RANCHO BERNARDO CANYON EAST OF 15 CANYON

(East Bernardo Trunk Sewer) Redirection of Flow Study

DRAFT REPORT

Date: June 5, 2006

Prepared by:
City of San Diego
Metropolitan Wastewater Department
Engineering and Program Management Division

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Executive Summary

East Bernardo Trunk Sewer (EBTS) is within the Rancho Bernardo Community
In Rancho Bernardo Canyon East of Interstate Highway 15. EBTS flows from south to north and leading to pump station 77A.

In accordance with Council Policies 400-13 and 400-14, staff evaluated the feasibility of redirecting the flow out of the canyon. Staff developed three alternatives:
1. Leave in place alternative where the EBTS is replaced in its current alignment,
2. Total redirection alternative, where flows are intercepted by pump stations and directed away from the canyon areas, and
3. Partial redirection that will reroute portion of the trunk and sewer main inside the canyon to the road right of way.

The leave in place alternative has an estimated life cycle cost of $8,079,455. The total redirection option has an estimated life cycle cost of $42,336,496. Finally the partial redirection potion's estimated life cycle cost is $24,414,088. These costs are based on today's cost over an estimated 75 year life of the pipe.

If the estimated cost of the total redirection option is 35% or less than the estimated cost for replace in place option, and then the redirection should be pursued. However, the total redirection option (Alternative 2) is 424 % greater that the replace in place option (Alternative 1). And the partial redirection (Alternative 3) is 202 % greater than the replace in place option (Alternative 1). Replace in place option (Alternative 1) should be considered as a feasible alternative. Table ES-1 summarizes these alternatives.

Summary of Cost Benefit Analysis

Table ES-1

Alternative	Estimated Cost	% Greater than Leave in Place
Replace in Place - Alt. 1	$8,079,455	N/A
Total Redirection - Alt. 2	$42,336,496	424 %
Partial Redirection - Alt. 3	$24,414,088	202 %

Recommendation

As indicated in the Cost Benefit Analysis Summary, the replace in place of the EBTS is economically feasible based on the cost differential guideline of 35%. Based on the criteria stated in Council Policies 400-13 and 400-14 the recommendation is to pursue Alternative 1.

Prepared by:_____ Mike Bajoua

Reviewed by:_____ Dr. David Hu

1.0 Introduction

The City of San Diego's Metropolitan Wastewater Department is responsible for managing approximately 3,000 miles of sewer pipelines and 82 wastewater pump stations, serving more than 1.2 million customers. Approximately 320 miles of these sewer lines have been located in canyons or other environmentally sensitive areas to take advantage of gravity flow. These environmentally sensitive areas and canyons have since become overgrown, often with sensitive vegetation that also provide habitat for protected wildlife. Manholes have become buried or hidden by thick plant growth and access to these sewer lines, for making regular inspections, cleaning and repairs, has become very difficult.

Current City policy as defined by Council Policy 400-13, Planning for Management of Sewer Facilities located in Canyons and Other Environmentally Sensitive Lands, and Council Policy 400-14, Planning for Redirection of Sewage Discharge Away From Canyons and Other Environmentally Sensitive Lands, requires that, whenever economically practical, sewer infrastructure should be relocated out of canyons or other environmentally sensitive areas. To assist in determining the feasibility of relocating a sewer line, a cost-benefit analysis was performed. In this case, redirection is considered feasible if the life-cycle cost of redirecting is no more than 35% higher than the life-cycle cost of maintaining the sewer in the canyon.

Financial concerns are not the only criteria used to determine the feasibility of relocating sewer facilities. Environmental impacts, such as sewer overflows, vehicular access, impacts to wildlife and community concerns are other factors that should be considered as part of the decision-making process.

A cost benefit analysis was performed to determine the feasibility of redirecting the flow of the East Bernardo Trunk Sewer (EBTS) out of the Rancho Bernardo Canyon. The purpose of this report is to present the results of that analysis.

Figure 1-1 &1-2 shows the vicinity & location map of the project.

2.0 Existing Conditions

East Bernardo Trunk Sewer (EBTS) is located in Rancho Bernardo Canyon East of Interstate 15. EBTS starts from manhole (MH) 1 (L08N) just South of Verano Dr to MH 42 (K09N) West of Interstate 15 and East of West Bernardo Drive. Rancho Bernardo Canyon is located in the Rancho Bernardo Community Planning Area.

EBTS was constructed in 1993 per as-built drawing 10399 – D. The trunk sewer flows from south to north leading to pump station 77A and passes under the bridge of Interstate 15. Since it is a fairly new trunk sewer, a CCTV video inspection has not been conducted yet. The trunk sewer is 21-inch diameter made of Vitrified Clay (VT) material. The canyon system is easily accessed from Cotorro Road and Escala Drive. The majority of the canyon has been accessed previously for emergency sewer work.

A "Biological Resources Report for the Rancho Bernardo Canyon for the Ranch Bernardo Canyon Emergency Sewer Access Project" was prepared by Merkel and & Associates, Inc, on July 26, 2004. A biological survey was conducted on the Rancho Bernardo Canyon Emergency Sewer Access Project site to access impacts resulting from recent sewer cleaning and repair work. The project resulted in direct impacts to 0.31 acre of Diegan coastal sage scrub and 0.02 acre of Tier IV upland habitat. Recommended mitigation measures were provided in the above report.

An 8-foot wide access easement parallels the sewer line at the bottom of Rancho Bernardo Canyon. This access easement contains a well established dirt road that has been used by MWWD crews to maintain the sewer line in the canyon. The majority of the manholes are in close proximity to this access road, though require additional clearing of vegetation, grading, and grubbing of a 15-foot radius around the manhole if the existing access path is utilized. One manhole requires the clearing and grading of an access path approximately 600 feet long by eight feet wide from Escala Drive

A CCTV video inspection program condition assessment on the EBTS has not been performed yet since the trunk sewer is fair condition as was constructed in 1993.

3.0 Design Criteria

The criteria used to assess the capacity of the HPETS alternatives are as follows:

For **existing** sewer pipes less than 18 inches in diameter whose:

- d/D exceeds 50% will be classified as **Critical.**
- d/D is between 40% and 50% will be classified as **Semi-critical.**
- d/D is less than 40% will be classified as **Non-critical.**

For **existing** sewer pipes greater than or equal to 18 inches in diameter whose:

- d/D exceeds 75% will be classified as **Critical.**
- d/D is between 50% and 75% will be classified as **Semi-critical.**
- d/D is less than 50% will be classified as **Non-critical.**

Any new facilities that are built to redirect flow away from canyons must meet the applicable design requirements of the City's current Sewer Design Guide (June 2004). These requirements, taken from the Sewer Design Guide published in 2004, are summarized below:

- The average dry weather flow will be calculated using equivalent population and 80 gallons per day per capita. The peak dry weather flow will be calculated using a peaking factor on population, as defined in the Sewer design Guide, Chapter 1.3.2.2.
- 15-inch or smaller in diameter, d/D not to exceed 50% for the projected peak wet weather flow at the buildout condition.
- 18-inch or larger in diameter, d/D not to exceed 75% for the projected peak wet weather flow at the buildout condition.
- Minimum allowable velocity of 2 fps or 1 percent slope for the projected peak dry weather flow at the year when the sewer upgrades were completed.
- New pump stations will be owned and operated by the City. The pump station and paved access roads will be located on land owned by the City (not an easement).
- All pump stations shall be equipped with dual force mains for maintenance and redundancy.
- New sewer mains shall be a minimum of 8 inches in diameter in residential areas, and a minimum of 10 inches in diameter in commercial, industrial, and high-rise building areas.
- Mains with a depth of 20 feet or greater shall not be permitted except in specific, exceptional cases.
- No lateral connections will be allowed on mains that exceed 20 feet in depth.
- No lateral connections will be allowed on mains of 18-inch diameter and larger.
- The maximum distance between manholes shall be 400 feet for pipes sizes from 8 to 15 inches and 800 feet for pipes sizes 18- inch and over.
- New access paths in canyons will be designed for canyon-proficient All Surface Vehicles (ASVs). These vehicles can drive over low vegetation without causing permanent damage, and they can climb or descend slopes as steep as 20%. The new access paths will not be designed for heavy equipment.

The Engineering and Program Management Division prepared a Modeling Study for the EBTS on July 18, 2002. The dynamic modeling program, HydroWorks Version 6.0 was used for this study. The flows for the existing year (2000 as the baseline year), 2010, and the buildout year scenarios were computed based on the SanDAG 2020 population and employment projections data. The criteria to classify criticality of the trunk sewers are in accordance with the Environmental Protection Agency (EPA) Stipulated Final Order and The City of San Diego MWWD Sewer Design Guidelines. Criticality is based on the maximum depth of the flow (d) and the pipe diameter (D) ratio (d/D) expressed as a percentage.

4.0 Analysis of Alignment Alternatives

4.1 Alternative # 1: Leave Sewer in Place Alternative

Three alternatives were evaluated to improve EBTS. These alternatives need to comply with current City Council Policies 400-13 & 400-14, effective January 2002. For the purpose of this report, staff assumed that the projected lifetime of a newly constructed trunk sewer is 75 years. This alternative, Replace-Sewer-in-Place, is the least expensive alternative of the three proposed.

Policy 400-13 defines canyon access parameters for maintenance, operation, and accessibility of sewer system located within canyons and other environmentally sensitive areas. Based on the existing conditions, part of the trunk sewer is located in the canyon area.

Alternative one (1) involves the replacement in place of the existing 21-inch trunk sewer line with the same size from MH # 1 (L08N) just South of Verano Drive to MH # 42 (K09N) West of Interstate 15 and East of West Bernardo Drive. Assuming the life span of 75 years, the trunk sewer will not be replaced till year 2068.

This alternative recommends the utilization and maintenance of the existing canyon access path. Implementation of the Maintenance and Emergency Access Plan utilizing the mostly pre-existing access path as the permanent plan will require stabilization for dry/fair season access and erosion control over the long term. Erosion control is beneficial for areas that are void of vegetation cover and are highly vulnerable to surface erosion. Vegetation restoration with appropriate native species is important to improve vegetation quality and aesthetics of the canyon.

Maintenance and improvements to the existing access path is needed to access manholes located in the canyon. Clearing, grubbing, and/or minor grading is needed for nine manholes to provide an access for the trunk sewer. The scope of work will provide for a fifteen foot (15) diameter area around each manhole, the widening of two (2) portions of the existing access path, and widening on one pedestrian path to accommodate canyon proficient vehicles. The area of access paths proposed for vegetation thinning, clearing, mowing, trimming, or minor grading is approximately 0.227 acre.

All work associated with the modifications to the access path will be monitored by a qualified biologist to assist in minimizing and/or avoiding biological impacts in this canyon. All work would be coordinated with the community. Permits required must be obtained from the applicable regulatory agencies. These agencies include, but will not be limited to, California Department of Fish and Game, Regional Quality Control Board, the U.S. Army Corps of

Engineers, the U.S. Fish and Wildlife Service and Development Services Department. Figure 4-1 shows Alternative 1-Replace Sewer in Place.

4.2 Alternative # 2: Total Redirection of Flow Alternative

The total redirection of flow away from canyons considers the following options:

1. New Gravity Main: This situation is possible if a new sewer can be built to intercept flow before it enters the canyon and redirects it by gravity to a point in the system downstream of the canyon.

2. Lateral Reconnection: In some cases, sewer laterals from individual properties run through the canyon and connect to the sewer pipeline (mains or trunk sewer) in the canyon. Redirection is possible if the laterals can be reconnected to a different pipeline located outside the canyon. If the new connection point is higher than the property, a private pump would be required on the new service connection.

3. New Pump Station: in certain situations, a new pump station is necessary at the point where flow enters the canyon. Flow is intercepted at this point and pumped through a new force main at a point in the sewer system where it can continue by gravity away from the canyon. This case is typically the most expensive alternative.

A combination of these options is often considered. Implementing a total redirection of the existing canyon sewer requires restoration of the environment and proper abandonment of existing facilities. For proper abandonment procedures, the City's design Guide would be followed.

Alternative two (2) involves the construction of seven (7) pump stations and approximately 2,864 feet of 15-inch dual force main, 838 feet of 8-inch dual force main. It also includes the construction of 2,521 feet of 20 inch of gravity sewer main, reconnection of sewer laterals and sewer lines.

It was assumed that the mains downstream from the discharge points have adequate capacity to accommodate the additional flow. This alternative is 262 % more than the least expensive, Alternative one (1). Figure 4-2, Alternative two (2) Total Redirection of Flow is attached.

4.3 Alternative # 3: Partial Redirection of Flow

This alternative involves the realignment and diversion of flow of EBTS from MH 01 (L08N) located South of Cotorro Road to MH 95 (K09N) located West of Cotorro Way.

Alternative three (3) involves the construction of three (3) pump stations and approximately 1,034 feet of 15-inch dual force main, 158 feet of 8-inch dual force main. It also includes the construction of 720 feet of 20 inch of gravity sewer main (from MH 237, L09N, on Verano Drive to MH 95, K09N at the canyon, and reconnection of sewer laterals and sewer lines.
It was assumed that the mains downstream from the discharge points have adequate capacity to accommodate the additional flow. This alternative is 262 % more than the least expensive, Alternative one (1).

Alternative three (3) also includes the installation of five (5) new manholes in the ROW, abandonment of four (4) manholes and sewer main in the canyon, re-vegetation with native plants and environmental mitigation.

The partial redirection is not feasible since the cost is 35% more than the cost of maintaining the sewer in place. Therefore this alternative is not recommended. Figure 4-3 shows Alternative three (3) - Partial Redirection of Flow.

5.0 Cost Benefit Analysis

A Cost Benefit Analysis (CBA) estimate was prepared for each of the studied alternatives described above. The CBA considers both direct and indirect costs. The complete cost estimates are presented in Appendix A. The results of the analysis are as follows:

Table 1
Summary of Cost Benefit Analysis

Item	Life-Cycle Cost
Leave Sewer in Place (Alternative # 1)	$ 8,079,455
Total Redirection of Flow (Alternative # 2)	$ 42,336,496
Partial Redirection of Flow (Alternative # 3)	$ 24,414,088

A Cost Differential Guideline was established by the City-Wide Canyon Sewer Maintenance Task Force and was adopted by the City Council as Council Policy 400-14. This guideline is used to assist in the determination of the best alternative. If the estimated cost of the total redirection is 35% or less higher than of the estimated cost for the Replace Sewer in Place alternative the redirection alternative should be pursued.

In this scenario the cost for the total redirection alternative, Alternative two (2), is 424 % greater than the leave in place alternative. The cost for the partial redirection of flow alternative, Alternative three (3) is 202 % greater than the cost of the leave sewer in place. Alternative one (1) falls within the guidelines mentioned above and would be an economically feasible option and is the preferred alternative based on this CBA.

6.0 Public Outreach

A community information session will be scheduled and community members and other interested parties will receive mailed notices announcing this meeting in advance of the session. Staff will present conceptual plans for the Replace in Place, Total redirection and Partial Redirection alternatives present in this study.

Those in attendance would be allowed to ask questions and make suggestions.

PHOTOGRAPHS OF EXISTING MANHOLES AT HPETS ALIGNMENT

Appendix A
Cost Benefit Analysis Spreadsheets

Appendix B
ROF Analysis- Biological Cost Estimate

Appendix C
Canyon Access Route Modification Types and Descriptions

City of San Diego
Sewer Canyon Access Project
Canyon Access Route Modification Types and Descriptions

Type 1: Stone Crossings (Broad Based Dips)

Application: Light water flows, or seasonally wet or muddy crossings.

NOT USED BY MWWD

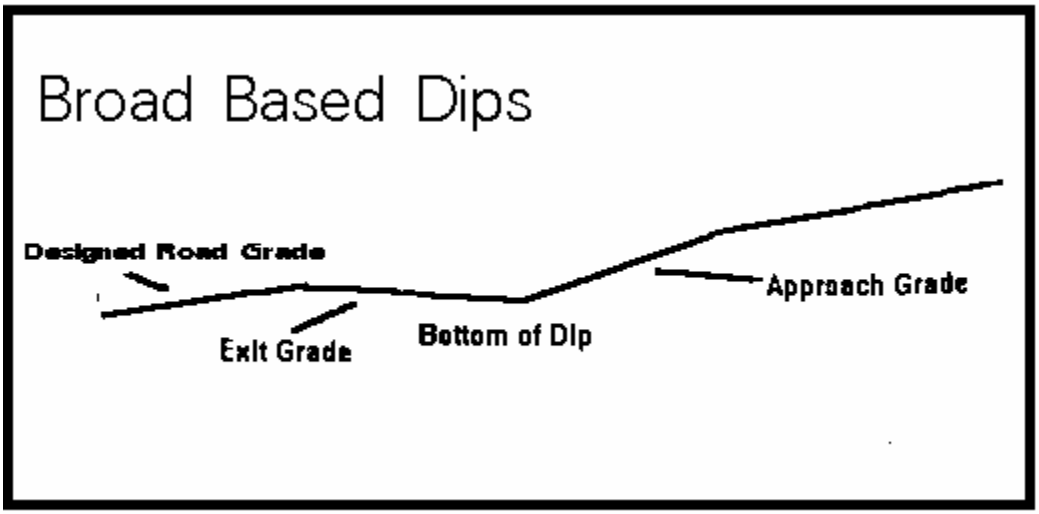
Materials:

- Round River Cobble – 6 inch or greater
- Geo-synthetic Fabric

Recommended Guidelines:

Excavate subgrade to a minimum depth of 18 inches below finish grade at the lowest part of the dip. Place filter fabric into channel. Overlap or sew fabric together at joints and anchor as necessary per manufacturer or design recommendations. Place cobble over fabric and bring up to grade. Slope match entrance and exit to existing channel. (Figure 1)

Figure 1


Broad Based Dips
Designed Road Grade
Approach Grade
Exit Grade
Bottom of Dip

Type 2: Stone and Concrete Crossing

Application: Medium water flows, constant or seasonal.

Materials:

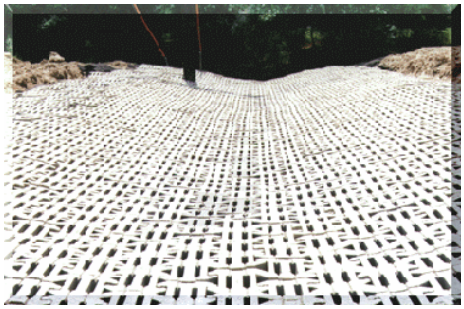
- Round River Cobble – 6 inches or greater
- Concrete
- Geo-synthetic Fabric

Recommended Guidelines:

Excavate subgrade to a minimum depth of 18-inches below finish grade. Place filter fabric, overlapping or sewing joints and anchor per manufacturer or design recommendations. Place a layer of stone onto the fabric. Place a 6-inch thick concrete layer over the first stone layer. Let concrete set slightly. Place final cobble layer into concrete, compacting lightly and contour to finish grade as needed. (Same as above except concrete lined)

Type 3: Interlocking Block Paver Arizona Style Crossing
(MWWD prefers this type be used for all water crossings in canyons)

Application: Heavy water flows or year-round standing water crossings.



Arizona Style Crossing with Interlocking Paver System

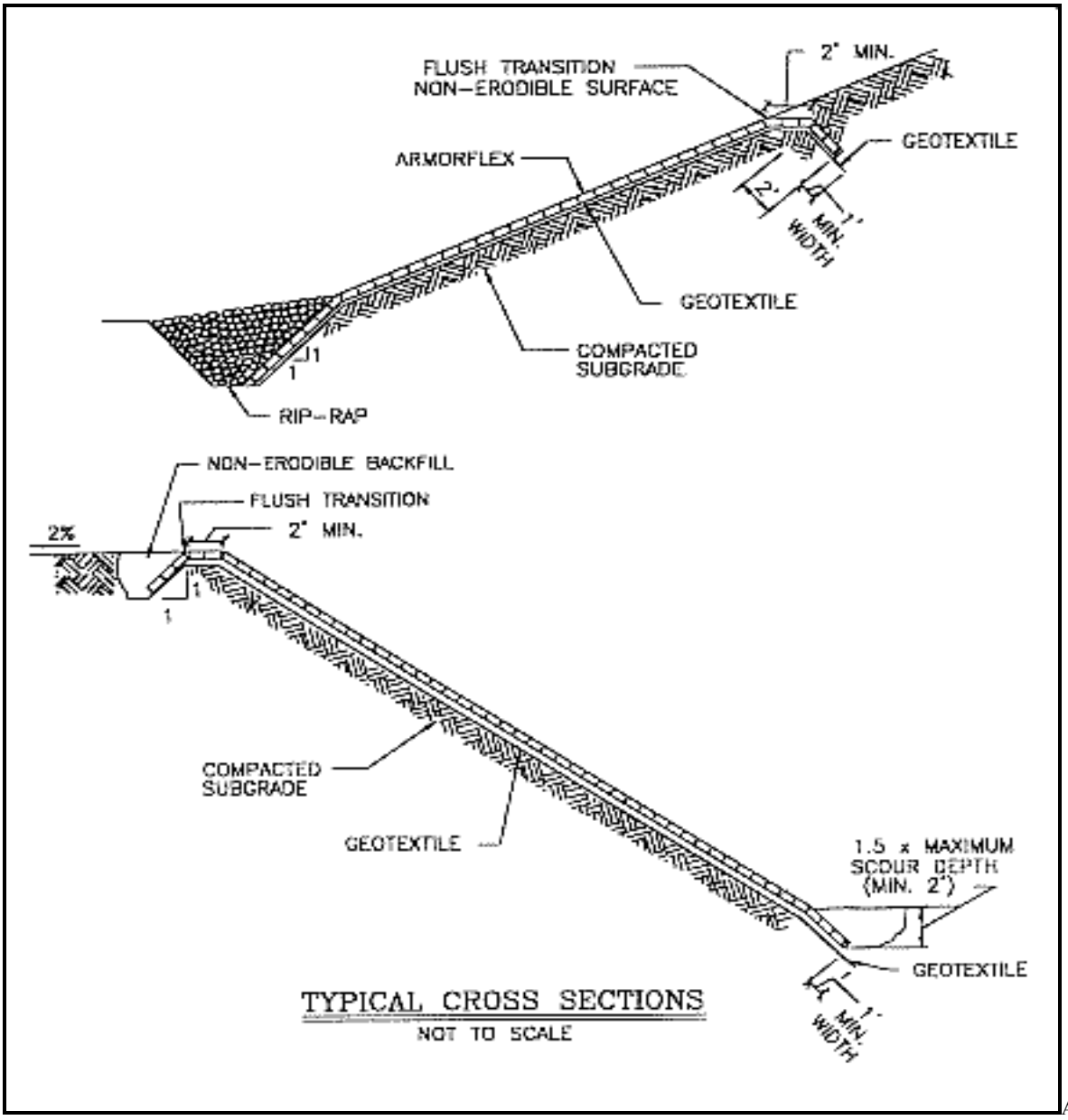
Materials

- Concrete block mats, cabled or non-cabled
- Geo-synthetic filter fabric
- Aggregate

Recommended Guidelines:

Excavate subgrade to assure proper bearing is attained per manufacturer design guidelines. Place filter fabric with overlaps or sewed joints as required. Install concrete mat system per manufacturer recommendations, anchor if required. Open block cells may be filled with seeded soil mix or aggregate as desired. MWWD has recommended a typical size of 8-feet wide by 30-feet long with a 2-foot subgrade depth to meet their requirements for canyon maintenance operations (Figure 2).

Figure 2



Armorte c Corporation

Type 4: Grading

Application: When necessary on the proposed equipment route to overcome severe cross-slopes, grades or other non-passable sections of canyon.

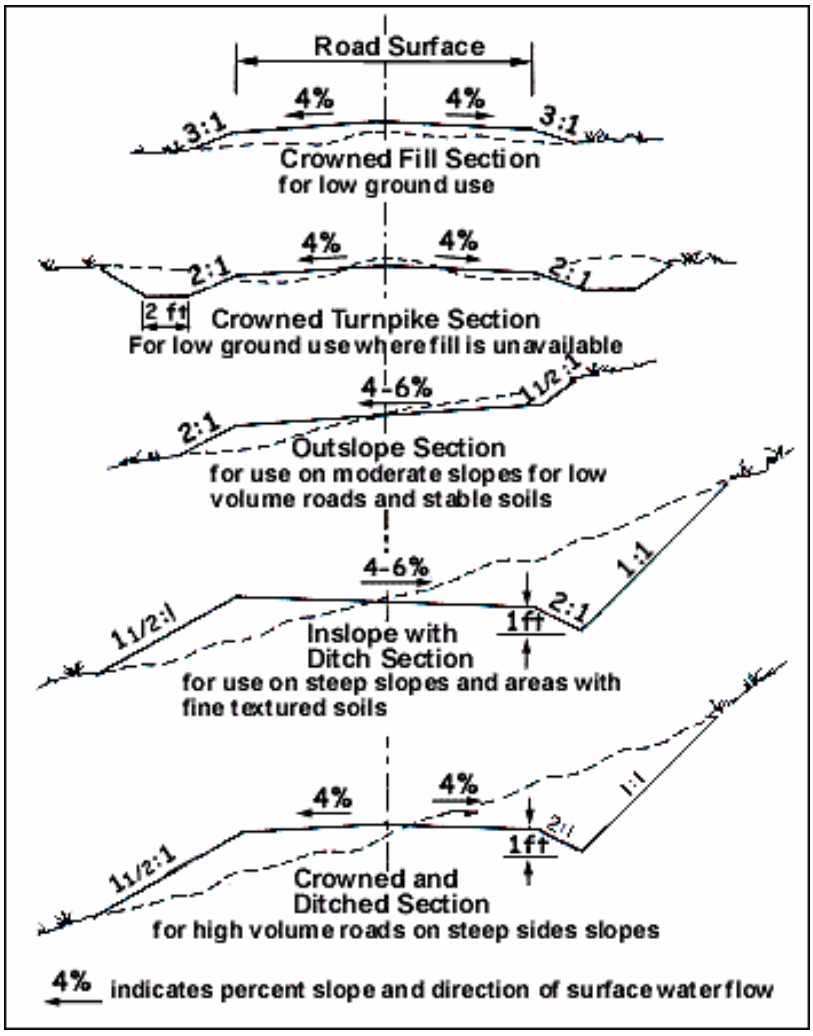
Materials:

- Native canyon material or select aggregate fill
- Straw wattles or other erosion control product

Recommended Guidelines:

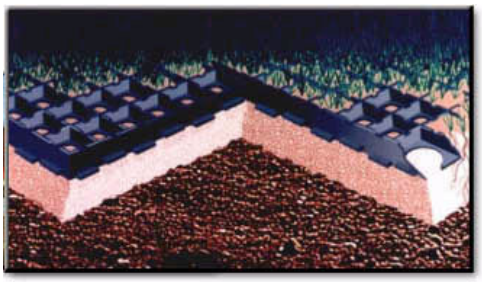
Grade as needed by referring to cross-sectional guidelines for construction of an access way for use by canyon sewer maintenance equipment. Do not over excavate or construct an access wider than needed. Provide and incorporate preferred erosion control (straw wattles, geo-textiles, etc.) and/or utilize other Best Management Practices (BMP) such as cross drainage to minimize erosion channels from forming. A liquid soil stabilizer (such as "EMC SQUARED" from Soil Stabilization Products Company Incorporated or equal) may also be used to stabilize extremely silty or soft soil conditions. (Figure 3)

Figure 3



Type 5: Geo-synthetic web containment system

Application: On level grade or moderate slopes where the existing soil condition is poor, either because of a non-compacted surface, sandy, loose organic fills, or slippery conditions (fine gravel).



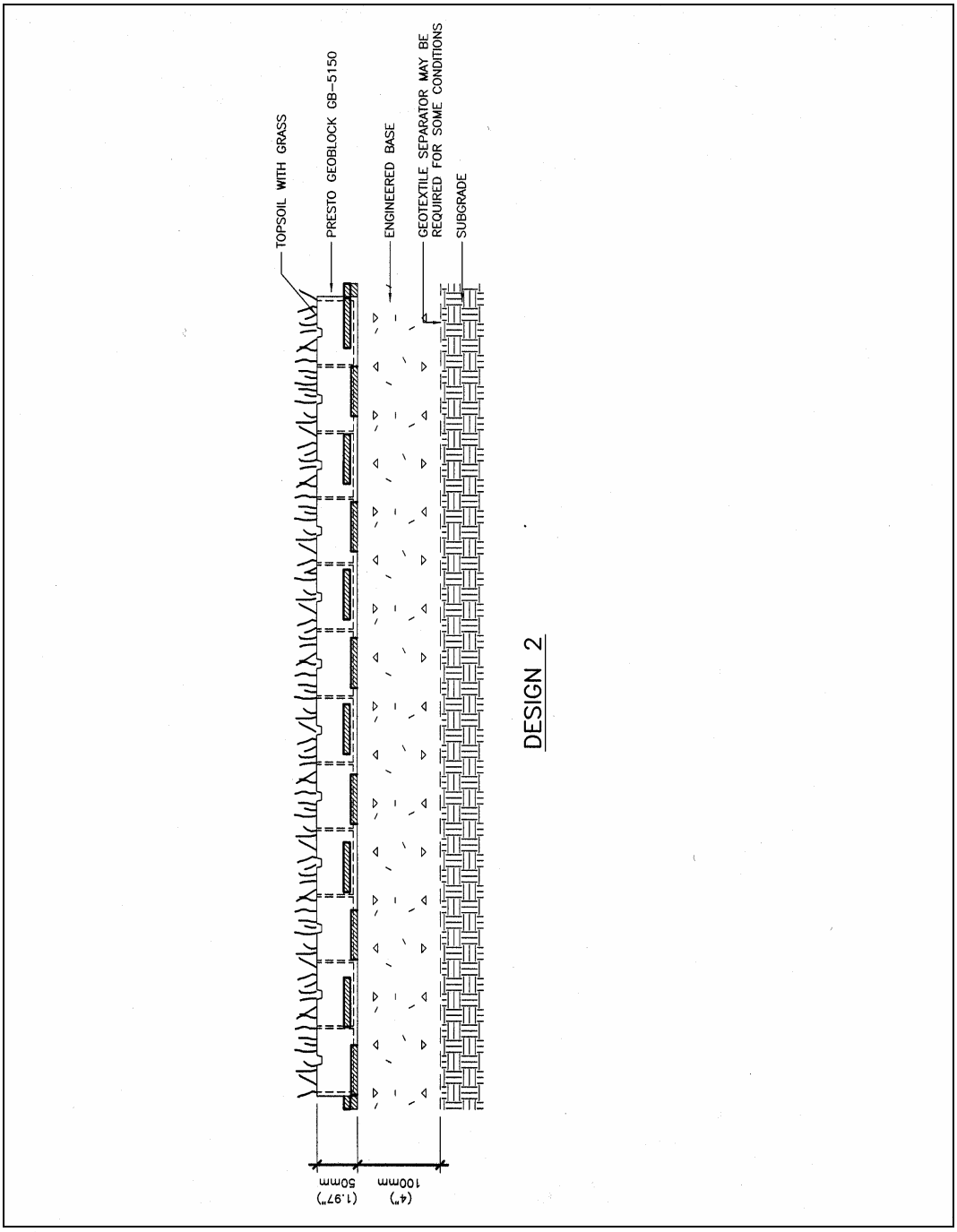
Materials:

- Geo-synthetic reinforcement grid
- Geo-synthetic filter fabric
- Various grid anchors and clips

Recommended Guidelines:

Excavate subgrade as required for installation of the geo-synthetic web system. Place filter fabric with overlapping or sewed joints per manufacturer recommendations. Install geo-synthetic web or block cells and anchor in place as required. Fill cells with desired material, usually a seeded soil mix design based on the existing vegetation of the surrounding area. It is also suggested that perforated cells be used on slopes, since this increases frictional interlock with aggregates and also allows for better drainage between cells. This increases the likelihood of vegetation re-growth within the entire cell system. (Figure 4)

Figure 4



Presto Products Company

Type 6: Concrete/Metal/Plastic Culverts
(MWWD least preferred crossing option)

Application: When needed to cross an area where a drainage channel exists.

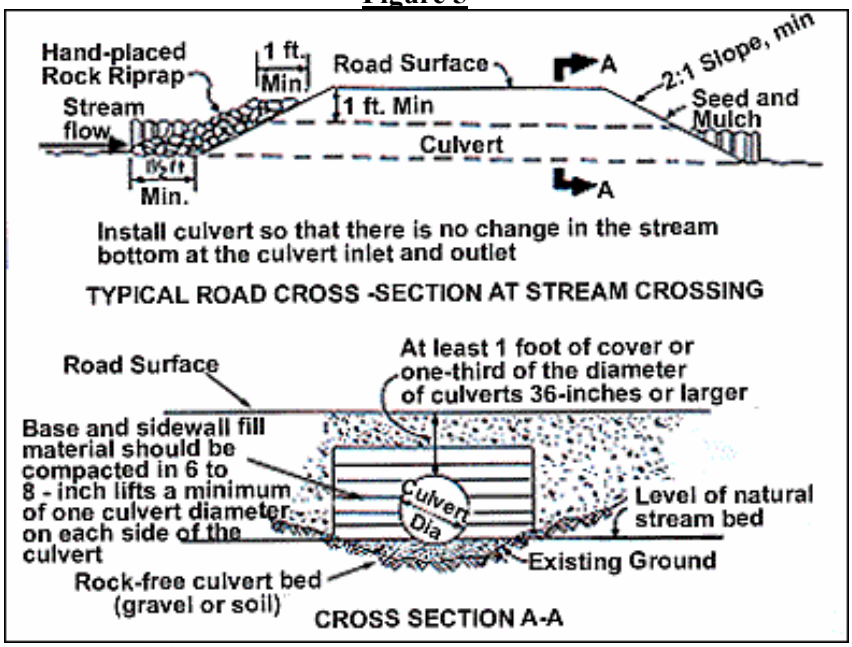
Materials:

- Culvert pipe; concrete, metal or plastic, sized for flow requirements
- Select bedding material
- Rip-rap, 6-12 inch size

Recommended Guidelines:

Excavate channel as required so the inlet and outlet of the pipe invert will match grade at each end. It is better to have the final pipe inlet and outlet inverts slightly lower than the channel, and design the slope to drain properly. Place select bedding material into the excavation and lay pipe. Completely backfill the culvert using proper compaction procedures. Final grade should provide 24-inches of minimum cover over top of pipe. Inlet and outlet may be lined with crushed rock, riprap or concrete to prevent erosion at pipe ends. (Figure 5)

Figure 5



United States Department of Agriculture

Type 7: Temporary or Permanent Bridges

Application: When needed to cross a stream or other deep channel where the banks are too steep or the flow is too great to use another crossing method.

Materials:

- Wood, Steel or Aluminum, depending on preference and engineering design requirements
- Concrete for abutments if required
- Various other materials, too extensive to list

General Design Guidelines:

Survey the channel to determine crossing location and span requirements. Soil will need to be analyzed for load bearing, scour and other pertinent details in places where abutments or piers are proposed. Refer to canyon proficient vehicle equipment guidelines and specifications to determine bridge loading and width requirements for sewer cleaning equipment necessary to cross. Preferences for constructing a temporary or permanent bridge structure will vary from canyon to canyon and internal city divisions will also need to be contacted by the bridge engineer/designer for input on which bridge type is preferred at each location.

All modifications recommended and shown in this report are conceptual only. Separate engineering designs will have to be completed for all final modifications and locations within each canyon.

Canyon	***Modification Area***	***Description***	***Modification Types (listed in order of MWWD preferences)***
Shawn Canyon	1	Grading	4
Shawn Canyon	2	Grading	4

Appendix D
Canyon Proficient Vehicles and Sewer Maintenance Equipment Report prepared by Earth Tech, Inc. dated February 2003