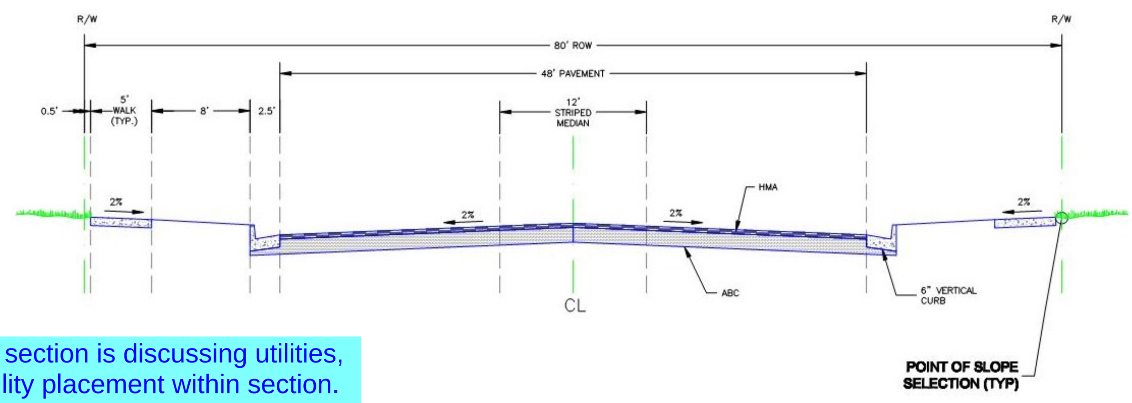


Figure 17. High Capacity Roadway Construction

The utility infrastructure shall be comprised of major & minor; water lines, sanitary sewer lines, gas, electric and storm sewer pipes. The roadway cross section and utilities shall conform to the standards of El Paso County. Several common cross sections which are anticipated for the development are provided on the following pages.



Since this section is discussing utilities, include utility placement within section.

Roadway Design Parameters
Design Speed: 40 mph
Posted Speed: 35 mph
Maximum ADT: 20,000
Design Vehicle: WB-50

Figure 18. - Urban Non-Residential Collector Roadway Standard Cross Section

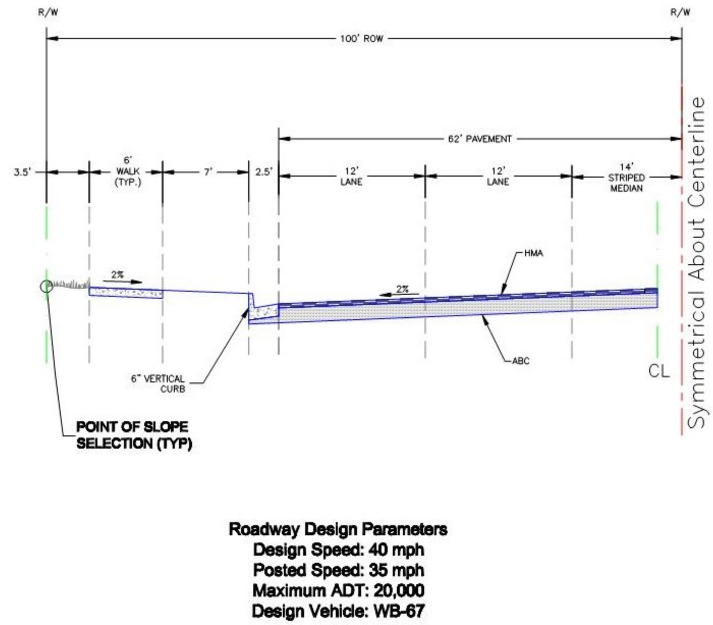


Figure 19. - Urban Minor Arterial Roadway Standard Cross Section

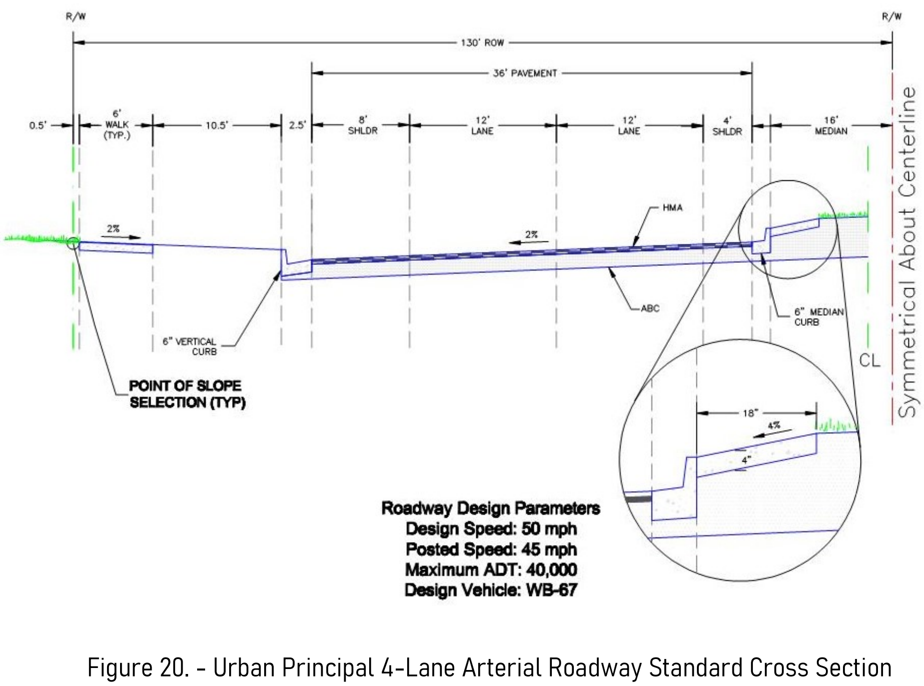


Figure 20. - Urban Principal 4-Lane Arterial Roadway Standard Cross Section

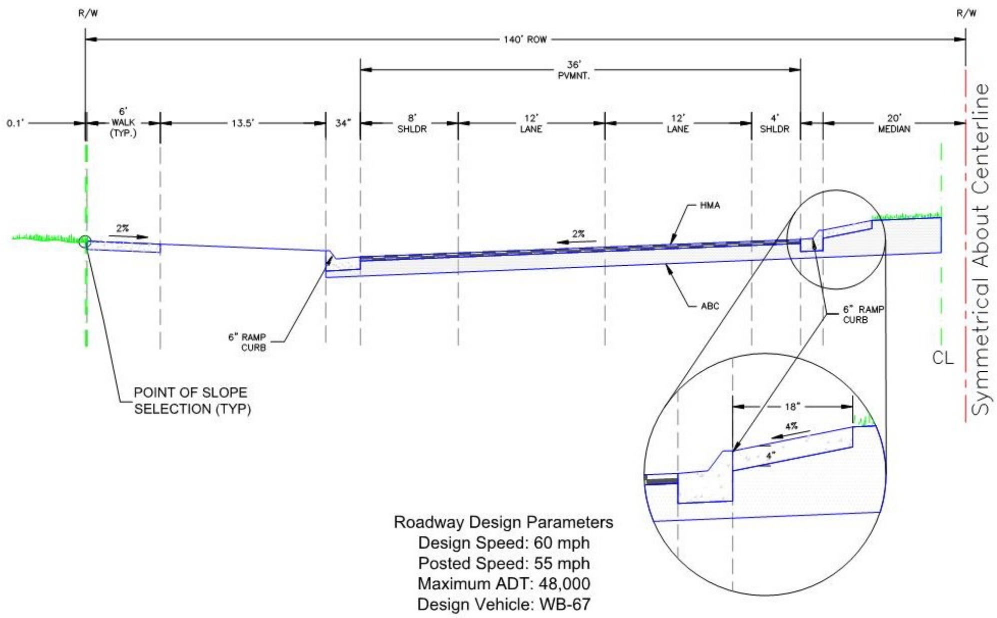


Figure 21. - Urban Expressway 4-Lane Arterial Roadway Standard Cross Section

Future Pad Development Drainage Considerations

All drainage systems being designed within SCRP shall take into account both minor intensity and major intensity storms. The objective of drainage system planning for minor intensity storms reoccurrence interval is to allow for the proper design of minor drainage systems (i.e., curb and gutters, storm sewers, culverts, open channels, and detention ponds) while minimizing minor damage and maintenance costs. The objective of drainage planning for major intensity storms (100-year reoccurrence interval) is to allow for proper design of major drainage systems (i.e., bridges, storm sewers, open channels, and detention ponds) while minimizing the possibility of major damage and/or loss of life.

Each development within SCRP shall contain and establish; runoff reduction practices, safe conveyance of stormwater runoff, as well as implement the construction of water quality and detention areas. The developments runoff should ultimately be conveyed to one of the existing and improved drainageways (specifically, Rock Creek or Little Fountain Creek or other yet determined un-named tributaries). The following paragraphs discuss common drainage design and criterion that shall be utilized with the development of the subject site.

Street in a Drainage System

The primary functions of streets are to convey traffic, however they also function to collect and convey stormwater runoff. The design criteria for the collection and conveyance of stormwater runoff on streets are based upon the storm event and the size of the street. The storm drain system should begin at or before the point where the maximum encroachment is reached.

Storm Sewer Systems

Once runoff is collected in streets, parking lots and grass lined swales it is typically directed to underground storm sewer systems. The storm drain systems are comprised of pipes, inlets, manholes, outlet structures, etc which convey drainage to detention basins, water quality facilities or other water bodies.

18" per ECM 3.3.C

Per EPC guidelines, proposed storm drains shall be sized to convey the minor storm event without surcharging. They shall have a minimum of 15" diameter and shall possess a design life of 50 years. Storm drains shall be designed to have a minimum mean velocity of 2.5 fps. In general, storm drain alignment between manholes shall be straight. Long radius curves may be allowed to conform to street alignment. Short radius curves may be used in place of elbows on larger pipes greater than 36" in order to reduce head losses. Curves may be produced by angling the joints or by fabricating beveled ends. Angled joints shall be kept at a minimum to maintain a tight joint. Curvature shall be limited to those specified by pipe manufacturer recommendations. Manholes shall be located as required for conduit junctions, changes in grade, changes in alignment, and ends of curved sections. The use of prefabricated wye and tee connections shall be restricted for pipes less than 48" in diameter.

Pipe materials acceptable for installation as storm drains within El Paso County are: Reinforced Concrete Pipe (RCP), Reinforced Concrete Box (RCB), Corrugated Steel Pipe - Galvanized (CSP), Aluminized Corrugated Steel Pipe - Type 2 (ACSP), Ribbed Polyvinyl Chloride Pipe (RPVC), Smooth Wall Polyvinyl Chloride (SPVC), Profile Wall Polyethylene Pipe (PWPE) and Corrugated Polyethylene Pipe (CPE).

Culverts

Culverts shall be designed to pass the 10-year runoff and 100-year flood in accordance with the EPC Table 6.4 for Allowable culvert overtopping and EPC Table 6.5 for allowable culvert headwater depths for Design flows. Adequate embankment projection must be provided to prevent the roadway from eroding in cases were runoff is allowed to overtop certain roadway classifications. It is recommended that a minimum velocity of 2.5 feet per second at the design flow be maintained in all drainage structures to prevent siltation.

Hydraulic Evaluation of Streets, Inlets and Storm Sewers

Hydraulic evaluation of the Storm sewer systems are required to show drainage criteria. Storm StormCAD V8i, a modeling program (or equivalent program approved by EPC) shall be utilized in the evaluation of the hydraulic grade lines and energy grade lines within the storm sewer network. Manhole and pipe losses for the models should be obtained from the Modeling Hydraulic and Energy Gradients in Storm Sewers: A Comparison of Computation Methods, by AMEC Earth & Environmental, Inc. Street and inlet capacities will be need to be evaluated; this will likely be accomplished using the Mile High Flood District's (MHFD) spreadsheet UD_Inlet (current version).

Allowable Clearance for Bridges and Other Major Drainageway Crossings

If bridge construction is required as a part of the development the EPC DCM states that all structures classified as a bridge shall not be overtopped. For clear span bridges, the minimum clearance between the bridge low chord and the water surface profile shall be a minimum of 2 feet for the 100-year design flow. For box culverts classified as bridges or culverts at major drainageways (100-year flows greater than 1500 cfs) adequate freeboard shall be provided for the passage of debris and should be no less than 2 feet.

Open Channels and Structures

There are five general types of concept channel improvements alternatives that are recommend for design at this stage in development process, although several additional concepts may be brought forward as development becomes finite and additional drainage analysis is preformed. They are Maintenance only, Natural Engineered Channels, and Engineered Channels.

Maintenance of Natural Channels

Once additional site inspections have been preformed (to evaluate the conditions of the existing channels onsite), and site development has been fully understood it is likely that many segments of the named and un-named tributaries may require little to no improvement even after increases in volume or have been considered. These portions of the channel would be classified as "Maintenance only" or protect in place. These reaches typical consist of small low flow channel that is connected to a wide floodplain. These areas provide excellent water quality due to infiltration being provided over a large area. These should likely fall within preservation areas. Maintenance may consist of minor dirt work, sculpting of established channels, installation of erosion control products and reseeding.

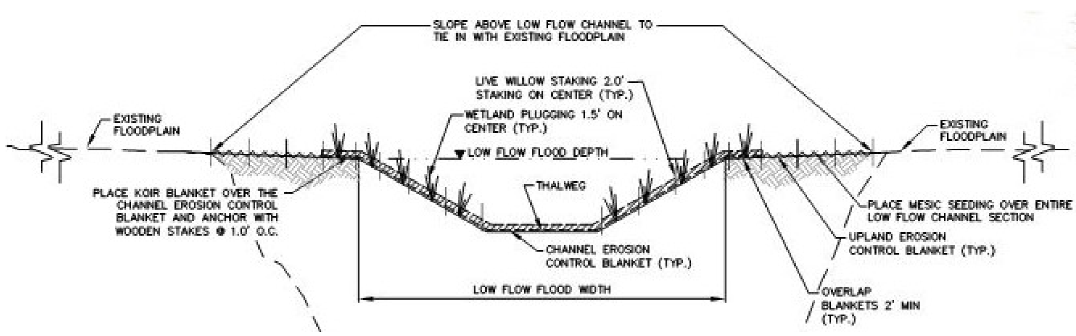


Figure 22. - Common Repair/Maintenance of Natural Channel

Grade Control Structures

To achieve the desired stable condition, grade control structures shall be proposed to mitigate steeper channel sections and function to stabilize the stream reach. Grade control structures in the SCRP consist of grouted boulder drop structures with a total drop height of 6 ft for the Engineered Channel Section and 4 ft for the Natural Engineered Channel Section. These are the maximum drop structure heights allowed by the DCM in constructed channels and constructed natural channel conditions respectively.

Natural Channels with Grade Control Structures

This reach alternative can be utilized where mild longitudinal slopes exist and where floodplain sheer stress can be withstood by the vegetation. These reaches possess excellent water quality due to the large infiltration areas located within the floodplain. Grade control structures would be utilized to achieve the desired channel grade. A cross section and profile are provided below.

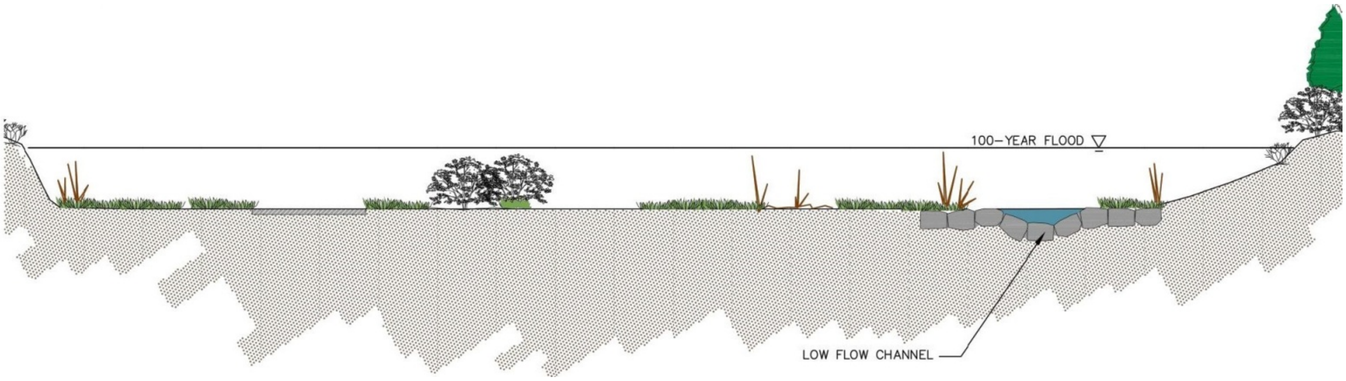


Figure 23. - Natural Channel with Grade Control Structure - Cross Section

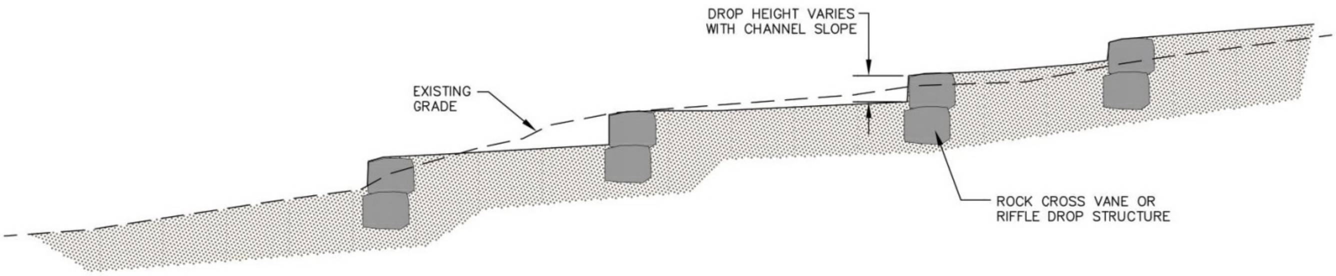


Figure 24. - Natural Channel with Grade Control Structure - Profile

Engineered Channels with Small Drop Structures

This reach alternative hardens the lower portion of side slope of the channel cross and relies on smaller 3 foot or less drop structure to maintain the desired channel grade. Typical drop structure spacing would be limited to 100 ft.

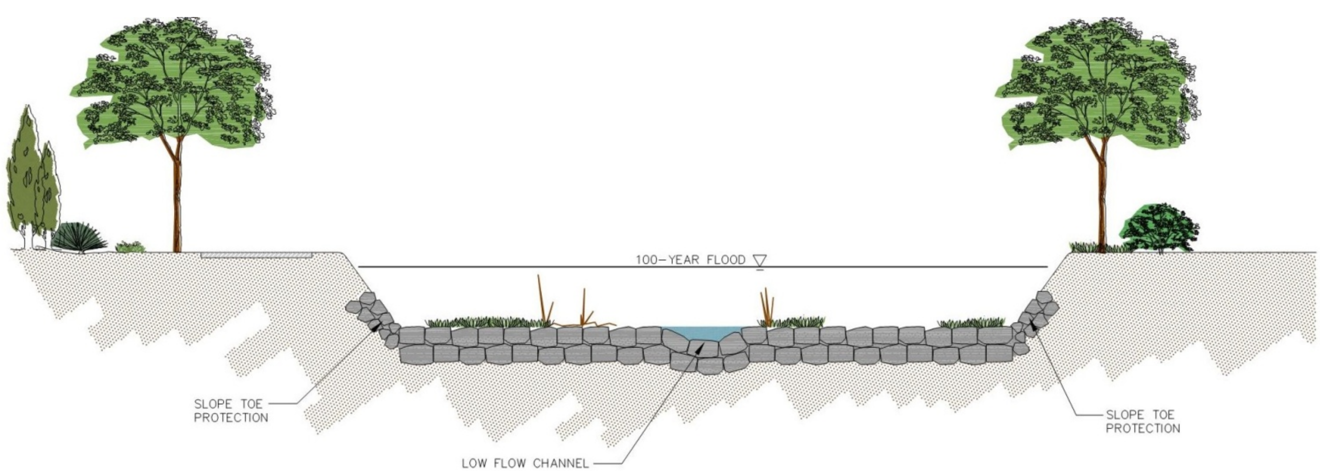


Figure 25. – Engineered Channel with Small Drop Channel - Cross Section

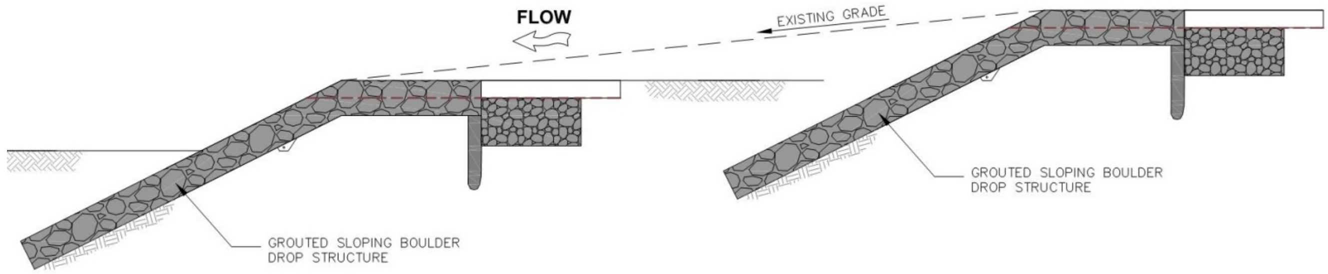


Figure 26. - Engineered Channel with Small Drop Channel - Profile

Engineered Channels with Large Drop Structures

This reach alternative hardens the lower portion of side slope of the channel cross and relies on a 3 feet to 6 feet tall drop structure to maintain the desired channel grade. Typical drop structure spacing should likely be 200 ft or greater.

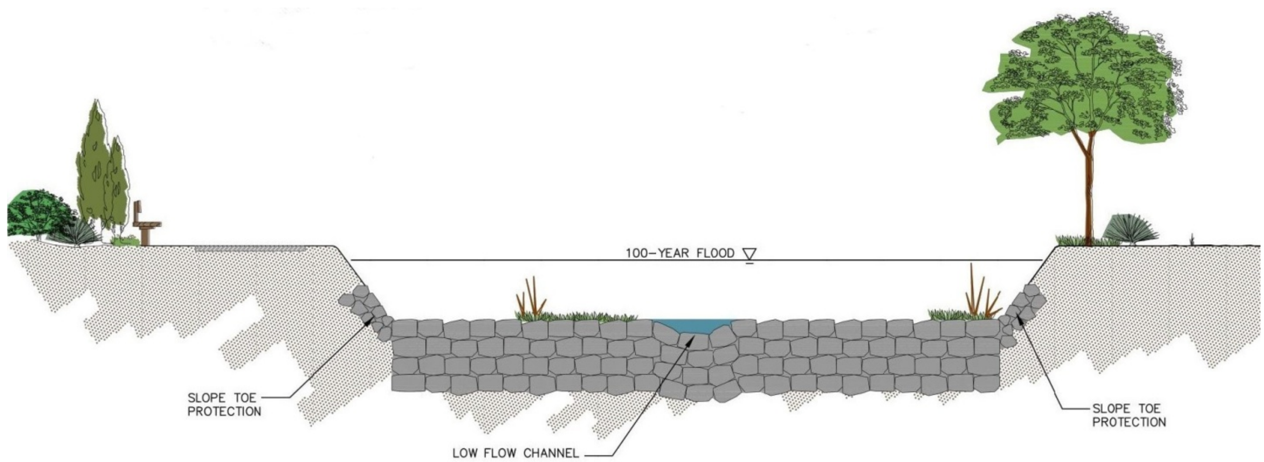


Figure 27. - Engineered Channel with Large Drop Channel - Cross Section

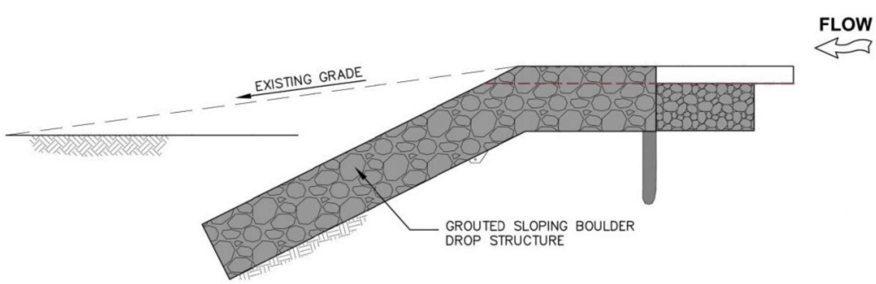


Figure 28. - Engineered Channel with Large Drop Channel - Profile

Fully-Lined Channels

This reach alternative involves lining a portion of the channel cross section with riprap for the full length of the reach. Riprap placed within the channel should be sized to hand the shear stresses from the 100-year event. Fully lined channels would only be required where large drop structures are not suitable due to channel width or spacing constraints.   A representative cross section and profile of a fully lined channel is provided below.

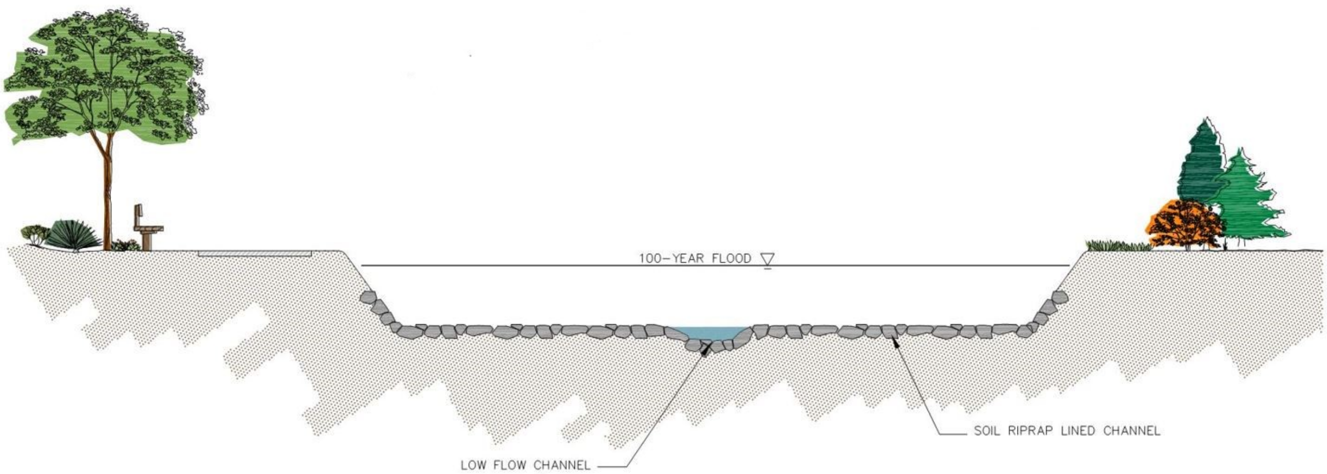


Figure 29. - Fully Lined Channel – Section

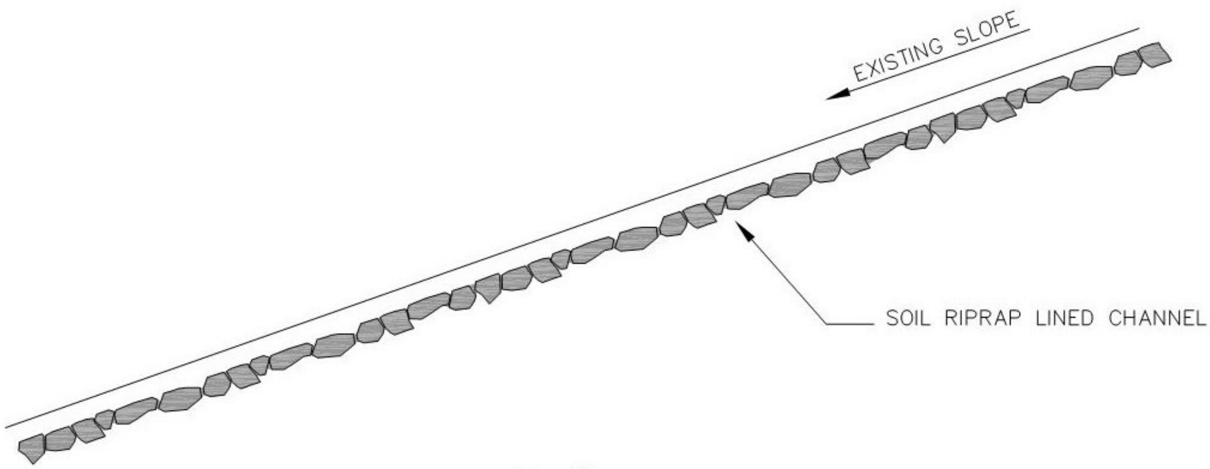


Figure 30. - Fully Lined Channel - Profile

Bank Stabilization Options

Additional bank stabilization may need to be provided to protect critical infrastructure where additional channel improvements are not proposed. In general, these improvements would be needed on outside bends where shear stresses induce bank erosion and lateral channel migration.

Bank stabilization shoud consist of one or more of the following techniques specified in the DCM;

- Reduction of Bank Slopes: Reducing banks slopes to 6H:1V or flatter in locations with sufficient right-of-way (ROW) and channel width will assist with vegetation establishment and overall stability. Steeper slopes may be required where site constraints do not allow for shallower slopes, with a maximum of 3H:1V being allowed with appropriate slope protection. This option would also involve revegetation to stabilize regraded banks.

- Riprap/Boulder Protection: Large riprap or boulder bank protection can be used at locations where ROW conditions limit shallower bank slopes. Riprap or boulder protection should be designed using the tractive force method and as defined in the DCM. Riprap bank protection may also be designed to be buried and re-vegetated to improve channel aesthetics.
- Bioengineered Bank: In limited places where establishment of vegetation is feasible, bioengineered channel banks can provide stability with a more natural look and feel than other armoring techniques. This option would involve use of surface stabilization measures

Due to the complexity of open channels, there are a wide range of design options available. An initial meeting with the Army Corp of Engineers is recommended, as well as a preliminary meeting with the EPC staff. Some additional criteria for the development of open channels are a follows:

Channel Depths

Channel depth should typically not exceed 5.0' at the 100-year storm when the 100-year flow is approximately 1500 cfs or less. Excessive depths should be avoided to minimize high velocities and for other public safety considerations.

Channel Side Slopes

Maximum side slopes permissible for grass lined channels is 4H:1V. Trapezoidal channels lined with concrete grouted riprap, or soil cement shall have maximum side slopes of 2H:1V. Existing channels with ROW restrictions and channels flowing under bridge abutments may have steeper side slopes as approved by the City/County. Loose riprap lined channels shall have a maximum side slope of 2.5H:1V. Additional freeboard is required on the outside bank of curved channels for superelevation.

Channel Maintenance and Access Roads

All open channels shall have a minimum 15 foot wide maintenance road parallel and adjacent to the channel. 15 foot wide access roads shall also be provided to major drainage way structures to provide public maintenance as determined by the City/County. Adequate access easements should be provided.

Channel Bottom Widths

Open channels with narrow bottoms are difficult to maintain and can be subjected to high flow velocities during periods of excess runoff. It is desirable to design open channels such that the bottom width is at least twice the design flow depth, but not less than eight (8) feet for channels conveying more than 400 cfs.

Low Flow Channels

Channel low flows, including base flows, from urban areas must be given special attention. If erosion of the bottom of the channel appears to be a potential problem, low flows shall be carried in a riprapped or concrete lined channel which generally has a minimum conveyance capacity of a 10-year duration storm. A minimum conveyance capacity of down to

10% of the 100 year storm event may be allowed if overbank conditions and scour velocities permit or only as otherwise approved by the City/County Engineer.

Channel Freeboard

In open channel flow, problems have been encountered with maintaining the flow within the designed channel, i.e., the flow overtops the channel lining, resulting in serious erosion problems and possible failure. Many of these problems can be prevented when design consideration superelevation and freeboard. For smaller channels, the freeboard is often sufficient to account for centrifugal forces and superelevation need not be considered.

The following formula shall be used to estimate freeboard. The height of freeboard shall be a minimum of one (1) foot. Freeboard (in feet) = $1.0 + 0.025(v)(d_{0.33})$.

Setbacks Adjacent to Channels

Portions of the subject property are characterized by intermittent and perennial streams which may provide significant wildlife habitat and riparian vegetation. When coupled with development, consideration needs to be given to the development and maintenance of property adjacent to stream corridors in a manner that is compatible with the environmental conditions, constraints, and character of the area. In addition ensuring development is safe distance from floodwaters.

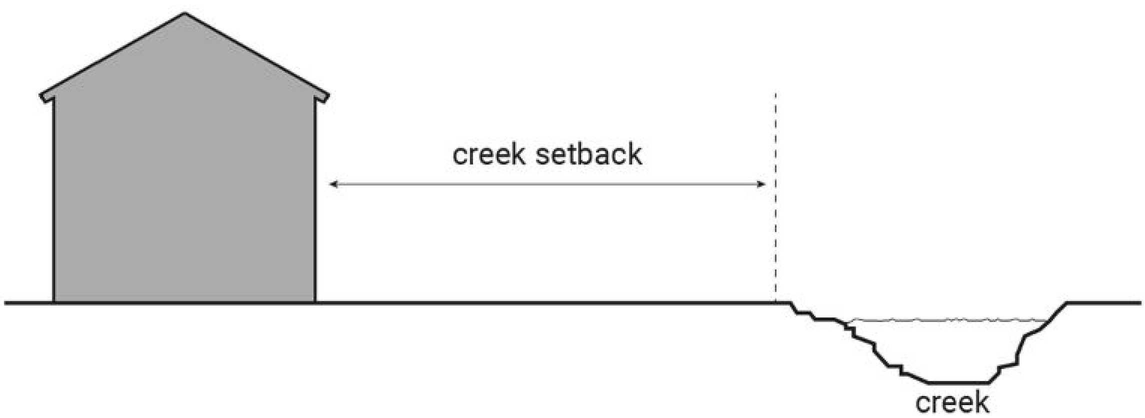


Figure 31. – Development Setbacks

Although less desirable in industrial use corridors than residential developments potential consideration should be given to;

- Identifying significant natural features and incorporate into site design
- Minimize wildlife impact.
- Where feasible provide recreational opportunities and connectivity within the community.
- Protect development from flood damage
- Inclusion of other planning documents by creating complementary plans
- Implement riparian buffers and limiting impervious surfaces

- Utilizing landscaping techniques that are cohesive with the surroundings
- Provide suitable revegetation and provide streambank stabilization

Implementation of similar development requirements and provisions will have a considerable impact on how development occurs within the site and how that relates to the conveyance, treatment and storage and discharge of stormwater runoff. Additional discussion regarding this matter is anticipated with the next phase of the planning and drainage studies.

Types of Proposed Detention

Detention storage facilities manage stormwater quantity by attenuating peak flows during flood events. They can also enhance stormwater quality by promoting sedimentation, infiltration, and biological uptake. In addition, they are necessary when it comes to growth as Colorado law requires detention be provided to control the 100-year peak flow for all new development in the unincorporated portions of all counties, and most incorporated municipalities in Colorado require the same. EPC guidelines require that detention facilities will be provided for all new development sites larger than 1 acre unless an approved basin plan includes the site being developed.

There are three basic approaches for locating storage facilities in relation to their upstream watersheds. These are:

- Regional Detention
- Sub-regional Detention
- Onsite Detention

Regional Detention

Regional detention facilities typically require less total land area and are more cost effective to construct and maintain than on-site facilities. These large scale facilities may also provide more favorable riparian habitat and offer greater opportunities for combining park and open space with shared use corridors. These systems can be favorable and may be needed upstream of existing facilities with capacity limitations or upstream of natural channel where preservation is anticipated.

Sub-Regional Detention

Sub-regional detention generally refers to facilities that serve multiple landowners or lots and have a total watershed of less than 130 acres. These facilities generally are located offline of major drainageways, but often discharge to minor drainages. These are commonly implemented to provide detention and water quality treatment for large scale commercial and industrial parks.

Onsite Detention

Onsite detention refers to facilities serving one lot, generally commercial or industrial sites draining areas less than 30 acres. On-site facilities are usually designed to control runoff from a single land development site.

Figure 32. - Full Spectrum Extended Detention Basin

Full Spectrum Detention

Roofs, streets, parking lots, sidewalks, and other impervious surfaces increase peak flows, frequency of runoff and total volume of stormwater surface runoff when compared to pre-development conditions. This increase is most pronounced for the smaller, more frequent storms and can result in stream degradation and water quality impacts as well as flooding during the large events.

Criteria for stormwater detention design has evolved from a focus on the minor and major events to an approach shown to better control peak flows for a wide range or “full spectrum” of events. The common recommended concept plan for the storage of urbanized runoff within the SCRP is to provide full section detention basins.

The intent of full spectrum detention is to reduce the flooding and stream degradation impacts associated with urban development by controlling peak flows in the stream across all storm events. Although full spectrum detention is expected to mitigate increases in peak flow rates and runoff volumes for the full range of runoff events, it is not anticipated to eliminate the need for channel stabilization downstream.

Hydraulic Criteria Mile High Flood District’s MHFD-Detention, Version 4.03 workbook will typically be required for pond sizing. The required detention volumes and allowable release rates, outlets and spillways, shall be designed per USDCM and CCS/EPCDCM criteria.

Types of Best Management Practices that implement Full Spectrum Detention

There are several types of BMPs that implement full spectrum Detention these are the most commonly used in El Paso County.

- Extended detention basins
- Retention ponds
- Constructed wetland ponds
- Sand filters
- Rain gardens (bio-retention)

Extended Detention Basin

An extended detention basin (EDB) is a sedimentation basin designed to detain stormwater for many hours after storm runoff ends. This BMP is similar to a detention basin used for flood control, however; the EDB uses a much smaller outlet that extends the emptying time of the more frequently occurring runoff events to facilitate pollutant removal. EDBs are well suited for watersheds with at least five impervious acres up to approximately one square mile of watershed. A copy of a typical plan and profile for an EDB is shown below.

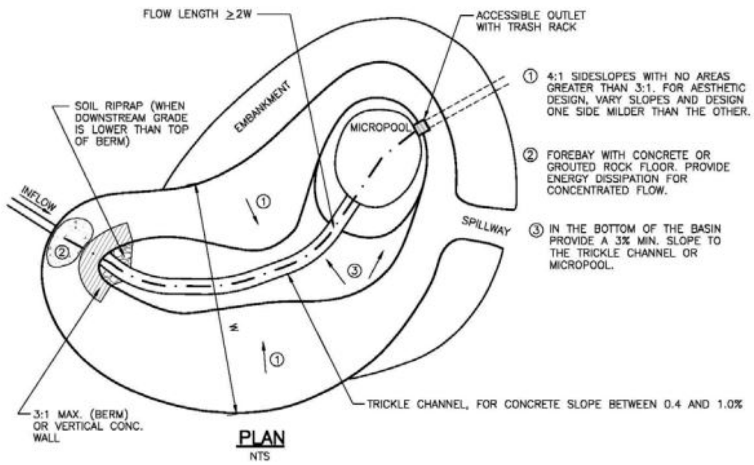


Figure 33. - Extended Detention Basin – Plan

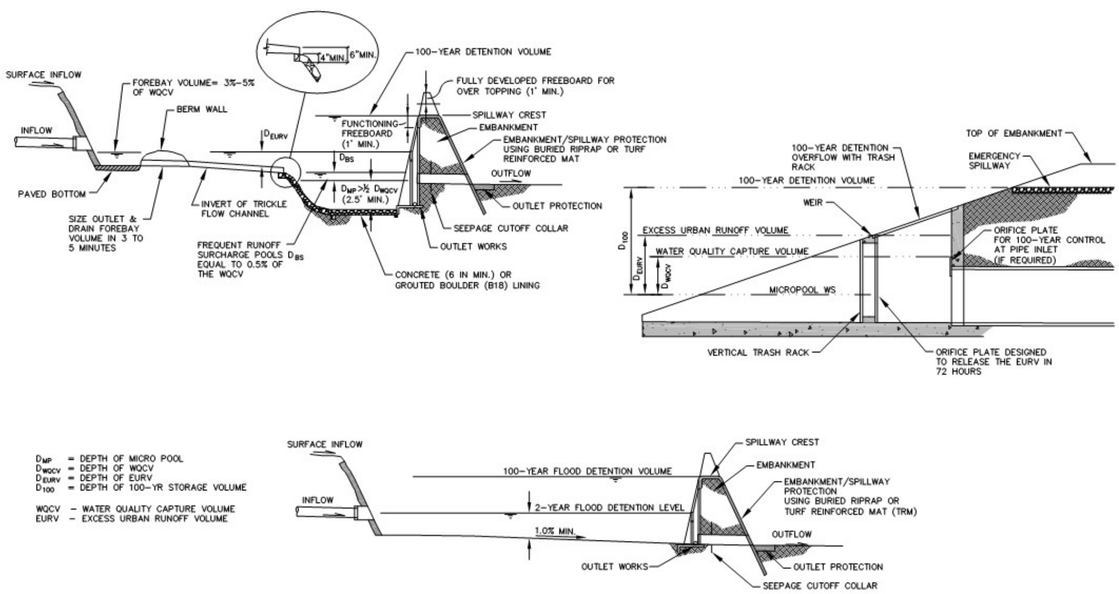


Figure 34. - Extended Detention Basin – Cross Section and Outlet Works

Four Step Process

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

The Four Step Process is summarized as follows:

Step 1: Reduce runoff by disconnecting impervious area, eliminating "unnecessary" impervious area and encouraging infiltration into soils that are suitable.

Step 2: Treat and slowly release the WQCV.

Step 3: Stabilize stream channels.

Step 4: Implement source controls.

Implementation of these four steps helps to achieve stormwater permit requirements. Added benefits of implementing the complete process can include improved site aesthetics through functional landscaping features that also provide water quality benefits. Additionally, runoff reduction can decrease required storage volumes, increasing developable land and reduce the size of downstream facilities.

El Paso County – Stormwater Drainage Facilities Maintenance Policies

Per the EPC DCM, El Paso County will not maintain any detention pond or basin created for on-site detention or water quality purposes unless responsibility for such maintenance has been accepted by El Paso County through the appropriate processes. If such responsibility is not accepted by El Paso County, it remains with the property owners or their agents.

Acceptance of maintenance responsibility by El Paso County for detention ponds or basins will only be considered when the following criteria are met:

- the detention pond or basin must be identified in a master drainage plan as a public facility serving more than a single property owner as a critical feature for the public drainage system for the attenuation of flood events incorporating the water quality features meeting the requirements of the ECM and the DCM Vol.2;
- the detention pond or basin must be included within an dedicated public easement or tract in which El Paso County has been identified as the agent responsible for maintenance;
- the detention pond or basin must have a storage volume in excess of fifteen (15) acre feet; and
- any structure must meet the jurisdictional dam requirements as stated by the Colorado State Dam Safety Inspector.

Detention basin maintenance agreements and easements must be approved in conjunction with El Paso County acceptance of maintenance responsibilities. Such documents shall clearly define the responsibilities of both El Paso County and private property owners or private entities related to long-term maintenance. Such documents shall also provide that in the event that property owners fail to fulfill their maintenance obligations, El Paso County may perform the required work and then seek to recover its costs.

Roads, Rights of Way, and Drainage Easements

Per the EPC DCM, El Paso County is responsible for the maintenance of all roads and rights-of-way which have been accepted as public roads by El Paso County through the appropriate process. In addition, El Paso County is responsible for maintenance of all drainage easements when such responsibility has been duly accepted by El Paso County through a Subdivision Plat or Improvement Agreement.

Rural roads are generally constructed with roadside ditches which are intended to carry runoff from the road right-of-way but are not designed or intended to convey runoff from adjacent property.

With respect to rural roads and easements for which El Paso County has accepted responsibility, El Paso County shall be responsible for the following:

- performing required drainage maintenance within the right-of-way or easement;
- removing accumulated sediment and trash from roadside ditches;
- cleaning, maintenance and repair of cross culverts within the roadway; and
- removing sediment from ditch out locations within the right-of-way.

El Paso County is not responsible for removing sediment from private lands.

With respect to rural roads, adjacent property owners shall be responsible for cleaning, repairing and maintaining driveway culverts and the ditch line within ten (10) feet of both the inlet and outlet ends of each culvert.

- The duties imposed on property owners pursuant to this paragraph 3 shall be temporarily assumed by El Paso County only when and for the period during which El Paso County is fully rebuilding the roadway resulting in a significant change of road geometry or grade adjustments.

Urban roads are generally constructed to include curb, gutter and storm drainage systems which are designed to carry the runoff from the road right-of-way, and which may also be designed to convey a defined amount of runoff from adjacent property as identified in filed subdivision drainage reports.

With respect to urban roads and easements for which El Paso County has accepted responsibility, El Paso County shall be responsible for the following:

- maintenance, repair and rehabilitation related to streets and highway maintenance;
- cleaning, maintenance and repair of storm drains and drainage channels;
- removal of sediment accumulations; and
- street sweeping.

Railroad System Drainage and Considerations for Future Development

Track or railway drainage is a fundament aspect of railway design as it directly affects performance, maintenance and safety. It often starts by limiting the drainage that reaches the rail yards and railways.

Figure 35. – Railroad Tracks that Diverge

The focus then shifts to collecting the runoff that occurs on or near track. These flows must be safely conveyed out from under heavily loaded rails systems to other off track areas. Finally, it ends with the collection of off track runoff and the conveyance of all flows to drainage facilities where water quality treatment and volume reduction can occur.

Limiting the Drainage that Reaches the Railyard.

Rail yards are made up of network of tracks often for sorting, loading and unloading of stock. They often consist of several components; yards, terminals, service facilities, stations and roundhouses. Uncontrolled runoff can degrade the safety and functionally of the facilities, thus it is imperative to limit the quantity of runoff allowed to reach the site in the early stages of development. An intrinsic benefit to lessening the runoff reaching the yard is the need for smaller onsite collection and conveyances systems. This can result in considerable cost savings by eliminating the need for expensive rail crossings and limiting utility conflicts.

Limiting the Drainage that Reaches the Track

Rails travel for several miles outside confines of the yards. Similar to onsite practices when outside of the railyard, positive drainage away from the track from other developments and intermittent construction must be maintained in order to avoid saturation of the track embankment or deposition of silts into the track ballast. In addition to safety issues, ponding runoff can lead to unwanted vegetation stands which can harbor wildlife and vermin.

Other Considerations for Railway Drainage

Drainage of the track bed (On-track drainage), is where often catch basins and collection systems are used to intercept drainage found directly underneath and/or adjacent to the running rail. It's in these areas where high active loads are transferred down thru soils to the collection systems. Special care should be taken to ensure that the installation methods and materializes utilized are in accordance with safe design practices.

Off-track drainage comprises areas outside of where active loads occur. The collection and conveyance of runoff within these areas can still be subject to considerable design constraints given they often fall within narrow corridors that are heavily loaded with utilities and possess relatively flat grades.

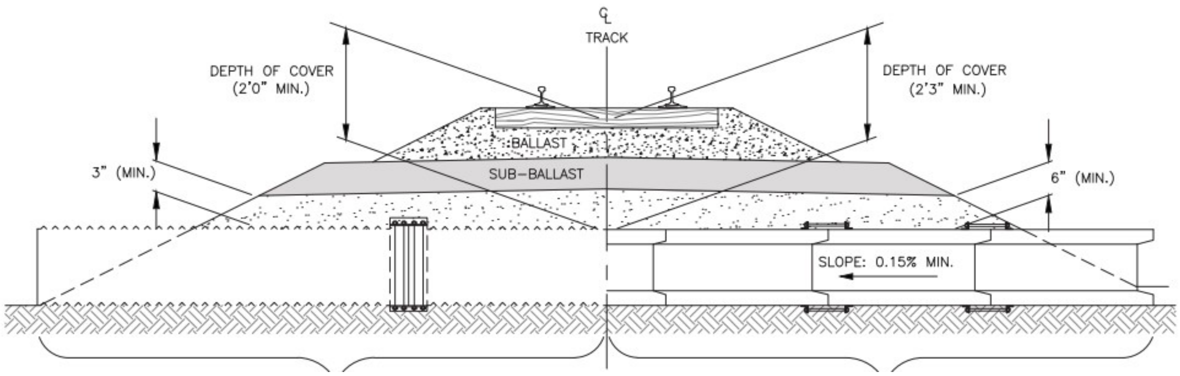


Figure 36. - Storm Drain under Rail Ballast

The requirements for the installation of subsurface drainage conveyances systems within railroads are not one size fits all. Criteria for the design of railroad drainage is often more stringent then the local drainage criteria. The engineer shall evaluate whether criteria by FHWA, FEMA, the city, the county, the reclamation board, the flood control district, or the local FEMA floodplain administrator, or other regional or local jurisdictional limits apply. As railroad companies are private companies and have their own guidelines and policies. When working on a rail-related project, early coordination with appropriate railroad representatives is encouraged.

Undeveloped Area within the Little Fountain Creek Drainage Basin

The Little Fountain Creek Drainage Basin (LFCDB) is mostly undeveloped and can be viewed as five (5) segments of land use type. The most westerly headwaters of the Little Fountain Creek and Rock Creek, the primary tributaries drain the south slope of the Pikes Peak massive. Public lands predominate, including Pike National Forest, until just West of Colorado State Highway 115.

Along the Hwy 115 corridor are small tracks of land with individual lots or small subdivisions accessed by gravel roads. The land between Hwy 115 and the Southern Colorado Rail Project (SCRP) is Fort Carson. Rock Creek and Little Fountain Creek join on the SCRP property, and continue as Little Fountain Creek. The downstream end of the drainage basin is where Little Fountain Creek flows through Colorado Springs Utilities' Clear Springs Ranch and joins the Fountain Creek mainstem.

Significant future development within the basin is unlikely other than the SCRP project. As shown on the following page, 39.30% of the basin is within the Fort Carson Military Base and 45.62% of the area west of CO Hwy 115 (combined 82.92%) is unlikely to ever be developed or pay drainage fees. Some but only a minor amount of additional development could occur west of CO Hwy115.

The land east of the SCRP property could be developed following the development of SCRP due to the presence of future utility lines. However, the parcel to the east is owned by the City of Fountain, which is pursuing a water resource treatment operation on the bulk of that land.

In the total area of the LFCDB, other than the SCRP, minimal land remains for major development projects.

Potential Area for Future Development		
Area of SCRP land	Definite	8.27 %
Area of land East of Interstate 25	Minor	2.20 %
Area of land of the Fort Carson Military Base	Nill	39.30 %
Area of land west of CO State HWY 115	Minor	45.62 %
Area of land near Ray Nixon Power Plant (Area)	Nil	3.78 %
Area of land in the City of Fountain	Minor	0.83 %
Total Percentage of Minor or Nill Development Potential		91.73 %

Table 9 – Potential Area for Future Development

El Paso County Drainage Basin Policy

The general concept of the drainage basin policy is; that drainage facilities that are required for the proper and orderly drainage and control of storm and surface waters be installed as a condition to development of property to protect the health, property, safety and welfare of the citizens. That is normally accomplished by requiring every piece of land to be developed in the basin, to contribute a fair share amount of dollars for public drainage improvements, required for the same drainage basin.

The City of Colorado Springs and El Paso County administer the drainage basin funding program. Drainage and Bridge fees have been established for each drainage basin in El Paso County. The fees are based upon the perceived cost of improvements to be made, divided by the total acres of undeveloped land remaining in the basin. The fees are collected by the City or County and reimbursed to developers who construct those public improvements. The above is a very general outline of the policy and each drainage basin in El Paso County is uniquely different.

There is no drainage basin planning study for Little Fountain Creek. Therefore, there are no cataloged public drainage improvements identified to be constructed, repaired or paid for.

Closed Basin Justification

The Southern Colorado Rail Park is approximately 3,108 acres. The 2023 Drainage basin fee for the Little Fountain Creek Drainage Basin is $2,950 per impervious acre and $0.00 for Bridge fees. It is unknown how that fee amount for this drainage basin was derived or established without a drainage planning study which establishes needed drainage facilities. Based upon the proposed land use being Heavy, Light Industrial or Commercial, a general range for imperviousness could be; 0.80-0.93, and the estimated would be calculated as follows;

Conservatively; 3,108 acres x 0.93 imp. x $2,950 fee per imp. acre = $8,526,798

The drainage basin fees are adjusted for inflation each year, and / or if new information is provided to adjust the fees in any particular basin. Therefore, over time, development of the SCRP property would generate over $10 million in drainage fees when the land is platted. In a typical basin, these dollars would be collected and held to reimburse other developments / developers for the construction of public drainage improvements within the basin. The fees would also be used to reimburse SCRP for its construction of the public improvements.

The LFCDB is unique as it relates to the development of the SCRP property because of the balance of undevelopable land in the rest of the basin. AS explained above, approximately 90% of the land in the LFCDB will never be developed, will never install drainage facilities, and therefore will not be required to pay drainage fees and will not be expecting to be reimbursed from the basin fund. Therefore, it would be inefficient and inequitable to require the SCRP property to participate in and pay into the basin to provided funding for drainage improvements (which are undefined, uncertain and without any cost basins). There are no planned drainage improvements downstream from the SCRP land which are engineered to accommodate drainage flows from the SCRP land. Because Fort Carson will not be participating in the basin system, there is no need to collect drainage fees from any drainage improvements that might be installed by Fort Carson, even if they might benefit the SCRP land.

It does not take an entire drainage basin planning study to agree with the facts above. No matter how big the costs of public drainage improvements required in the drainage basin, there is not enough developable land paying drainage fees to afford the entire basin's needs. Most notably, Fort Carson Military Base would never pay any fees nor construct public improvements that would benefit the overall basin. Other than the SCRP project, no other piece of land of any considerable size will ever develop or pay fees. Therefore, "no one" else will be paying any fees to refund SCRP for the cost of public drainage improvements.

The development of the SCRP project should be exempt from paying drainage fees into the drainage basin fund. The SCRP project will construct all of its own necessary public improvements and be certain to not cause any negative drainage impacts downstream, which is the goal of the drainage basin system. The SCRP project will abide by all governmental agency criteria for drainage. The closed basis will require SCRP to engineer its drainage and build needed drainage improvements to insure that the SCPR parcel releases drainage flows at equal to or less than the historic rates. That will protect any users downstream from the SCRP land. The SCRP project shall not expect reimbursement from the LFCDB fund for drainage improvements installed by the SCRP project.

Not a correct assumption to not pay drainage fees if doing channel improvements. Improvements could be credited to drainage fees, if they we identified within the DBPS. As the DBPS does not, there is no mechanism to use as credits. A DBPS amendment could be done which would identify channel improvements as reimbursable items. DBPS amendment would have to go to the drainage board for approval.

What about fees for Fort Carson basin?

Further Study

As previously discussed, the next step in the process will be [illegible] of the watershed, quantify surface runoff, define floodplains, identify drainage impacts, develop alternate drainage solutions, and prepare a drainage master plan. The information developed by this subsequent study will be used to regulate future developments and mitigate the major drainageways within the watershed. As the site planning is currently infancy, this report provides only a high-level analysis and general development requirements and drainage criterion for the future development of the SCRP. As parcels develop within the SCRP project, further drainage analysis and engineering will be completed in conjunction with specific development plans to insure that the drainage received and released from the site is well engineered internally and so that flows from the site do not exceed historic flows.

Conclusion and Recommendations

The drainage summary provided herein has documented the general information, criteria, and concepts in support of The Southern Colorado Rail Park (SCRP) Sketch plan. Based upon the information gathered and provided herein the summary has;

- Discussed existing site conditions
- Discussed the common development infrastructure

- Provided information that shall be needed to further the subsequent drainage studies
- Provide and discussed drainage concepts that are in line with the Sketch Plan
- Provide relevant drainage criteria for El Paso County and other Federal, State and Local Agencies
- Provided drainage concepts to preserve, mitigate and develop drainageways
- Indentify methodologies for the analysis of waters within the Little Creek Drainage Basin
- Identify procedures and concepts that shall achieve water quality and meet stormwater permit requirements
- Identify that future development within the LFCDB seems unlikely other than the SCRP project
- Establish the justification for a 'Closed Basin'

By utilizing the information provided within this summary, and the criteria and methods established by the Federal, State and Local Agencies, the development of the Southern Park shall not negatively affect water quality or exceed the historic or predevelopment release rates, upon which downstream facilities have been development.

Include section discussing suitable outfall per ECM Section 3.2.4

References

1.) City of Colorado Springs Drainage Criteria Manual, Volume 1, March 2014, Revised January 2021.

2.) City of Colorado Springs Drainage Criteria Manual, Volume 2, prepared by Matrix Design Group/ Wright Water Engineers. March 2014, Revised December 2020.

3.) El Paso County Drainage Criteria Manual Volume 1, October 31st 2018.

4.) Urban Drainage and Flood Control District, Urban Storm Drainage Criteria Manual Volume 1 & 2 dated January 2016.

5.) Web Soil Survey, USDA NRCS Soils Map https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm accessed, September 2023

6.) FEMA flood Map Service Center, Federal Emergency Management Agency https://msc.fema.gov/portal/home accessed September 2023.

7.) USGS. Guide for Selecting Manning's Roughness Coefficients. (WSP 2339)

8.) El Paso County Parks Master Plan, prepared by El Paso County, June 2013

9.) Colorado Water Conservation Board. 2004. Guidelines for Determining 100-year Flood Flows for Approximate Floodplains in Colorado, Version 6.0. Prepared in cooperation with the Colorado Flood Hydrology Advisory Committee. U.S. Geological Society and U.S. Department of the Interior. 2000.

10.) Analysis of the Magnitude and Frequency of Floods in Colorado. Water-Resources Investigations Report 99-4190. Prepared in cooperation with the Colorado Department of Transportation and the Bureau of Land Management. Federal Emergency Management Agency. 1999.

11.) Applied River Morphology, by Rosgen, Dave. 1996.

12.) Soil Conservation Service, 1963. Guide for Selecting Roughness Coefficient "n" Values For Channels.

13.) USGS. Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Floodplains (WSP 2339) City of Colorado Springs. 1990 (Rev. 1994).

14.) Procedures for Determining Peak Flows in Colorado: Incorporates and Supplements Technical Release No. 55 Urban Hydrology for Small Watersheds. CDOW. 1998.

15.) Riparian and Vegetation Data. Colorado Division of Wildlife, Denver, Colorado. ESRI ArcGIS feature files downloaded from: http://ndis.nrel.colostate.edu/ftp/ftp_response.asp CVCP. 2003.

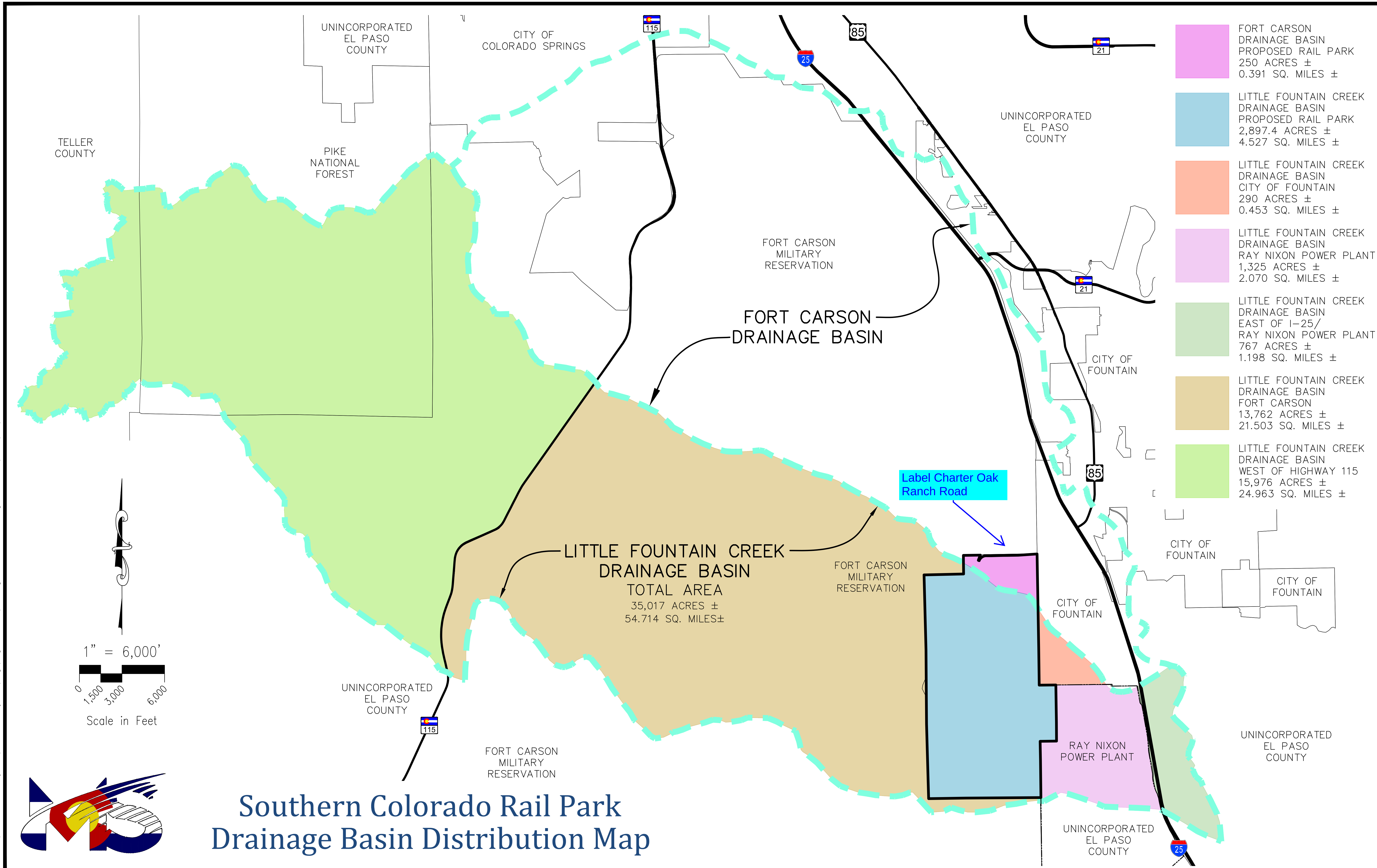
16.) HEC-RAS River Analysis System Hydraulic Reference Manual.

17.) HEC-HMS Hydrologic Modeling System Reference Manual.

SOUTHERN COLORADO RAIL PARK
EL PASO COUNTY, COLORADO
CONCEPTUAL DRAINAGE SUMMARY

APPENDICIES

SCRP Drainage Basin Distribution Map
Little Fountain Creek Drainage Basin Aerial
SCRP Drainage Basin Map w/ USGS Overlay
SCRP & Little Fountain Creek Drainage Basin Soils Map
Natural Channel-Common Repair
Natural Channel with Grade Control Structures
Engineered Channel with Small Drop Structures with Toe Protection
Engineered Channel with Large Drop Structure with Toe Protection
Fully-Lined Channel
Common Detention Pond Details
SCRP Flood Insurance Rate Map (FIRM)
SCRP Sketch Plan



Southern Colorado Rail Park Drainage Basin Distribution Map

Little Fountain Creek Drainage Basin Aerial

1" = 6,000'

0 1,500 3,000 6,000

Scale in Feet

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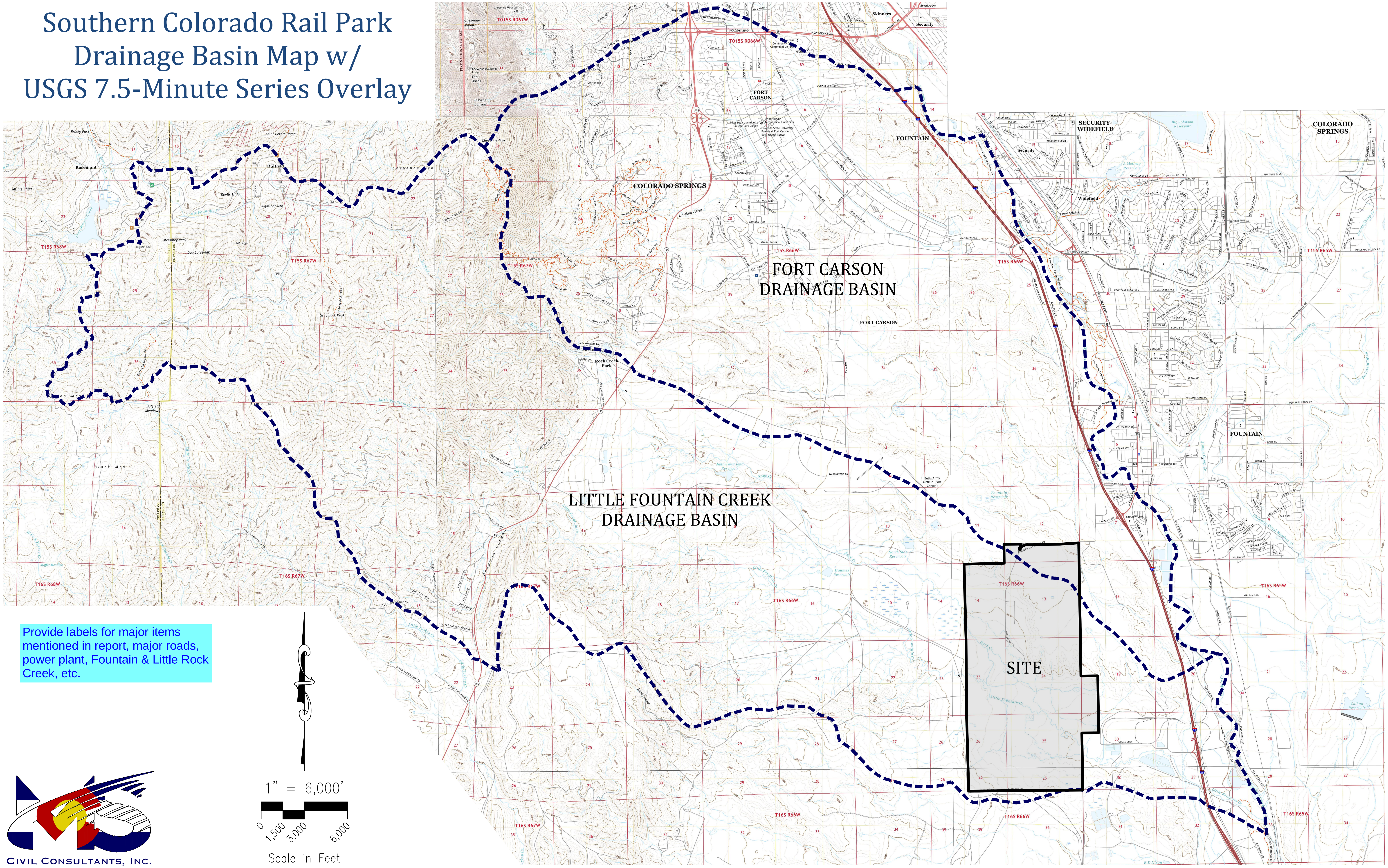
Southern Colorado Rail Park
Drainage Basin Map w/
USGS 7.5-Minute Series Overlay



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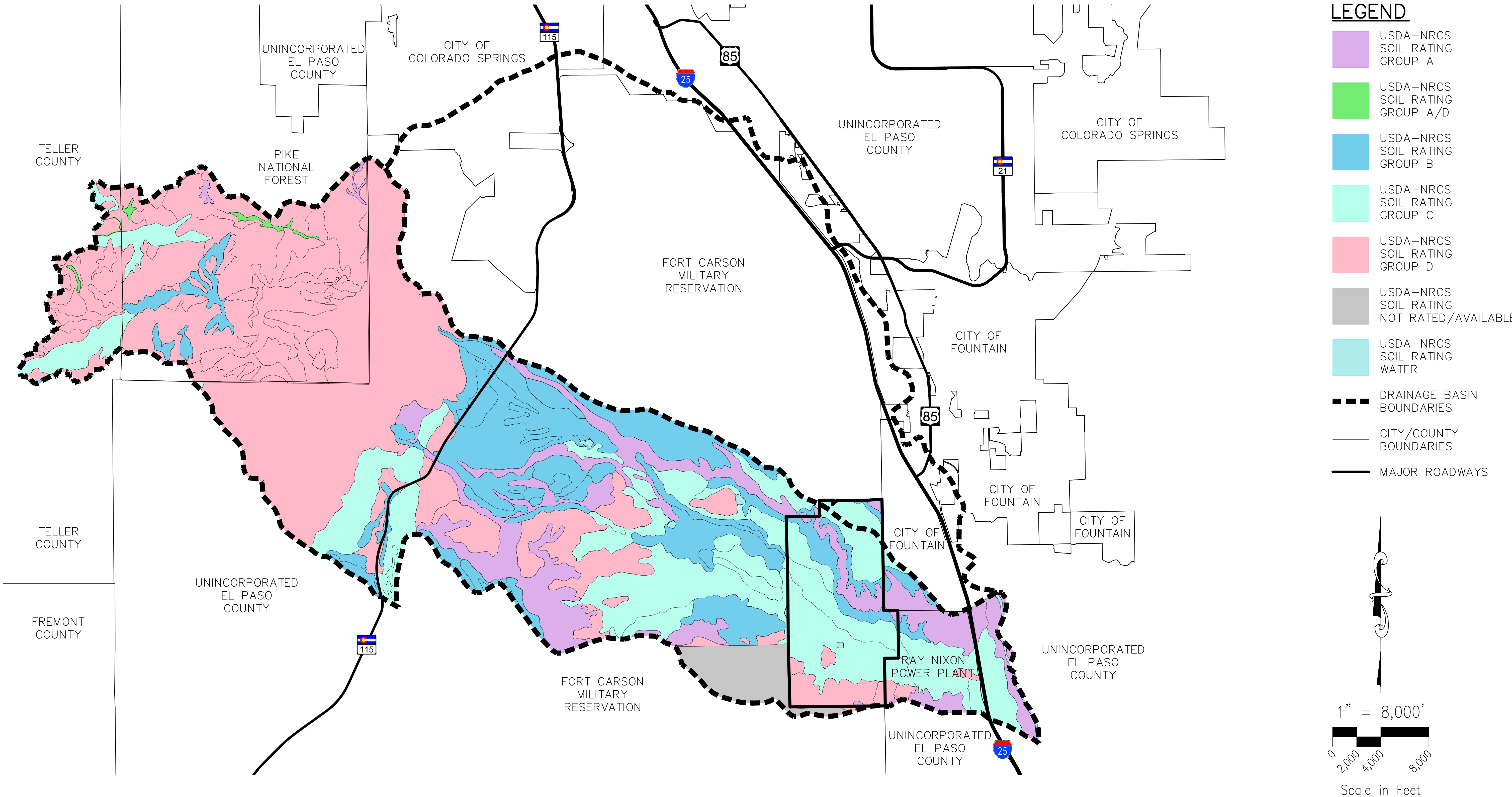

Southern Colorado Rail Park & Little Fountain Creek Drainage Basin Soils Map

Provide something similar to second page of sketch plan, with general flow arrows to show how the site drains. No flows or smaller basins need to be defined, just a general overall concept of what areas go to which creeks, detention areas, etc.

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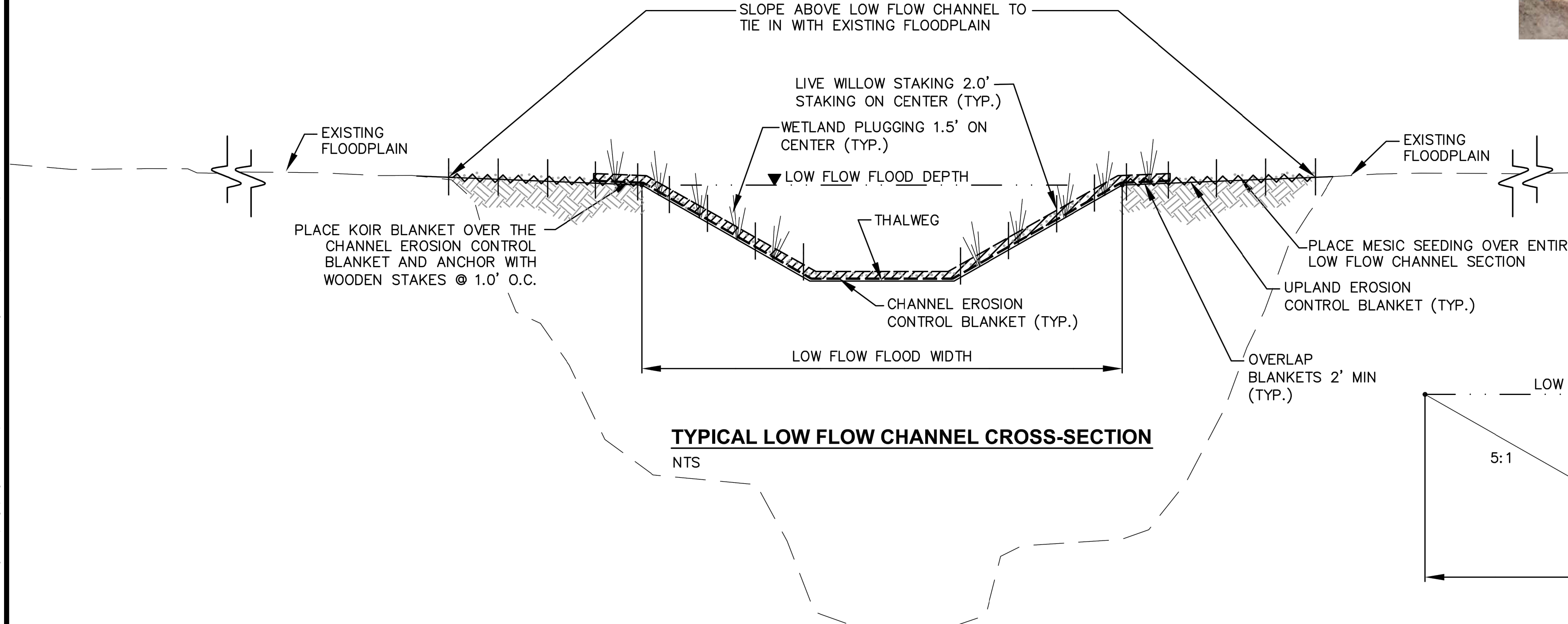
BEFORE NATURAL CHANNEL CONSTRUCTION

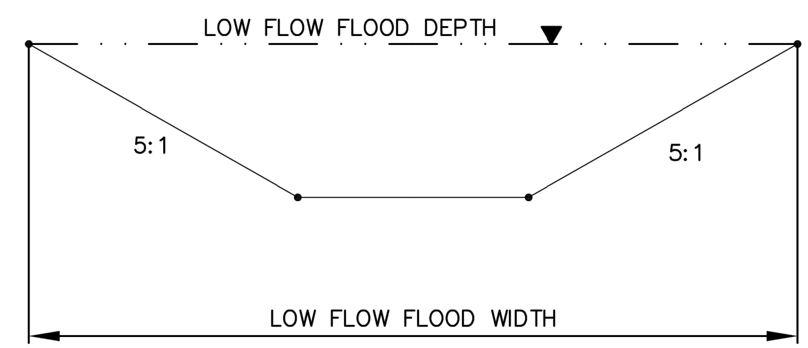
AFTER NATURAL CHANNEL CONSTRUCTION



TYPICAL LOW FLOW CHANNEL CROSS-SECTION

NTS

Section



TYPICAL LOW FLOW FLOOD CROSS-SECTION

NTS

Natural Channel - Common Repair

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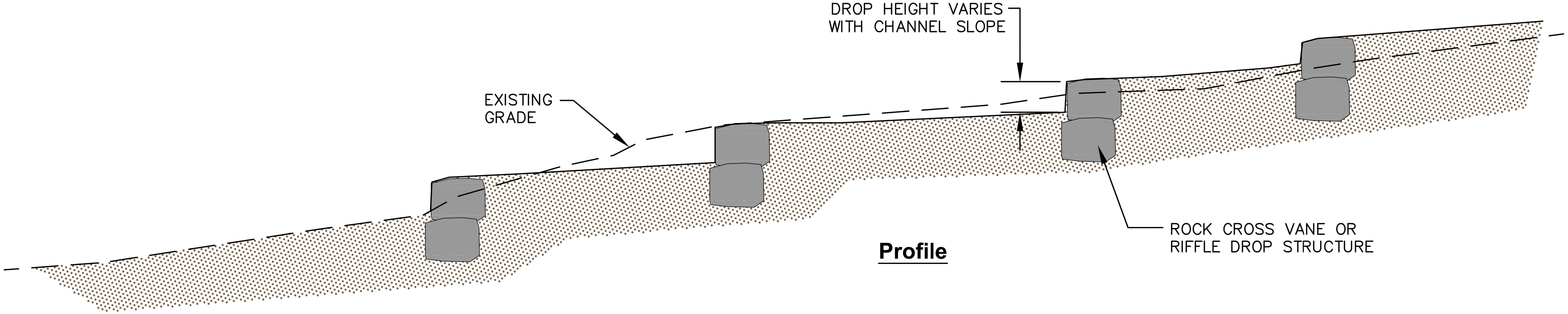

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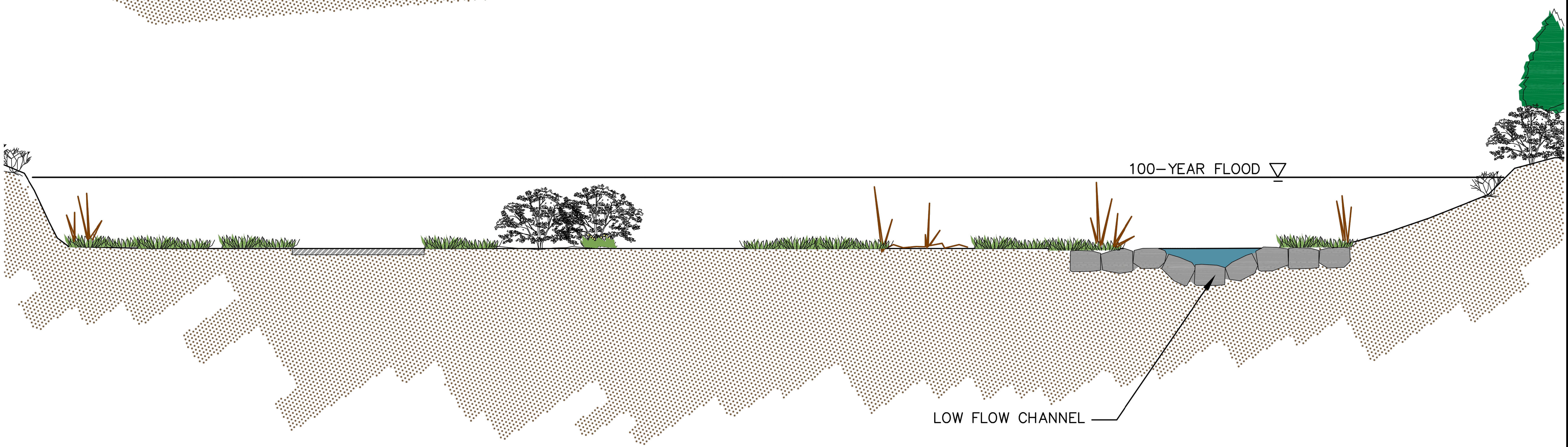

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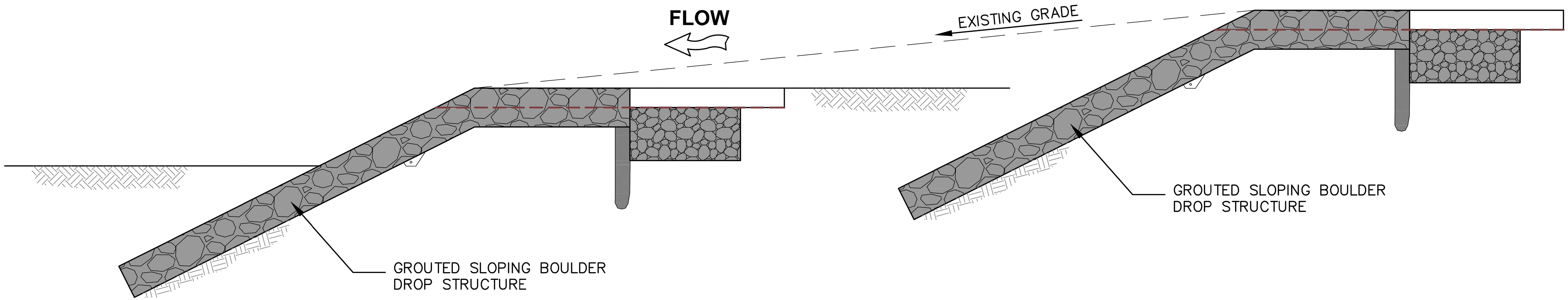
Natural Channel with Grade Control Structures



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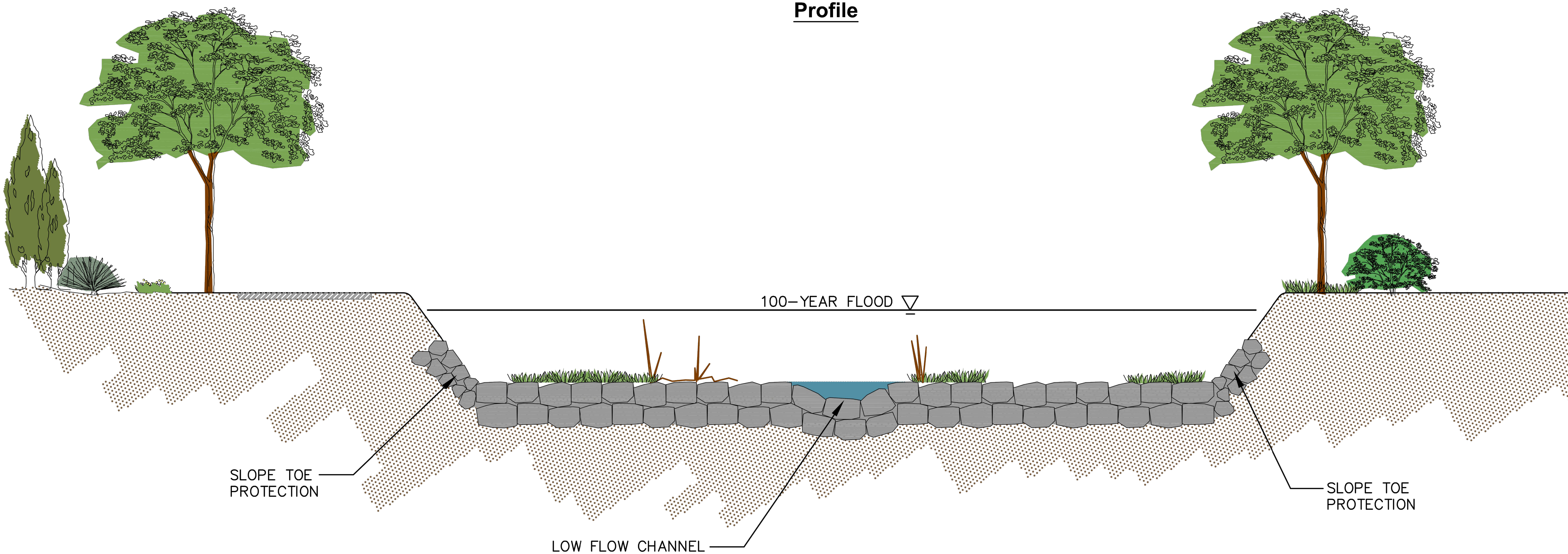

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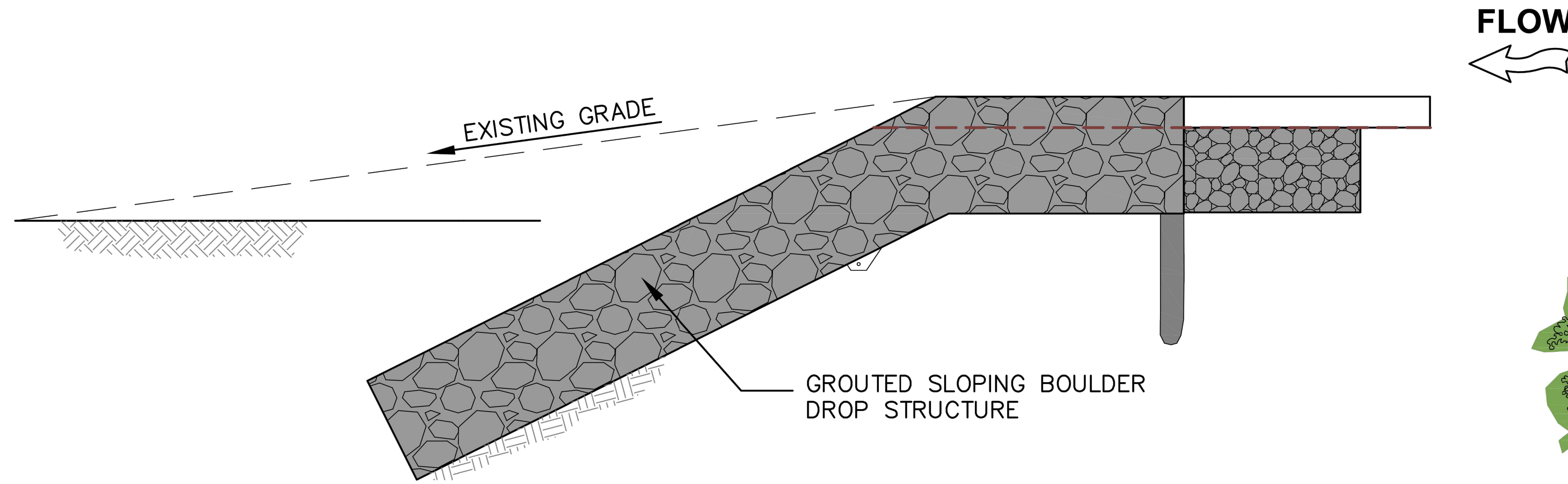
Engineered Channel with Small Drop Structures and Toe Protection



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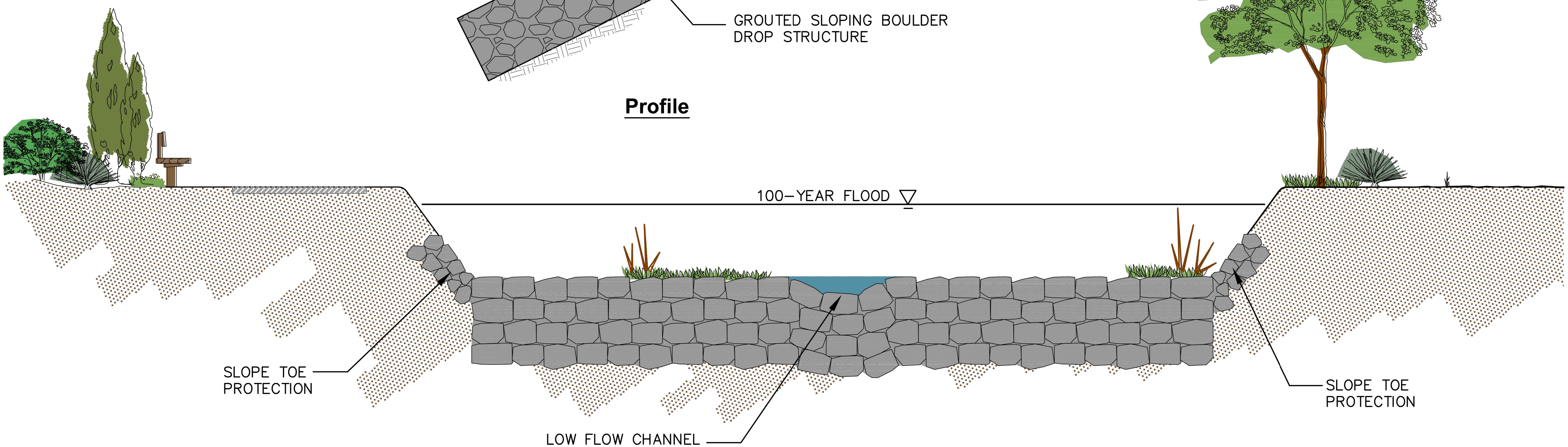

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Engineered Channel with Large Drop Structures and Toe Protection

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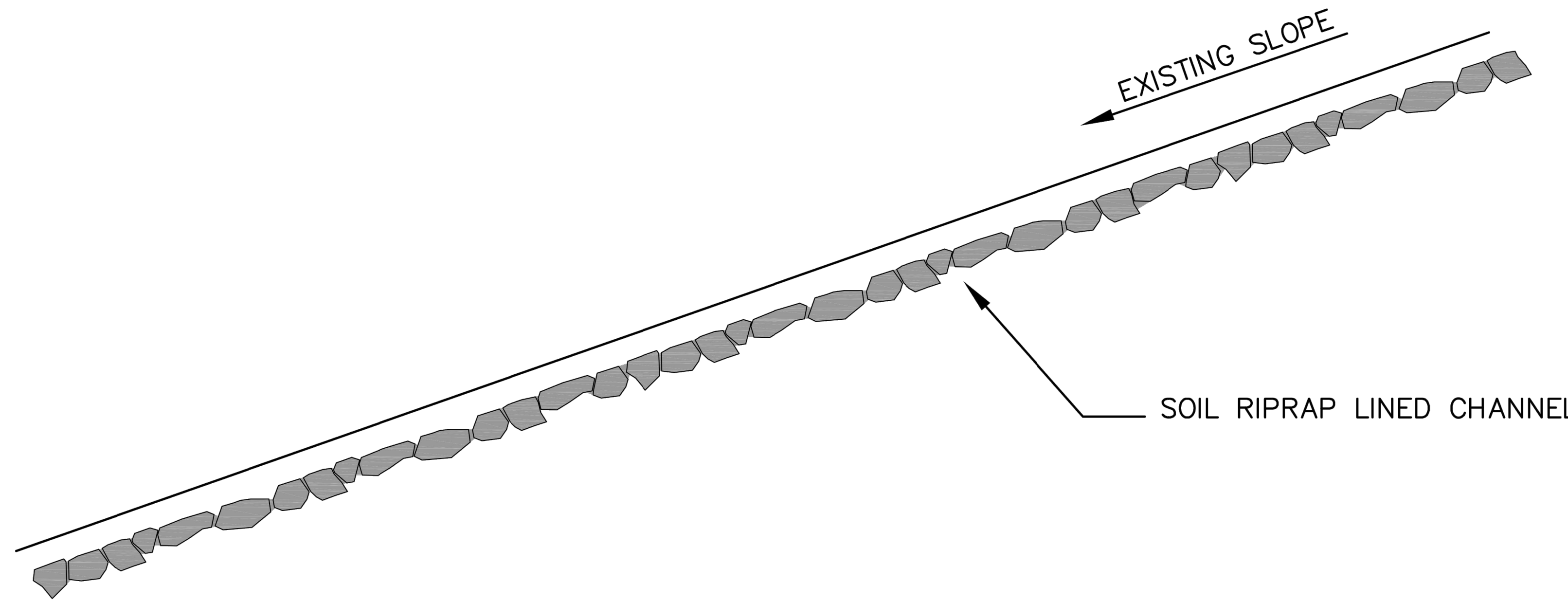

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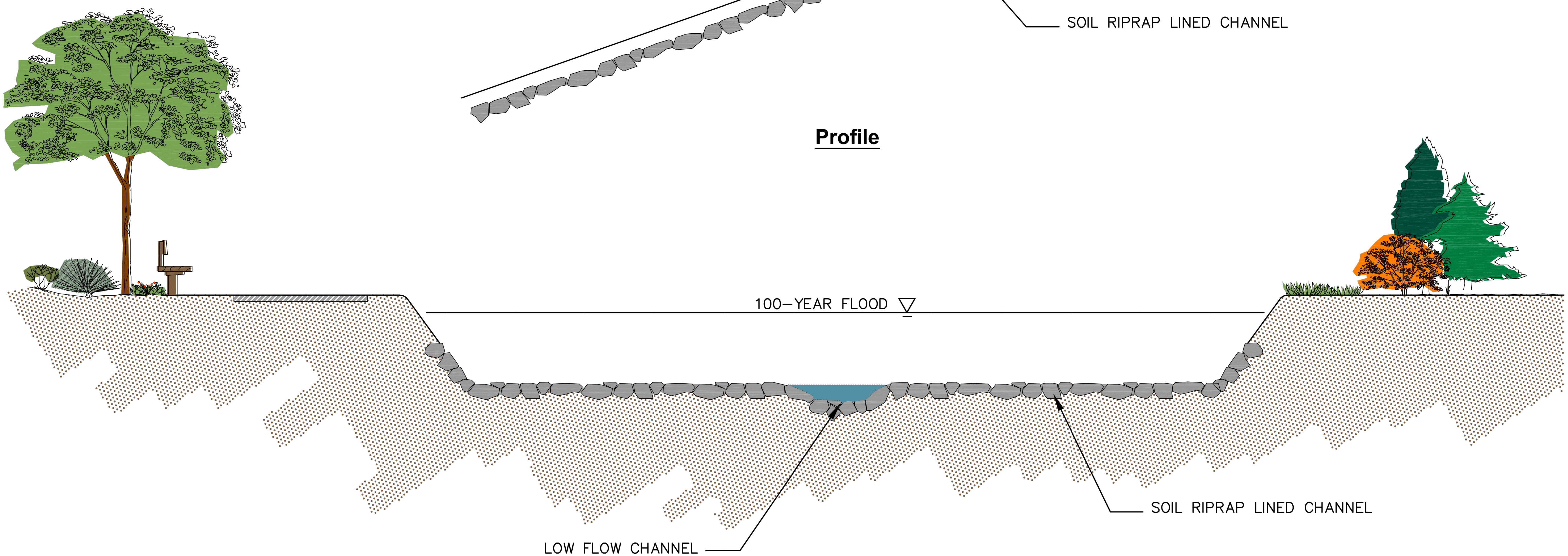

Section

Fully-Lined Channel

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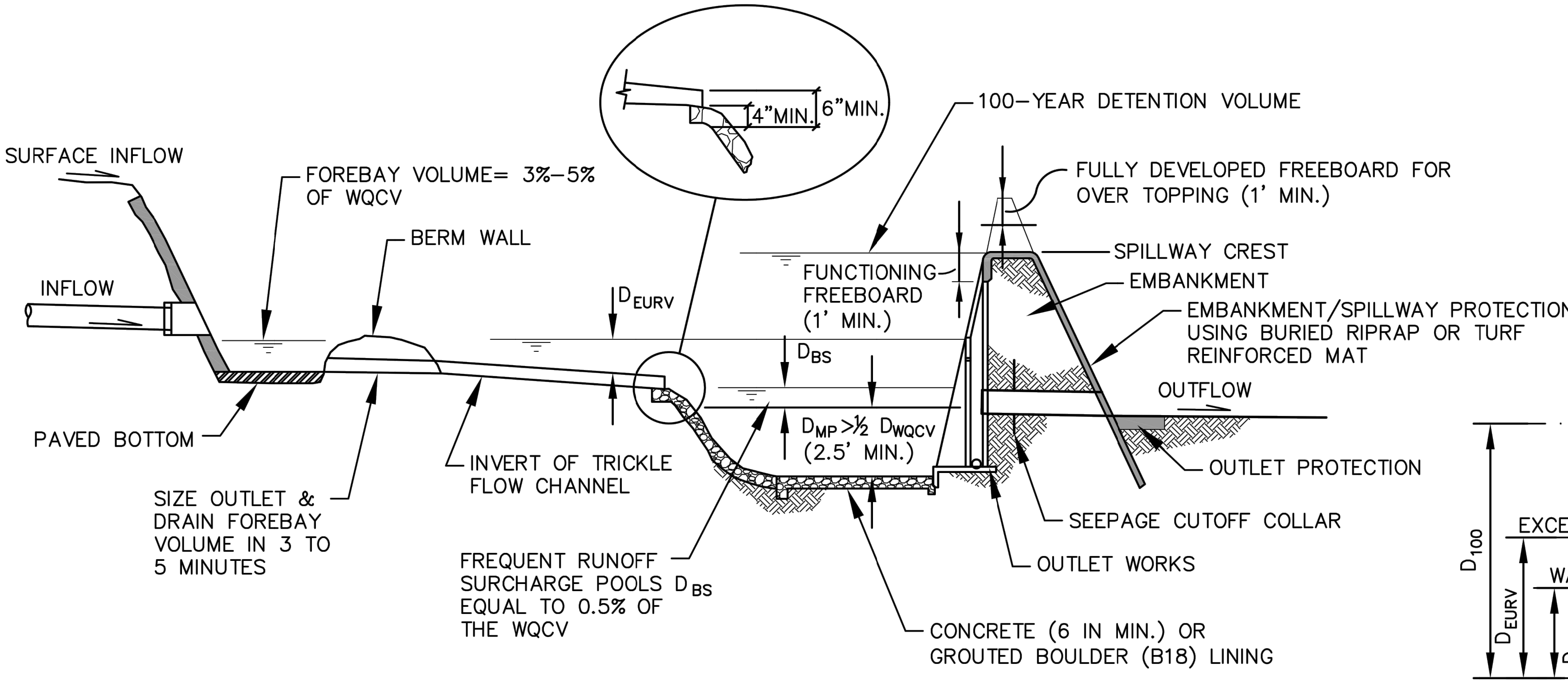
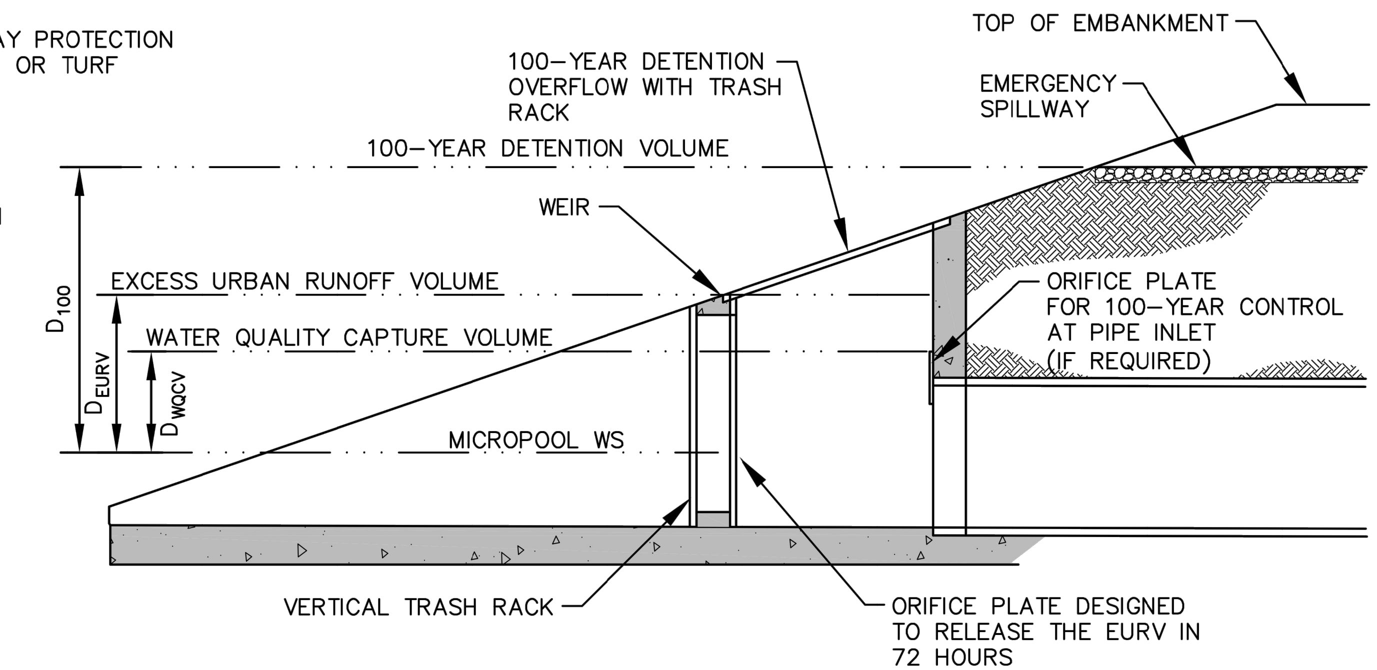


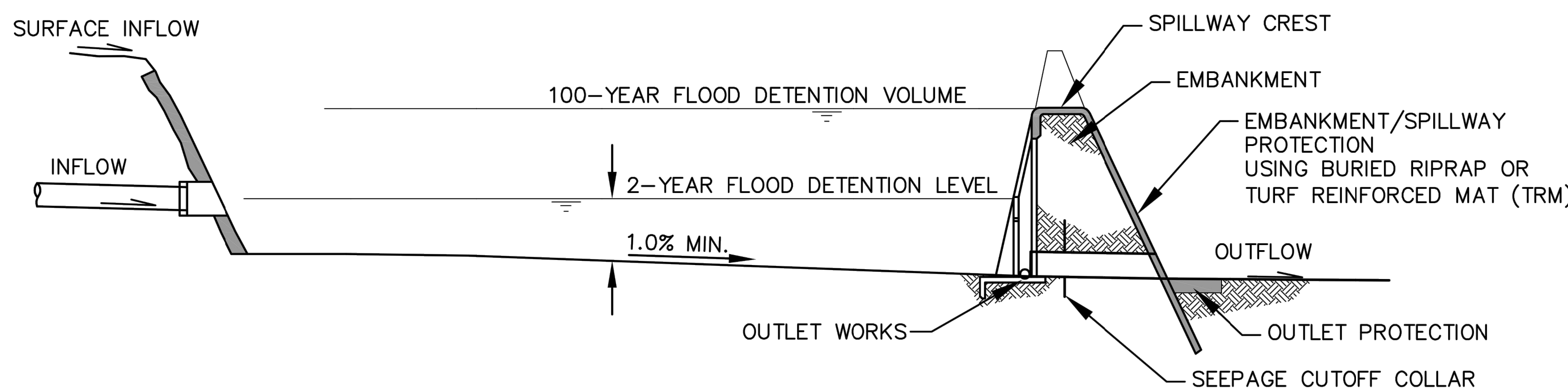
Typical Profile of an EURV in a Flood Control Detention Basin



Typical EURV Outlet Structure

D_{MP} = DEPTH OF MICRO POOL
D_{WQCV} = DEPTH OF WQCV
D_{EURV} = DEPTH OF EURV
D_{100} = DEPTH OF 100–YR STORAGE VOLUME

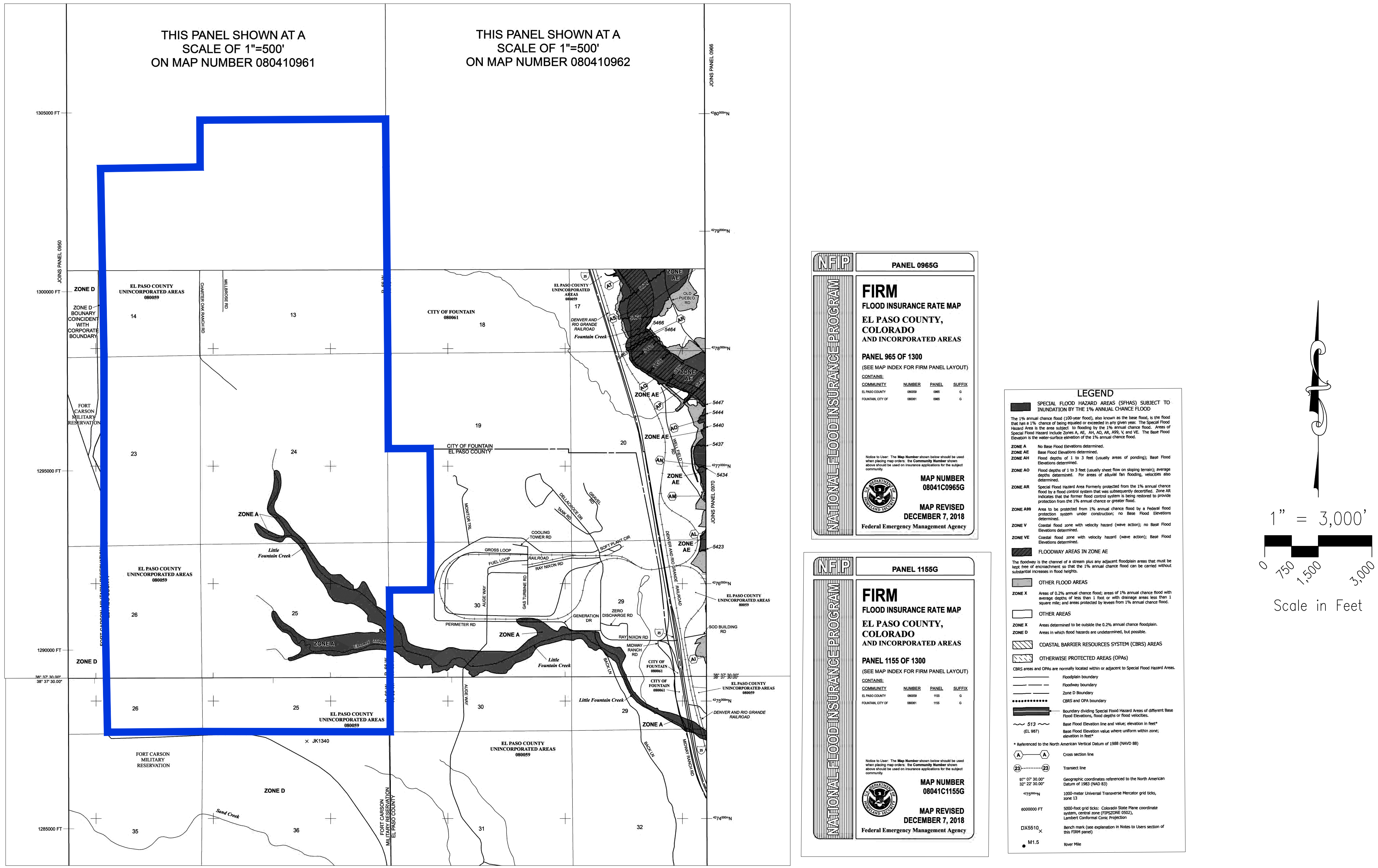
WQCV – WATER QUALITY CAPTURE VOLUME
EURV – EXCESS URBAN RUNOFF VOLUME



Typical Profile of A Flood Control Detention Basin

CIVIL CONSULTANTS, INC.

Common Detention Pond Details



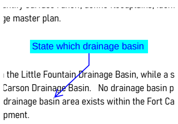
Southern Colorado Rail Park
Flood Insurance Rate Map (FIRM)

CIVIL CONSULTANTS, INC.

File: O:\10012A-Ed Levy Co\Edw. C. Levy Co\dwg\Eng Exhibits\FIRM Panel Exhibit.dwg Plotstamp: 9/29/2023 10:39 AM

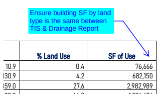
V1_MDDP.pdf Markup Summary

Callout (8)



Subject: Callout
Page Label: 7
Author: CDurham
Date: 10/27/2023 9:17:20 AM
Status:
Color:
Layer:
Space:

State which drainage basin



Subject: Callout
Page Label: 16
Author: CDurham
Date: 10/27/2023 9:38:11 AM
Status:
Color:
Layer:
Space:

Ensure building SF by land type is the same between TIS & Drainage Report

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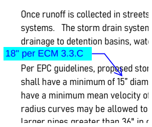
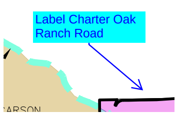


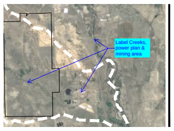
Subject: Callout
Page Label: 30
Author: CDurham
Date: 10/27/2023 10:22:03 AM
Status:
Color:
Layer:
Space:

18" per ECM 3.3.C



Subject: Callout
Page Label: Drainage Basin Distribution
Author: CDurham
Date: 10/27/2023 11:26:39 AM
Status:
Color:
Layer:
Space:

Label Charter Oak Ranch Road

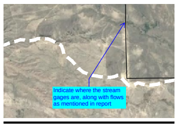


Subject: Callout
Page Label: Little Fountain Creek Aerial
Author: CDurham
Date: 10/27/2023 11:32:01 AM
Status:
Color:
Layer:
Space:

Label Creeks, power plan & mining area

Subject: Callout
Page Label: Little Fountain Creek Aerial
Author: CDurham
Date: 10/27/2023 11:28:16 AM
Status:
Color:
Layer:
Space:

Label major roadways



Subject: Callout
Page Label: Little Fountain Creek Aerial
Author: CDurham
Date: 10/27/2023 11:33:10 AM
Status:
Color:
Layer:
Space:

Indicate where the stream gages are, along with flows as mentioned in report

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Subject: Callout
Page Label: Little Fountain Creek Aerial
Author: CDurham
Date: 10/27/2023 11:33:36 AM
Status:
Color:
Layer:
Space:

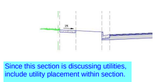
Label confluence with Fountain Creek and FEMA flow.

Text Box (7)

Show property boundary on exhibit, so able to see mining area in relation to site.

Subject: Text Box
Page Label: 12
Author: CDurham
Date: 10/27/2023 9:25:59 AM
Status:
Color:
Layer:
Space:

Show property boundary on exhibit, so able to see mining area in relation to site.



Subject: Text Box
Page Label: 27
Author: CDurham
Date: 10/27/2023 10:19:49 AM
Status:
Color:
Layer:
Space:

Since this section is discussing utilities, include utility placement within section.

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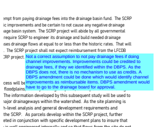
the historic or predevelopment relea
Include section discussing suitable outfall per ECM Section 3.2.4

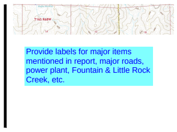
Subject: Text Box
Page Label: 46
Author: CDurham
Date: 10/27/2023 10:56:16 AM
Status:
Color:
Layer:
Space:

Include section discussing suitable outfall per ECM Section 3.2.4



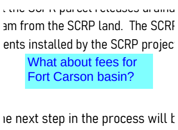
Subject: Text Box
Page Label: 45
Author: CDurham
Date: 10/30/2023 7:53:39 AM
Status:
Color:
Layer:
Space:

Not a correct assumption to not pay drainage fees if doing channel improvements. Improvements could be credited to drainage fees, if they we identified within the DBPS. As the DBPS does not, there is no mechanism to use as credits. A DBPS amendment could be done which would identify channel improvements as reimbursable items. DBPS amendment would have to go to the drainage board for approval.



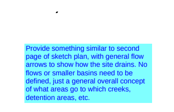
Subject: Text Box
Page Label: Drainage Basin Map & USGS Overlay
Author: CDurham
Date: 10/27/2023 11:29:27 AM
Status:
Color: ■
Layer:
Space:

Provide labels for major items mentioned in report, major roads, power plant, Fountain & Little Rock Creek, etc.



Subject: Text Box
Page Label: 45
Author: CDurham
Date: 10/27/2023 11:34:43 AM
Status:
Color: ■
Layer:
Space:

What about fees for Fort Carson basin?



Subject: Text Box
Page Label: SCRP & LFC Basin Soils Map
Author: CDurham
Date: 10/27/2023 11:42:26 AM
Status:
Color: ■
Layer:
Space:

Provide something similar to second page of sketch plan, with general flow arrows to show how the site drains. No flows or smaller basins need to be defined, just a general overall concept of what areas go to which creeks, detention areas, etc.